Environmental
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PHASE 2

ENVIRONMENTAL REPORT

job number	C4477/25/E/7515
date	12/05/2025
site address	The Shears, 210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR
written by	S. Hale
checked by	R. Palmer
issued by	S. Hale

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Report on a Phase 2 Environmental Investigation

Location:	The Shears 210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR
For:	Andrew Mitchell
Consultants:	One 17 Architects & Interior Designers
Report No.	C4477/25/E/7515 Report date: April 2025

For and on behalf of **Rogers Geotechnical Services Ltd**

Steven Hale BSc FGS Geo-environmental Technician	**Rob Palmer** MSc FGS ACIEH Engineering Director

Report Summary[1]

Item	Comments	Section
Development	Construction of two detached dwellings with garages; alterations to the existing public house to form one dwelling; erection of a single and two storey extension.	1.
Geology	Superficial geology – None. Solid geology – Pennine Lower Coal Measures Formation.	5.
Strata Conditions	Made ground, overlying sandstone gravel and clay.	6.1
Groundwater	None encountered during investigation.	6.2
Contamination	Lead, arsenic and PAH contamination identified within the made ground	9.1.1
Gas	Characteristic Situation Level 1, no protective measures required.	9.1.2
Effect of Sulphates	DC-1 concrete.	9.1.3

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land at The Shears, 210 Halifax Road is to be developed by the construction of two detached dwellings with garages; alterations to the existing public house to form one dwelling; erection of a single and two storey extension. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils and to take into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C4477/24/E/6835 in June 2024. This report has been used during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 10th March 2025 and included the three windowless sample boreholes with gas monitoring standpipes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths with diameters of 67mm and 57mm. The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils were described in general accordance with BS5930: 2015 and full descriptions are given on the windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered.

4.2 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 1.2m and 1.4m depth in all of the boreholes and the installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to between 0.2m and 0.4m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal above, and the installation was capped with a stop box cover in a concrete surround.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

Strata Type	Strata Name[2]	Previous Name[3]	Description[3]
Superficial Geology	N/A	N/A	Not indicated to underlie the site.
Solid Geology	Pennine Lower Coal Measures Formation	Grey Measures of Yorkshire and Nottingham	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile

Depth m below ground level to underside of layer	**Strata Type**	**Positions Encountered**	**Groundwater Strikes** m below ground level
0.05	MADE GROUND (Asphalt)	WS03	None
0.60 – 1.00	MADE GROUND (Dark brown, slightly sandy, gravelly SILT)	All	None
1.25	Orangish brown mottled grey, slightly sandy, gravelly, silty CLAY [COMPLETELY WEATHERED PENNINE LOWER COAL MEASURES FORMATION]	WS01	None
+1.40	Brown SANDSTONE recovered as gravel. [PENNINE LOWER COAL MEASURES FORMATION]	WS01	None
+1.20 – +1.40	Brown, silty, sandy GRAVEL [PENNINE LOWER COAL MEASURES FORMATION]	WS02 & WS03	None

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

[2] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[3] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

6.1 General Strata

The borehole records indicate that made ground consisting of slightly sandy, gravelly silt was revealed at all locations to depths of between 0.60m and 1.00m below ground level (begl).

Beneath this made ground, slightly sandy, gravelly, silty clay was encountered to a depth of 1.25m begl within WS01, which was then proceeded by brown sandstone to termination depth. It is anticipated that this material represents the completely weathered Pennine Lower Coal Measures Formation. Additionally, silty, sandy gravel was encountered beneath the made ground to termination depths within both WS02 and WS03. It is anticipated that this material also represents the Pennine Lower Coal Measures Formation.

6.2 Groundwater

No groundwater strikes were observed during the site investigation. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Gas and Water Level Monitoring

The standpipes were monitored between the 18th March and the 22nd April 2025. The results of the gas monitoring undertaken are tabulated below with the full results presented within Appendix 3.

Table 3: Gas monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	18.03.2025	0.1	0.1	21.1	0.1	1025 ↓	1.37	1.4
	25.03.2025	0.0	0.2	20.0	0.0	1021 ↑	1.37	
	01.04.2025	0.1	0.3	20.7	0.0	1027 ↓	1.57	
	08.04.2025	0.0	0.1	20.7	0.0	1028 ↑	1.40	
	16.04.2025	0.0	0.2	21.6	0.0	998 ↑	1.15	
	22.04.2025	0.1	0.2	20.7	0.0	1013 ↑	1.15	
WS02	18.03.2025	0.0	0.1	20.7	0.0	1025 ↓	-	1.2
	25.03.2025	0.0	0.1	20.2	0.0	1021 ↑	-	
	01.04.2025	0.0	0.2	20.9	0.0	1027 ↓	-	
	08.04.2025	0.0	0.1	20.9	0.0	1028 ↑	-	
	16.04.2025	0.0	0.1	20.1	0.0	998 ↑	-	
	22.04.2025	0.0	0.1	20.2	0.0	1013 ↑	-	
WS03	18.03.2025	0.0	0.1	21.3	0.0	1025 ↓	-	1.4
	25.03.2025	0.0	0.4	20.4	0.0	1021 ↑	-	
	01.04.2025	0.0	0.3	21.2	0.0	1027 ↓	-	
	08.04.2025	0.0	0.3	20.9	0.0	1028 ↑	-	
	16.04.2025	0.0	0.2	20.9	0.0	998 ↑	-	
	22.04.2025	0.0	0.2	20.2	0.0	1013 ↑	-	

↑ - rising pressure ↓ - falling pressure ↔ -steady pressure

This first gas monitoring readings were undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 25th October 2024.

8. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr(VI), Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN^-.
- Polycyclic aromatic hydrocarbons (PAHs).
- Others – pH, organic content and total/soluble SO_4^{2-}.
- Asbestos.

This testing was undertaken by i2 Analytical and the results of all of the chemical testing are presented in Appendix 4 of this report.

9. Discussion of Ground Conditions - Environmental

9.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of two detached dwellings with garages; alterations to the existing public house to form one dwelling; erection of a single and two storey extension. Consequently, the site may be classified as residential with plant uptake.

9.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 2.4% and 4.4%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website[4] and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 5. These results indicate the following:

Table 4: Summary of contaminated areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
WS01	0.40	PAHs: Napthalene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene & Benzo(g,h,i)perylene.
WS02	0.20	Lead & Arsenic PAHs: Indeno(1,2,3-c,d)Pyrene & Benzo(g,h,i)perylene.
WS03	0.70	PAHs: Chrysene, Benzo(b)fluoranthene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene & Benzo(g,h,i)perylene.

[4] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

Concentrations of cadmium, chromium(VI), selenium and free cyanide were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soil samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion[5]. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 5: Summary of areas contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
WS01	0.40	PAHs: Napthalene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene & Dibenz(a,h)Anthracene.
WS02	0.20	None.
WS03	0.70	None.

On the basis of the above information, the results of the investigation have concluded that the made ground present on site is contaminated with respect to the intended end use and remediation will be required.

9.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of methane of 0.1%, with concentrations of carbon dioxide ranging between 0.1% and 0.4%, in association with oxygen levels of between 20.0% and 21.6%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate of 0.1 litres per hour was recorded and will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 998mb and 1028mb.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% methane was recorded along with 0.4% (0.004) carbon dioxide, in association with a maximum flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0004 l/hr for carbon dioxide.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[1]. Accepting that the proposed development is of moderate sensitivity (flats) and that the generation potential is very low, these tables suggest that 6 readings could be

[5] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Residential with home grown produce land use, 23.06.17.

undertaken over a period of at least 3 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.* In this case, six monitoring visits have been carried out over the course of a six-week period during which variable atmospheric pressures have been captured. In addition, no noticeable or excessive changes in gas characteristics have been identified over the monitoring period.

In accordance with table 2 of BS8485: 2015*, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures,* of CIRIA report C665.

9.1.3 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2[6], which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements. Assuming static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[7], which can be found in Part D, *Specifying concrete for general cast-in-situ use,* of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

9.2 Site Specific Risk Assessment

9.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency[8] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[9] This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'[10]

[6] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*
[7] Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*
[8] R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.
[9] The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.
[10] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

9.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 6. Sources of contamination include the following:

On-site – Made Ground (Lead, arsenic and PAHs).

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

N/A - A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.

Low - A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.

Moderate - The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary

High - The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 6.

Table 6: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: Lead, arsenic and PAHs]				
Conceptual Site Model			**Site Specific Risk Assessment**	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – contamination found to be present at the site and contact with soil likely during works.	High	Contamination is present within the made ground underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – contamination found to be present at the site and site to be developed into residential dwellings with landscaped areas.	High	
	Neighbours	Yes – contamination found to be present at the site and a populated residential area surrounds the site.	High	
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from contaminated soils. PAH contamination is not considered likely to represent a significant vapour risk as it anticipated that it is derived from coal fragments within the made ground.	High (Dust) Low (Vapours)	Contamination is present within the made ground underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – dust may be derived from contaminated soils. PAH contamination is not considered likely to represent a significant vapour risk as it anticipated that it is derived from coal fragments within the made ground.	High (Dust) Low (Vapours)	
	Neighbours	Yes – contamination found to be present at the site and residential properties located within 250m radius of the site. Possible inhalation of dust during the works.	High (Dust) Low (Vapours)	
Ingestion of fruit/vegetables and/or waters	Operative	No – no edible plants or contained water sources in the area of the proposed new works.	N/A	Contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – Contamination found to be present at the site and site to be developed by the construction of residential properties with associated garden areas.	High	
	Neighbours	Yes – Contamination found to be present at the site and residential area adjoins the site. However, contamination is not expected to be highly mobile.	Low	

Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – low levels of ground gases revealed and site is classified as Characteristic Situation Level 1.	Low	Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. No protective measures are required.
	End User		Low	
	Neighbours		Low	
Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – known controlled waters within 250m. However, the contamination is anticipated to be bound within coal fragments.	Moderate	Contamination has is present in the soils underlying the site. Remediation will be required to either remove the contamination or break pathways. Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a secondary A aquifer is present beneath the site and the site is underlain by granular soils. However, the contamination is anticipated to be bound within coal fragments.	Moderate	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. However, the contamination is anticipated to be bound within coal fragments.	Moderate	
Direct contact with contaminated soils	Plants	Yes – contamination present at the site which may affect plants.	High	Contamination is present in the soils underlying the site. Remediation will be required to either remove the contamination or break pathways.
Uptake via root system			High	
Direct contact with contaminated soils	Building Materials	Yes – PAH contamination revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s.	High (plastic services) Low (buried concrete)	Please see section 9.3.3 for information on good building practice.
Direct contact with contaminated groundwater				
Exposure to Radon	Operative	Yes – the site is located within a radon affected area as between 1% and 3% of properties are above the action level.	Low	The publication BR211 states that no protection measures are necessary.
	End User			

9.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy could include the following main elements.

9.3.1 Remediation Objectives

Based on the site-specific risk assessment the object of the remediation is likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect the end user from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect neighbours from the inhalation and ingestion of dust during the construction process.
- To protect end users and neighbours from the ingestion of contaminated fruit and vegetables.
- To protect plants from direct contact with contamination and prevent uptake via root system.
- To ensure that contamination cannot enter the former services occupying the site which may return to controlled waters.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwater.

9.3.2 Development Requirements

It is understood that it is to be developed by the construction of two detached dwellings with garages; alterations to the existing public house to form one dwelling; erection of a single and two storey extension. In view of the above a site-specific remediation strategy should be undertaken. However, for preliminary design and costing the following remediation proposals are offered.

9.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore, the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be

included in the contractor's Health and Safety Plan and site-specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with contaminated soils..
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Access to the site by the general public should be restricted until remediation has taken place.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- In order for contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.

Landscaped Areas

It is understood that soft landscaped areas are proposed. In view of this and the potential contamination on site, it is considered that landscaped areas will require some remediation.

Should the made ground be entirely removed from the site, then no contamination linkage would be present and clean cover would not be required within garden areas. It may of course need to

be demonstrated with accurate site levels and photographic evidence that the made ground has been wholly removed.

Should made ground not be entirely removed garden and landscaped areas within the development remediation could include the provision of a clean cover system. This system would need to employ a capping layer of say 500mm of inert material, which will put the contaminated ground out of the end users' dig range. At the base of this layer, a granular capillary break of say 100mm of free draining granular soil should be placed in order to prevent mobile contamination rising upward. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

9.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3883 (2007)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG[11] documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 7: Validation sampling and testing

Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	1 or 2 depending on the type of stone (to confirm the inert nature of the material)	Standard metals/metalloids (As, Cd, Cr, Cr(VI), Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 1000m³	Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos
Greenfield/ Manufactured Soils	The greater of a minimum of 3 or 1 per 250m³	Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos
Brownfield/ Screened Soils	The greater of a minimum of 6 or 1 per 100m³	Standard metals/metalloids as above plus PAH (16 USEPA), TPH (CWG banded) and Asbestos Any additional analysis dependant on the history of the donor site.

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

[11] *YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V3.3* Appendix 1a, October 2016.

Table 8: Fill screening values					
Contaminant	**Screening Value (Residential with Plant Uptake) (mg/kg)**				**Reference**
	1% SOM		**6% SOM**		
As	37		37		Atrisk^{SOIL} SSVs
Cd	22.1		22.1		Atrisk^{SOIL} SSVs
Cr(VI)	3.62	20.5	3.63	20.5	Atrisk^{SOIL} SSVs
Cu	4730		4790		Atrisk^{SOIL} SSVs
Hg	8.81		15.80		Atrisk^{SOIL} SSVs
Ni	136		136		Atrisk^{SOIL} SSVs
Pb	200		200		Atrisk^{SOIL} SSVs
V	136		138		Atrisk^{SOIL} SSVs
Zn	20000		20300		Atrisk^{SOIL} SSVs
TPH CWG	See attached summary sheet				Atrisk^{SOIL} SSVs
PAH 16 USEPA	See attached summary sheet				Atrisk^{SOIL} SSVs

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

9.5 Verification Report

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

10. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Produce a remediation strategy report.
- Produce a validation report to demonstrate that the geo-environmental risks discussed in this report have been mitigated.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

11. References

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  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*

- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.

- British Standards Institution (2015) BS5930: *Code of practice for site investigations,* B.S.I., London.

- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.

- British Standards Institution (2015) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.

- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.

- British Standards Institution (2004) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, *incorporating corrigendum no.1 (2007)*, B.S.I., London.

- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*

- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.

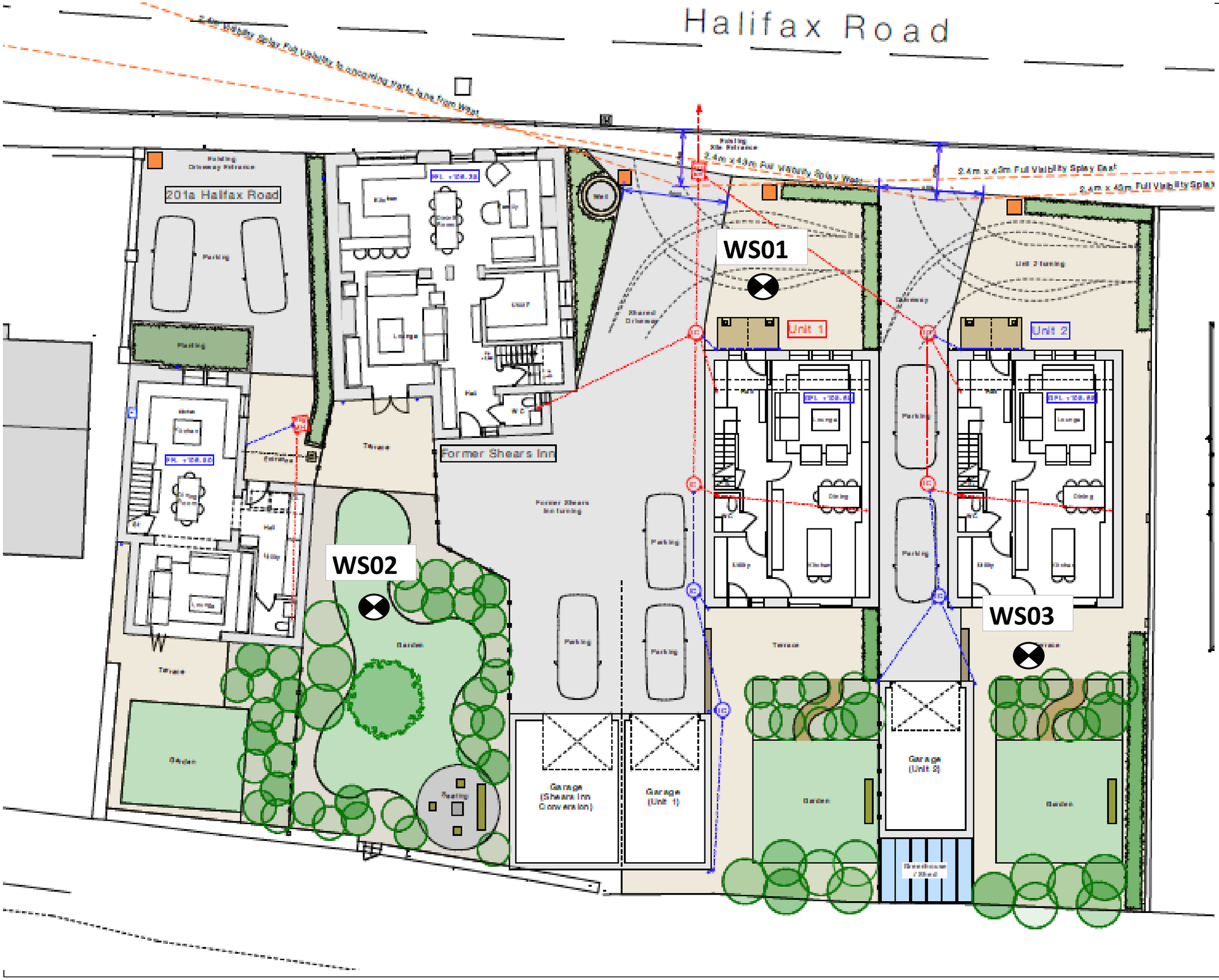
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.

- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.

- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings,* CIRIA Report C665.

Appendix 1

Site Plan



Notes:

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe
Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:

Andrew Mitchell

Job Number:

C4477/25/E/7515

Project Details:

The Shears, Liversedge

Scale: Not to scale - reference only

ground investigation | drilling & excavation | insitu testing
laboratory testing & gas monitoring | engineering consultancy
surveying & flood risk assessments | training, CPD & expert witness
... delivered using our own drilling rigs / crews / soils lab / engineers
Constructionline · QMS ISO 9001:2015 · QMS ISO 14001:2015 · QMS ISO 45001:2018 · UKAS

Appendix 2

Borehole Records

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS01**

Sheet 1 of 1

Project Name: The Shears	Project No. C4477/25/E/7515	Co-ords:	Hole Type WLS
Location: 210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR		Level:	Scale 1:25
Client: Andrew Mitchell		Dates: 10/03/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				67	100		0.60			MADE GROUND (Soft, dark brown, slightly sandy, gravelly SILT. Sand is fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone with occasional coal fragments).
				57	100		1.25			Firm, orangish brown mottled grey, slightly sandy, gravelly, silty CLAY. Sand is fine to medium. Gravel is angular and fine to coarse sandstone. [COMPLETELY WEATHERED PENNINE LOWER COAL MEASURES FORMATION]
							1.40			Brown SANDSTONE recovered as gravel. [PENNINE LOWER COAL MEASURES FORMATION]
										End of Borehole at 1.40m

1 2 3 4 5

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS02**

Sheet 1 of 1

Project Name:	The Shears	Project No. C4477/25/E/7515	Co-ords:	Hole Type WLS
Location:	210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR		Level:	Scale 1:25
Client:	Andrew Mitchell		Dates: 10/03/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				67	85		0.60			MADE GROUND (Soft, dark brown, slightly sandy, gravelly SILT. Sand is fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone with occasional coal fragments).
				57	50		1.20			Brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. [PENNINE LOWER COAL MEASURES FORMATION]
										End of Borehole at 1.20m

1 2 3 4 5

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS03**

Sheet 1 of 1

Project Name:	The Shears	Project No. C4477/25/E/7515	Co-ords:	Hole Type WLS
Location:	210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR		Level:	Scale 1:25
Client:	Andrew Mitchell		Dates: 10/03/2025	Logged By SH

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
				67	85		0.05			MADE GROUND (Asphalt). (Drillers notes). MADE GROUND (Soft, brown, slightly sandy, gravelly, silty CLAY. Sand is fine to coarse. Gravel is angular to sub-angular and fine to coarse of ash, brick, concrete and sandstone).
				57	50		1.00			Brown, silty, sandy, angular to sub-angular and fine to coarse GRAVEL of sandstone. [PENNINE LOWER COAL MEASURES FORMATION]
							1.40			End of Borehole at 1.40m

1 2 3 4 5

Remarks

AGS

Appendix 3

Gas Monitoring Sheets

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	1	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	18.03.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.1	0.1	0.1	0.1	0	0	0	0	21.4	21.1			0.1	0.1	1.37		1.6	
2	0	0	0.1	0.1	0	0	0	0	20.8	20.7			0	0	DRY		1.22	
3	0	0	0.1	0.1	0	0	0	0	21.3	21.3			0	0	DRY		1.31	
Max.	0.1	0.1	0.1	0.1	0	0	0	0	21.4	21.3	0	0	0.1	0.1	1.37			
Min.	0	0	0.1	0.1	0	0	0	0	20.8	20.7	0	0	0	0	1.37			

ND - Not detected

DRY - No water in well

NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0.2l/m2 in last 6 hours
Wind	8
Temperature	7
Barometric Pressure	1025
Pressure Trend	Falling

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4	0	0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate	0	0

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	2	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	25.03.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0	0	0.2	0.2	0	0	0	0	20.7	20			0	0	1.37		1.6	
2	0	0	0.1	0.1	0	0	0	0	20.8	20.2			0	0	DRY		1.22	
3	0	0.1	0.4	0.4	0	0	0	0	20.4	20.4			0	0	DRY		1.39	
Max.	0	0.1	0.4	0.4	0	0	0	0	20.8	20.4	0	0	0	0	1.37			
Min.	0	0	0.1	0.1	0	0	0	0	20.4	20	0	0	0	0	1.37			

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0l/m2 in last 12 hours
Wind	18
Temperature	12
Barometric Pressure	1021
Pressure Trend	Rising

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	20
Min O_2	20	20
Flow rate		

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	3	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	01.04.2025				

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.1	0.1	0.3	0.3	0	0	0	0	21.1	20.7			0	0	1.57		1.6	
2	0	0	0.1	0.2	0	0	0	0	21.4	20.9			0	0	DRY		1.22	
3	0	0	0.3	0.3	0	0	0	0	21.2	21.2			0	0	DRY		1.39	
Max																		
Min.																		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	0l/m2 in last 12 hours
Wind	11
Temperature	8
Barometric Pressure	1027
Pressure Trend	Falling

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	20
Min O_2	20	20
Flow rate		

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	4	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	08.04.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0	0	0.1	0.2	0	0	0	0	20.9	20.7			0	0	1.4		1.6	
2	0	0	0.1	0.2	0	0	0	0	21	20.9			0	0	DRY		1.22	
3	0	0	0.3	0.3	0	0	0	0	20.9	20.9			0	0	DRY		1.39	
Max																		
Min.																		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	0
Wind	6
Temperature	10
Barometric Pressure	1028
Pressure Trend	Rising

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	20
Min O_2	20	20
Flow rate		

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	5	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	16.04.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0	0	0.2	0.2	0	0	0	0	21.6	21.6			0	0	1.15		1.34	1: Cap removed by excavator. Install pipe
2	0	0	0.1	0.1	0	0	0	0	23.1	20.1			0	0	DRY		1.22	buried. This was found with the tap in
3	0	0	0.2	0.2	0	0	0	0	21.4	20.9			0	0	DRY		1.39	place. I do not know if the tap was put
																		back in the pipe by the client. Water level
																		taken to the top of the install pipe.
Max																		
Min.																		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	3l/m2 over last 6 hours
Wind	No data, gusty
Temperature	12
Barometric Pressure	998
Pressure Trend	Rising

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	20
Min O_2	20	20
Flow rate		

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4477/25/E/7515	Client:	One 17 Architects	Visit:	6	Of	6
Site:	The Shears, 210 Halfax Road, Liversedge, WF15 6NR	Date:	22.04.2025				

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd , Offices 1 & 2 Barncliffe Business Park, Shelley, Huddersfield, HD8 8LU

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
1	0.1	0.1	0.2	0.2	0	0	0	0	20.7	20.7			0	0	1.15		1.34	To top of blue pipe
2	0	0	0.1	0.1	0	0	0	0	20.5	20.2			0	0	Dry		1.22	
3	0	0	0.2	0.2	0	0	0	0	20.6	20.2			0	0	Dry		1.4	
Max																		
Min.																		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	Dry
Precipitation	0l/m2 in last 6 hours
Wind	4
Temperature	10
Barometric Pressure	1013
Pressure Trend	Rising

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)		
	Peak	Steady
Max CH_4		0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	20
Min O_2	20	20
Flow rate		

Operative Details.	M.Tuck

Appendix 4

Laboratory Testing

Rogers Geotechnical Services Ltd
Offices 1&2 Barncliffe Business Pk
Near Bank, Shelley
Huddersfield
West Yorkshire
HD8 8LU

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

Analytical Report Number : 25-013027

Project / Site name:	The Shears	**Samples received on:**	12/03/2025
Your job number:	C4477	**Samples instructed on/ Analysis started on:**	14/03/2025
Your order number:		**Analysis completed by:**	20/03/2025
Report Issue Number:	1	**Report issued on:**	21/03/2025
Samples Analysed:	3 soil samples		

Signed:

Joanna Wawrzeczko
Senior Reporting Specialist
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
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-013027
Project / Site name: The Shears

Lab Sample Number				483099	483100	483101
Sample Reference				WS01	WS02	WS03
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.40	0.20	0.70
Date Sampled				11/03/2025	11/03/2025	11/03/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Stone Content	%	0.1	NONE	< 0.1	33.9	< 0.1
Moisture Content	%	0.01	NONE	19	18	17
Total mass of sample received	kg	0.1	NONE	0.6	0.7	0.6
Asbestos						
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MUA	MMI	MUA
Analysis completed	N/A	N/A	N/A	20/03/2025	18/03/2025	20/03/2025
General Inorganics						
pH (L099)	pH Units	N/A	MCERTS	7.4	8	7.2
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	110	39	49
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	53.2	19.7	24.4
Organic Matter (automated)	%	0.1	MCERTS	2.5	4.4	2.4
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	1.4	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.12	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	3	< 0.05	0.08
Fluorene	mg/kg	0.05	MCERTS	2.3	< 0.05	0.06
Phenanthrene	mg/kg	0.05	MCERTS	20	0.17	0.7
Anthracene	mg/kg	0.05	MCERTS	5.2	< 0.05	0.18
Fluoranthene	mg/kg	0.05	MCERTS	29	0.24	2
Pyrene	mg/kg	0.05	MCERTS	26	0.2	2.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	14	0.12	1
Chrysene	mg/kg	0.05	MCERTS	13	0.14	1
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	14	0.15	1.7
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	6.9	0.08	0.61
Benzo(a)pyrene	mg/kg	0.05	MCERTS	14	0.11	1.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	6.3	0.08	0.77
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.5	< 0.05	0.17
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	6.5	0.06	0.81
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	163	1.36	12.7

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 25-013027
Project / Site name: The Shears

Lab Sample Number				483099	483100	483101
Sample Reference				WS01	WS02	WS03
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.40	0.20	0.70
Date Sampled				11/03/2025	11/03/2025	11/03/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	42	29
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	18	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	170	60	47
Lead (aqua regia extractable)	mg/kg	1	MCERTS	50	260	34
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	26	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	30	43	35
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	88	76	63

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 25-013027
Project / Site name: The Shears

* 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 *
483099	WS01	None Supplied	0.4	Brown clay and loam with gravel and vegetation
483100	WS02	None Supplied	0.2	Brown loam and clay with gravel and stones
483101	WS03	None Supplied	0.7	Brown clay and sand with gravel

Analytical Report Number : 25-013027
Project / Site name: The Shears

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
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	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	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

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' 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.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Appendix 5

Soil Screening Value Comparison Sheet

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4477/25/E/7515
Job Name	The Shears, 210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR
Date	21.03.2025
Client	Andrew Mitchell

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2's detectable limit for this compound.
B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.
C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.
D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.

KEY
- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%		Sample Location	WS01	WS02	WS03							
				Atrisk 2015 (No Free Product	Atrisk 2017	Depth Top	0.40	0.20	0.70							
						Depth Base										
Cadmium	mg/kg	C	0.2		22.1		< 0.2	< 0.2	< 0.2							
Chromium (Hexavalent)	mg/kg	B/C	1.8	20.5	3.62		< 1.8	< 1.8	< 1.8							
Copper	mg/kg	A+	1.0		4730		170.00	60.00	47.00							
Mercury	mg/kg	A/D	0.3		8.81		< 0.3	0.40	< 0.3							
Nickel	mg/kg	A+	1.0		136		14.00	26.00	19.00							
Lead	mg/kg	C	1.0		200		50.00	260.00	34.00							
Zinc	mg/kg	A+	1.0		20000		88.00	76.00	63.00							
Vanadium	mg/kg	A+	1.0		136		30.00	43.00	35.00							
Arsenic	mg/kg	C	1.0		37		11.00	42.00	29.00							
Selenium	mg/kg	A	1.0		375		< 1.0	< 1.0	< 1.0							
Cyanide (Free)	mg/kg	A	1.0		34		< 1.0	< 1.0	< 1.0							
Total Phenols	mg/kg	A	1.0		267											
Naphthalene	mg/kg	A+	0.05	0	0.829		1.40	< 0.05	< 0.05							
Acenaphthylene	mg/kg		0.05				0.12	< 0.05	< 0.05							
Acenaphthene	mg/kg	A+	0.05	608	157		3.00	< 0.05	0.08							
Fluorene	mg/kg	A+	0.05	0	735		2.30		0.06							
Phenanthrene	mg/kg		0.05				20.00	0.17	0.70							
Anthracene	mg/kg	A+	0.05	0	10200		5.20	< 0.05	0.18							
Fluoranthene	mg/kg	A+	0.05		983		29.00	0.24	2.00							
Pyrene	mg/kg	A+	0.05		668		26.00	0.20	2.10							
Benzo[a]anthracene	mg/kg	A	0.05	4.52	1.71		14.00	0.12	1.00							
Chrysene	mg/kg	A	0.05	585	0.44		13.00	0.14	1.00							
Benzo[b]fluoranthene	mg/kg	A	0.05	7.72	1.22		14.00	0.15	1.70							
Benzo[k]fluoranthene	mg/kg	A	0.05	84.4	0.686		6.90	0.08	0.61							
Benzo[a]pyrene	mg/kg	B/C	0.05	4.95	1.51		14.00	0.11	1.50							
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	7.31	0.0614		6.30	0.08	0.77							
Dibenz(a,h)Anthracene	mg/kg	A	0.05	0.838	0.00393		1.50	< 0.05	0.17							
Benzo[g,h,i]perylene	mg/kg	A	0.05	96.2	0.0187		6.50	0.06	0.81							
Total Of 16 PAH's	mg/kg		0.8													
Aliphatic TPH >C5-C6	mg/kg	A+	0.01	0	42.7											
Aliphatic TPH >C6-C8	mg/kg	A+	0.01	0	99.3											
Aliphatic TPH >C8-C10	mg/kg	A+	0.01	0	13.9											
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	81.7	49.9											
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	385	20.9											
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		210000											
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		210000											
Aliphatic TPH >C35-C44	mg/kg		10.0													
Total Aliphatic Hydrocarbons	mg/kg		10.0													
Aromatic TPH >C5-C7	mg/kg	A+	0.01		0.137											
Aromatic TPH >C7-C8	mg/kg	A+	0.01	0	113											
Aromatic TPH >C8-C10	mg/kg	A+	0.02	0	20.5											

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4477/25/E/7515
Job Name	The Shears, 210 Halifax Road, Liversedge, West Yorkshire, WF15 6NR
Date	21.03.2025
Client	Andrew Mitchell

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2's detectable limit for this compound.
B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.
C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.
D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.

KEY

- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%		Sample Location	WS01	WS02	WS03							
						Depth Top	0.40	0.20	0.70							
						Depth Base										
Aromatic TPH >C10-C12	mg/kg	A+	1.0		70											
Aromatic TPH >C12-C16	mg/kg	A+	2.0	165	155											
Aromatic TPH >C16-C21	mg/kg	A+	10.0		319											
Aromatic TPH >C21-C35	mg/kg	A+	10.0		1120											
Aromatic TPH >C35-C44	mg/kg		10.0													
Total Aromatic Hydrocarbons	mg/kg		10.0													
Total Petroleum Hydrocarbons	mg/kg		10.0													
pH			N/A				7.40	**8.00**	**7.20**							
Sulphate (2:1 Water Soluble) as SO4	g/l		0.00125				**0.053**	**0.020**	0.024							
ACM Type			N/A				Not detected	Not detected	Not detected							
Asbestos Identification	%															
ACM Detection Stage			N/A													
Moisture	%		0.01				19.00	18.00	17.00							
Soil Colour			N/A													
Other Material			N/A													
Soil Texture			N/A													
Sulphate (Total)	%		0.005													
Organic Matter	%		0.1				2.50	**4.40**	**2.40**							

Appendix 6

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

Tox Data Report No.	Compound	Residential with Homegrown Produce Landuse (mg/kg)				Reference
	Metals	**SOM: 1%**		**SOM: 6%**		
3	Cadmium	22.1		22.1		C
4	Chromium VI	3.62	20.5	3.63	20.5	B/C
	Copper	4730		4790		A+
7	Mercury	8.81		15.80		A/D
8	Nickel	136		136		A+
	Lead	200		200		C
	Zinc	20000		20300		A+
	Vanadium	136		138		A+
	Semi and Non Metals					
1	Arsenic	37		37		C
10	Selenium	375		375		A
	Free Cyanide	34		34		A
9	Phenols (total)	267		1200		A
	Poly Aromatic Hydrocarbons	Free product	No free product	Free product	No free product	
20	Napthalene	0.829		12.2		A+
	Acenaphthene	157	608	2760		A+
	Fluorene	735		2610		A+
	Anthracene	10200		26200		A+
	Fluoranthene	983		2980		A+
	Pyrene	668		2120		A+
	Benzo(a)anthracene	1.71	4.52			A
2	Chrysene	0.44	585			A
2	Benzo(b)fluoranthene	1.22	7.72			A
2	Benzo(k)fluoranthene	0.686	84.4			A
2	Benzo(a)pyrene	1.51	4.95	2.05	4.95	B/C
2	Dibenzo(a,h)anthracene	0.00393	0.838			A*
2	Indeno(1,2,3-cd)pyrene	0.0614	7.31			A
2	Benzo(g,h,i)perylene	0.0187	96.2			A
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	42.7		369		A+
	Aliphatic C6-C8	99.3		768	1240	A+
	Aliphatic C8-C10	13.9		204		A+
	Aliphatic C10-C12	49.9	81.7	297	1180	A+
	Aliphatic C12-C16	20.9	385	125	4130	A+
	Aliphatic C16-C21	210000		210100		A+
	Aliphatic C21-C35	210000		210100		A+
	Aromatic C5-C7 (Benzene)	0.137		0.871		A+
	Aromatic C7-C8 (Toluene)	113		780		A+
	Aromatic C8-C10	20.5		232		A+
	Aromatic C10-C12	70		468		A+
	Aromatic C12-C16	155	165	830		A+
	Aromatic C16-C21	319		1040		A+
	Aromatic C21-C35	1120		1710		A+
Others						
Asbestos Not Detected						
A+ = Values update June 2017.						
A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.						
B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report).						
C = Catergory 4 Screening Levels (C4SLs).						
D = SSV provided is for Methyl Mercury.						