LAND AT WHAMS ROAD,
CROW EDGE, HEPWORTH,
SOUTH YORKSHIRE, S36 4HE

PHASE 2 GEO-ENVIRONMENTAL INVESTIGATION REPORT

Prepared by

SILKSTONE ENVIRONMENTAL LTD

For

ROGERS BUILDING SUPPLIES LTD

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0	18/08/2021	Phase 2 Geo-Environmental Investigation Report	NP
1	14/09/2021	Updated gas risk assessment following completion of gas monitoring programme.	NP

EXECUTIVE SUMMARY

Site Location	The site is located to the north of Pennine Edge road off the A616 in Crow Edge, Hepworth, approximately 12.3km to the south southeast of Huddersfield town centre at National Grid Reference (NGR) 418715, 404611.
History	The site existed as open land to the rear of a nearby public house before the majority of the site was subjected to the licensed tipping of commercial waste between 1994 and 1995. The western part of the site subsequently formed part of the car park to the public house up until sometime before 2005 when the car park and surface vegetation had been removed as part of the redevelopment of the public house site for residential dwellings.
Proposed Development	The proposed development is for the construction of five residential dwellings in accordance with planning permission 2019/0312 which is understood to include private gardens.
Purpose of Investigation	An intrusive investigation was undertaken to characterise ground conditions, assess contamination risk to human health and the wider environment, risk from ground gas and potential shallow coal mining and to ascertain geotechnical parameters to inform foundation design.
Scope of Works	The investigation involved the following: • 3 no. window sampling boreholes with Standard Penetration Testing (SPTs); • 3 no. rotary open hole boreholes to investigate the potential for shallow mining; • Soil sampling for contamination and geotechnical testing; • Surface water sampling for chemical analysis; • A programme of gas monitoring from 3 no. monitoring wells.
Encountered Strata	The area of the proposed development is underlain by Made Ground to depths of between 2.55 and 3.65m below existing ground level (begl) comprising a slightly gravelly silty topsoil above granular soils of gravelly sand and sandy gravels and cohesive soils of gravelly clay. The fill constituents include gravels of sandstone, mudstone, limestone, quartzite, slate, coal, rock aggregate, concrete, brick and slag with cobbles of sandstone, mudstone, concrete and rock aggregate and possible boulders of the same and occasional fragments of ceramic drain, tarmac, glass, pottery, metal, plastic, polythene and reinforced plastic packaging straps. At one of the exploration holes a large proportion of the granular fill was described as building rubble between 1.20 and 3.00m begl.
	Natural soils below the Made Ground comprise predominantly of soft to very stiff clay soils to thicknesses of between 0.10 and 1.60m, sometimes incorporating gravels of mudstone. A medium dense gravelly sand was encountered to a thickness of 0.20m beneath the clay at one location. Mudstone bedrock was encountered at all locations from depths of 3.20-5.00m begl.
Groundwater	Perched groundwater was recorded within a natural sand horizon at a depth of 3.00m begl at one location during the fieldwork and subsequent monitoring has consistently recorded groundwater in two of the wells at depths of between 2.63 and 4.52m begl.
Geotechnical	There is a potential for slope failure on the steeper sections of the embankment which are currently stable due to the density of vegetation reinforcing the existing fill layers. De-vegetation or general excavations on the steeper slopes should therefore be avoided to minimise this.
	Traditional strip footings are considered unsuitable because of the variable nature and depth of Made Ground and the risk of slope failure on the embankment. An alternative foundation solution is advised to alleviate any excessive differential settlement from the variable fill and from potential slope instability which could involve a reinforced strip footing / ring beam supported by mini piles driven through the Made Ground and highly compressible natural soils into the weathered Mudstone.
	Options need to be considered for overcoming potential excessive differential settlement to areas of proposed hardstanding, access roads and parking areas. Possible options include the use of mini piles to support areas of hardstanding or the use of linked Continually Reinforced Concrete Pavements.
Contamination	The soil contamination assessment for human health has identified isolated elevations in copper and sulphide and sporadic low level concentrations in. polyaromatic hydrocarbon compounds within the Made Ground that were slightly in excess of relevant screening assessment criteria. An isolated occurrence of amosite (brown) asbestos fibres has also been identified and quantified to the minimum level.

	The contamination risk to the water environment (surface and groundwater) has been completed based upon the results from testing on water samples from Sledbrook Dike and testing for leachable PAHs and copper in soil from the relevant samples elevated in these substances. The results indicate that the risk to Sledbrook Dike and groundwater within the Secondary A bedrock aquifer from the proposed development is low.
Gas Monitoring	The gas risk assessment based on the completion of six monitoring visits has determined that the site equates to an 'Amber 2' classification under the NHBC 'Traffic Light System'. This means that high-level ground gas protection measures are required for low rise housing with a 150mm deep underfloor void.
	A risk to neighbouring residents has also been identified from the potential accumulation of carbon dioxide gas migrating to the adjoining existing houses as a result of the development proposals capping the on-site landfill, thereby changing the preferential migration pathway for gas off site. The construction of a gravel filled vent trench along the southern site boundary is therefore recommended to minimise this risk.
Past Coal Mining	Each of the three rotary open hole boreholes were drilled to 30.00m begl. No coal was encountered during the investigation and no voids or worked or soft / broken ground or discoloured water flush / arisings to suggest that coal has been worked at shallow depth beneath the site. On this basis it is considered that the proposed development is unlikely to be subject to surface instability relating to coal mining legacy issues. Should future development be considered on site out-with the proposed development area, the mining risk will need reassessing.
Removal of Soils From Site	If surplus soils are to be removed for appropriate off-site disposal as part of the proposed development, landfill operators are likely to require the results of testing for Waste Acceptance Criteria (WAC) on the soils which should be supplemented with the testing data appended to this report.
	Removal of surplus soils from site should be carried out by a registered waste carrier to an appropriately licensed waste management facility with waste transfer documentation being provided and retained for future reference.
Contamination Remediation	The following recommendations are made regarding remediation of the site: • The preparation of a Remediation Statement for approval by the Local Authority and describing the options for mitigating the human health risk from soil contamination within areas of proposed garden and carbon dioxide gas ingress into proposed and adjoining existing buildings. • For contamination this is likely to favour the provision of a clean cover system to areas of proposed garden affected by sporadic elevations in PAHs. • For carbon dioxide gas, high-level ground gas protection measures are required on the basis the development is for low rise housing with a 150mm deep underfloor void. • Consideration to be given to the construction of a gravel filled vent trench along the southern site boundary to mitigate the risk to neighbouring residents from the accumulation of carbon dioxide gas migrating to the adjoining dwellings as a result of the proposed development causing a potential change to the preferential migration pathway for gas off site. • Prior to the commencement of development, decommissioning the 3 no. gas wells in order to remove them as a potential migration pathway for gas migration to the surface or any surface contamination to groundwater.
Risk Overview	Based on the proposed development, it is considered that the site presents an overall **Low to High** environmental risk.

This Executive Summary should be read in conjunction with the entire report as it is only a brief account highlighting the key findings of the report.

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REFERENCES

A *Land Contamination Risk Management*, Environment Agency (April 2021).
B *Guiding Principles for Land Contamination*, Environment Agency (March 2010).
C BS 5930:2020 *Code of Practice for Site Investigations*.
D BS 10175: 2017 *Investigation of potentially contaminated sites: Code of practice*.
E CIRIA C665:2007 *Assessing the risk posed by hazardous ground gases to buildings*.
F CIRIA C758D *Abandoned mine workings manual*, CIRIA, 2019.
G Town and Country Planning Act 1990.
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I Revised Statutory Guidance dated April 2012 implementing the contaminated land provisions under Part 2A of the Environmental Protection Act 1990.
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R YALPAG technical guidance on *Verification requirements for gas protection systems*, version 1.1, December 2016.

1.0 INTRODUCTION

1.1 Brief

Silkstone Environmental Ltd (SEL) have completed a Phase 2 (intrusive) geo-environmental investigation on behalf of Rogers Building Supplies Ltd (the Client) following completion of the Phase 1 desk study in April 2021.

The site under investigation extends to approximately 0.2ha and comprises part of a plateau area of open rough grass and peripheral shrub with a steep embankment vegetated with rough grass, shrubs and occasional trees extending along the north eastern and eastern edges.

The proposed development is for the construction of five residential dwellings in accordance with planning permission 2019/0312 which is understood to include private gardens.

This report has been prepared in accordance with Conditions 11 and 12 of the planning permission and follows completion of a *Phase 1 Preliminary Geo-Environmental Risk Assessment* (desk study) prepared by SEL, reference 21066/P1/0 and issued on 23rd April 2021, which should be read alongside this latest report.

The purpose of the investigation was to characterise ground conditions to assess the contamination status of the site, ground gas risk coal mining legacy risk and inform the design of building foundations and areas of hardstanding. The work included investigation fieldwork, insitu testing, chemical and geotechnical laboratory testing and the preparation of this report.

1.2 Guidance and Information Sources

This report has been produced in line with relevant guidance and best practice. The ground investigation has been carried out in general accordance with the requirements of *Land Contamination Risk Management* (Ref. A), involving a tier 2 generic quantitative risk assessment. The investigation has also been carried out in general accordance with the '*Guiding Principles for Land Contamination*' (Ref. B), the recommendations of BS5930: (2020) *Code of Practice for Site Investigations* (Ref. C), BS10175:(2017) *Investigation of Potentially Contaminated Sites: Code of Practice* (Ref. D), CIRIA C665:2007 *Assessing the risk posed by hazardous ground gases to buildings* (Ref. E) and CIRIA C758D *Abandoned mine workings manual*, 2019 (Ref. F).

If land proposed to be developed is suspected to be contaminated either historically or by its current use, an investigation may be requested by the Local Authority under the Town and Country Planning Act 1990 (Ref. G) and the National Planning Policy Framework (2018) (Ref. H) to determine the level of risk and if remediation is necessary or whether there may be grounds for the land to be considered contaminated under Part 2A of the Environmental Protection act 1990 (Ref. I). Under this regime investigations are carried out to determine if the current condition of the site is suitable for its proposed use.

1.3 Report Limitations

The comments and opinions expressed in this report are based on the ground conditions encountered at the specific locations during the fieldwork and on the results of measurements made in the field and in the laboratory. However, conditions may prevail which were not revealed by the investigation and which, therefore, could not be taken into account. In particular it should be noted that groundwater levels may vary due to seasonal or other effects such as boring, drilling and excavation processes.

The conclusions reached in this report are necessarily restricted to those which can be determined from available information and may be subject to amendment in the light of additional information becoming available or to changes in relevant legislation.

This report is strictly confidential to the party to whom it is addressed and may only be relied upon by that party or their other professional advisors, for the specific purpose to which it refers. Any third party using this report does so entirely at their own risk and SEL accepts no responsibility or liability for any costs, claims, damages or expenses (including consequential damages) as a result of this report or any part of its contents being used by any third party.

Except in connection with the specific purpose for which this report has been prepared, neither the whole nor any part of this report, nor any reference thereto, may be included in any published document, circular or statement, nor published in any way, nor disclosed orally to a third party, without the written approval from SEL of the form and context of such publication or disclosure. Such approval is required whether or not SEL are referred to by name and whether or not the report is combined with others.

SEL are unaware of any conflicts of interest in the preparation of this report.

2.0 ENVIRONMENTAL SETTING

2.1 Site Location

The site is accessed from Pennine Edge (road) off of the A616 in Crow Edge, Hepworth, South Yorkshire, as shown on the site location plan presented as Figure 1 in Appendix A. The site is centred on National Grid Reference (NGR) 418715, 404611 and the plateau area of the site is situated at an approximate height of 301m Above Ordnance Datum (AOD), with the embankment sloping down to approximately 298m AOD.

2.2 Historical Uses

The history of the site has been determined from the Phase 1 desk study report (referred previously). This shows that the site existed as open land to the rear of a public house before the majority of the site was subjected to the licensed tipping of commercial waste by S Thacker Plant Hire between 1994 and 1995.

The western part of the site subsequently formed part of the car park to the public house up until sometime before 2005 when the car park and surface vegetation had been removed in association with the redevelopment of the adjoining public house for residential dwellings. The site has remained open land since this time with part of it near the site access being used for the occasional parking of vehicles by adjoining residents.

The site is located in a semi-rural location where uses within the surrounding area have included a colliery and mineral railway, brickworks, gravel pit / quarry, unspecified tipping and slag heap (Crowedge mine). A large area to the west is currently occupied by the Hepworth works (ceramics) and Plevins wood recycling plant for biomass fuel.

2.3 Current Site Condition

At the time of the Phase 2 intrusive investigation, the appearance of the site was as described in the Phase 1 desk study (see photos 1-4 in Appendix C). The Phase 1 report describes the site to comprise an area of open grassland with juvenile trees to the southeast and semi- mature to mature vegetation comprising of brambles and trees along the north eastern and north western boundaries.

A steep embankment overgrown with brambles was identified on the north eastern boundary, extending down to a dry stone wall adjoining a small watercourse (Sledbrook Dike).

The adjoining residential properties and associated garages were described along the south and southwestern site boundaries.

2.4 Geology

The anticipated geology of the location based on the previous Phase 1 desk study is summarised in Table 1.

Table 1: Anticipated Geology

Artificial Ground	Made Ground from the historic licensed tipping of commercial waste and former car park use.
Superficial Deposits & Landslips	None recorded on site.
Solid Geology	**Pennine Lower Coal Measures Formation** comprising interbedded grey mudstone, siltstone and pale grey sandstone, with occasional coal seams, ironstone beds, seat earth beds and marine bands. The rock type at this location is described as having a variable (low to moderate), fracture type permeability.
Dip of Solid Strata	7° north (based on dip recorded on BGS map).
Faults	Closest fault recorded onsite described as a normal fault, inferred, down throwing to the south.

2.5 Coal Mining

The Phase 1 desk study identified the proposed development to be potentially at risk from recorded shallow (<30m depth) coal mine workings in one coal seam (36 Yard Coal) beneath the site. An intrusive site investigation for coal mining was recommended involving three rotary open-hole boreholes to a target depth of 30.00m to determine the depth and disposition of the workings and risk to the development.

2.6 Hydrogeology

Key features determined from the Phase 1 desk study are outlined as follows:

- The bedrock strata is described as a Secondary A Aquifer.
- The groundwater vulnerability for the Secondary Aquifer is categorized as medium vulnerability with shallow soils (natural soils if present) of low leaching class.
- The site does not lie within a groundwater Source Protection Zone.
- The chemical quality of bedrock groundwater in the region is classified as poor.
- There are 19 no. groundwater abstractions licensed by the Environment Agency (EA) within 2km of the site, 4 no. of which are active licenses. The nearest of these is held by R Plevin & Sons Ltd at a location 378m south west for dust suppression.
- There is 1 no. active potable groundwater abstraction licensed by the EA recorded within 2km of the site held by Wavin Limited Ltd 893m northwest (up-gradient).
- Groundwater resources were not considered to be highly sensitive to any potential contamination at this location.

2.7 Hydrology

Key features determined from the Phase 1 desk study are outlined as follows:

- The nearest surface water feature is Sledbrook Dike located 5.00m to the north east. This flows in a south easterly direction as a tributary to the River Don located approximately 1.95km to the southeast.

- The most recent chemical quality data for the relevant stretch of the Don (2019) records the chemical quality as 'Fail' although the quality has been 'Good' in previous years.
- There are 6 no. EA licensed surface water abstractions recorded within 2km of the site, two of which are recorded as being active. The closest active abstraction is held by Hepworth Pipe Co Ltd for general use relating to a secondary category (Medium Loss) located 1.42m west.
- There are no active EA licensed surface water abstractions recorded within 2km.
- There are no active EA licensed discharge consents to controlled waters within 500m of the site.
- There are 3 no. pollution incidents recorded by the EA within 500m of the site, all recorded as having a Category 3 (minor) water impact. The nearest was pollution from solid manure in August 2002 194m southeast (down gradient) from the site.
- Local surface water resources were assessed to be moderately sensitive to any potential contamination due to the close proximity of Sledbrook Dike.

2.8 Ecology

The open mosaic habitat designation located 121m to the south west was identified as a potential sensitive ecological receptor to any future on site development in the Phase 1 report. Sledbrook Dike was also identified as having some potential ecological value.

2.9 Ground Gas

The Phase 1 report identified several potential sources for the generation of ground gases within 250m of the site, the nearest being the historical landfill for commercial waste identified onsite and the shallow coal mine workings that are recorded on site and adjoining areas. A programme of gas monitoring was therefore recommended to assess gas risk to the development involving a minimum of 6 no. visits over a period of 3 months.

The site is not located in a Radon Affected Area and there is therefore no requirement for radon protection measures for new buildings.

3.0 GROUND INVESTIGATION

3.1 Objectives

The objectives of the recent Investigation were as follows:

- To confirm the outputs from the Phase 1 report by investigating the potential presence of contamination and ground gas and likely pathways for contamination to reach receptors;
- To provide geotechnical information to assist in the design of foundations for the proposed development with basic recommendations;
- To determine the depth, thickness and disposition of possible workings in the 36 Yard coal seam to a depth of 30.00m to assess the risk to the development;
- To characterise the site and refine the conceptual site model and environmental risk assessment presented in the Phase 1 desk study, as appropriate; and
- To make recommendations for any remediation or further work.

3.2 Scope of Investigation

The investigation fieldwork was completed between 28th and 30th June 2021 and involved the following:

- Window (also known as dynamic or windowless) sampling with Standard Penetration Testing (SPTs) at 4 no. locations (WS01 to WS04) to depths of between 3.60 and 5.00m below existing ground level (begl), with monitoring well installations at two locations;
- Rotary open hole drilling at 3 locations (RBH01 to RBH03) to a depth of 30.00m begl under a Coal Authority permit to prove the depth and disposition of old shallow coal mine workings beneath the site (if present). A gas monitoring well was also established at one location to the depth of Made Ground;
- Soil sampling at appropriate depth horizons for contamination testing to enable assessment of the potential human health risk and geotechnical testing to inform geotechnical design; and
- Surface water sampling from Sledbrook Dike at locations downstream, the mid-point adjoining the site and upstream to assess the potential impact from the on-site landfill on the chemical quality of the watercourse as it passes the site.

A programme of gas monitoring was also initiated from the new well installations following on from the fieldwork, involving 6 visits at approximately 2 weekly intervals over a period of 3 months to enable an assessment of gas risk to the future development.

The investigation locations are identified on the exploration hole location plan presented as Figure 2 in Appendix A, with the water sampling points identified in Figure 3.

The exploratory holes were positioned to provide the maximum possible representative spread across the development area, taking into account some limitation due to impenetrable shrub vegetation along sections at the top of the embankment. The rationale for the location of the exploratory holes is provided in the following table.

Table 2: Rationale for Exploratory Hole Locations

Hole ID	Position	Rationale for Hole Position					
		Targeted Location	Comments	Environ. Sampling	Geotech. Sampling	Insitu Geotech. Testing	Gas Monitoring Standpipe
WS01	SE end of site.	N	Characterisation of chemical properties for proposed gardens and geotechnical properties of soils for foundations.	Y	Y	Y	Y
WS02	Central NW part of site.	N		Y	Y	Y	
WS03	NW end of site.	N	Characterisation of chemical properties of soils for proposed gardens.	Y	Y	Y	Y
WS04	Central SE part of site.	N	Characterisation of chemical properties for proposed gardens and geotechnical properties of soils for foundations.	Y	Y	Y	
RBH01	Set out as a triangle across the site to enable calculation of dip if coal seam or workings encountered.	N	To identify presence, depth and disposition of old shallow coal mine workings.				
RBH02		N					Y
RBH03		N					

WS = Window sampling location, RBH = Rotary open borehole.

3.3 Ground Investigation Methodology

The investigation was supervised on site by a suitably qualified and experienced SEL Engineer with all window sampling holes logged and sampled in accordance with BS5930:2020 (Ref. C). The rotary holes were logged by the rotary driller. The exploratory hole logs are provided in Appendix B and a photographic record is provided in Appendix C.

Prior to commencement, the location of underground utilities was reviewed by reference to service drawings obtained for the site. Each exploratory hole location was then cleared using a Cable Avoidance Tool (CAT) prior to breaking ground.

The window sampling was completed using an Archway Competitor tracked rig and the soils retrieved from the ground in sample tubes fitted with a plastic sample liner to prevent cross contamination between locations.

Small disturbed soil samples for both contamination and geotechnical testing were collected from the window sampling holes and placed in appropriate sealed containers provided by the analytical laboratory. Soil samples to be analysed for organic compounds (such as petroleum hydrocarbons) were stored in cool boxes with ice packs prior to dispatch to the chemical laboratory. All samples were collected using appropriate sampling equipment that was cleaned between each sampling location.

Standard Penetration Tests (SPTs) were carried out at 1m intervals to provide information on soil strength.

Three surface water samples were retrieved from Sledbrook Dike using a telescopic sampler commencing with the downstream sample first. The water samples were placed in the appropriate laboratory supplied bottles and stored in an insulated cool box with ice packs prior to transfer to the chemical laboratory.

The rotary open hole drilling was undertaken in accordance with CIRIA guidance C758D (Ref. F) under Coal Authority Permit 22219, granted 14th June 2021, a copy of which is provided in Appendix D.

The permit outlined the following conditions:

- Water flush medium;
- Gas Monitoring for CO, CH_4, CO_2, O_2 & H_2S at borehole and rig;
- Operators undertaking the work to be in possession of the certificate and the Permit boundary plan at the time of works; and
- Appropriate borehole sealing without delay and to withstand site level changes.

The rotary drilling was completed to 30.00m begl at 3 no. locations under the supervision of SEL using a Baretta T41-2 track mounted rotary rig. Drilling was undertaken using water flush in accordance with the requirements of the permit. A gas alarm was attached to the front of the drill rig during drilling. No abnormal concentrations in ground gases were recorded during the investigation.

Upon completion of the fieldwork, gas monitoring wells had been established at two of the window sampling locations and one of the rotary boreholes protected with lockable cast iron metal covers set in concrete and flush with the surface.

Window sampling holes without gas wells were backfilled with soil arisings in approximately the same order that they were excavated.

The rotary boreholes were backfilled with bentonite in order to remove the risk of creating a preferential pathway for potential contaminants within the landfill migrating into the bedrock groundwater. A gas monitoring well was also established in one of the rotary holes (RBH02) targeting only the Made Ground (top 5.00m[1]) above the bentonite backfill.

3.4 Laboratory Testing

Samples for potential contamination and geotechnical testing were sent to UKAS accredited laboratories; SUEZ (formerly Derwentside Environmental Testing Ltd)[2] for contamination and Professional Soils Laboratories (PSL) for geotechnical testing. All tests were scheduled by SEL in accordance with the encountered ground conditions.

Geotechnical Testing

The following geotechnical tests were scheduled:

Table 3: Scope of Geotechnical Testing

Test	Number
BRE concrete design suite (soil aggressiveness)	3
Atterberg limits (liquid and plastic limits)	5
Moisture content	5

[1] The gas well was established in one of the rotary holes as a safeguard in case the window sampling encountered difficult ground conditions restricting the depth to which the wells could be established.
[2] Derwentside Environmental Testing Ltd (DETS) also has MCERTS accreditation for soil testing.

The geotechnical laboratory results are provided in Appendix E (the results for BRE concrete design are included with the chemical testing results in Appendix F) and discussed in Section 5.

Contamination Analysis

Samples for contamination testing were selected for analysis in accordance with the following schedule:

Table 4: Chemical Analysis Suite

Analytical Parameters	Soils	Surface Water
pH (acidity/alkalinity)	11	3
Metals / metalloids (arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc)	8	3
Hexavalent chromium	8	
Total cyanide	8	3
Thiocyanate	8	3
Sulphate (2:1 water soluble) as SO4	11	
Total sulphate as SO4	11	3
Sulphide	8	3
Total and speciated polyaromatic hydrocarbons (PAHs)	8	3
Total petroleum hydrocarbons (TPHs) CWG aliphatic / aromatic split	4	3
Benzene, toluene, ethylbenzene, xylenes (BTEX) & MTBE	4	3
Phenol (monohydric)	8	3
Volatile and semi-volatile organic compounds (VOCs & SVOCs)	2*	
Polychlorinated biphenyls (PCBs)- WHO12	2*	
Soil organic matter (SOM)	8	
Asbestos screen & ID	10	
Ammoniacal nitrogen, chloride, electrical conductivity, biochemical oxygen demand (BOD)		3

* Completed following assessment of the results on other parameters

The certified chemical laboratory results are presented in Appendix F of this report and discussed in section 6.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 General

The ground and groundwater conditions encountered are described in detail on each of the exploratory hole logs and summarised below. The logs for each location are presented in Appendix B and a photographic record of the soils encountered is provided in Appendix C.

4.2 Made Ground

Made Ground was encountered at all exploratory hole locations and proven to its full thickness at all window sampling locations to depths of between 2.55 and 3.65m begl[3], This comprised a slightly gravelly silty topsoil to depths of between 0.07 and 0.75m begl above 45% granular fill and 55% cohesive fill material.

The granular fill comprised gravelly sand and sandy gravels of sandstone, mudstone, limestone, slate, coal, rock aggregate, concrete, brick and slag with cobbles of sandstone, mudstone, concrete and rock aggregate and possible boulders. The granular fill also included occasional fragments of ceramic drain, glass, pottery, metal, plastic, polythene and reinforced plastic packaging straps. The granular fill was described as building rubble between 1.20 and 3.00m begl at WS03. An organic (rotting) odour was noted in WS02 at 1.80 – 1.90m begl.

The cohesive fill comprised gravelly clay with gravels of sandstone, mudstone, limestone, quartzite, coal, brick and concrete and cobbles of sandstone, concrete and rock aggregate with occasional fragments of tarmac, glass and polythene.

Some of the clay was described as organic in WS01 and included fragments of decaying tree branches in WS02.

A possible former ground surface was encountered at a depth of 1.00m begl at WS03 which was sparsely vegetated with lichen and clover.

4.3 Natural Ground

Natural soils below the Made Ground comprised predominantly clays encountered to thicknesses of between 0.10 and 1.60m. These comprised soft to very stiff grey and brown orange clay, sometimes with gravel of mudstone. A medium dense gravelly sand was encountered to a thickness of 0.20m beneath the clay at WS02.

Mudstone bedrock was encountered at all locations from depths of 3.20-5.00m begl and was penetrated to a depth of 30.00m begl in the rotary boreholes which also penetrated an isolated 1.30-1.80m thick bed of seat earth (drillers description) from 7.00-9.80m begl. A 2.80m thick bed of sandstone was also encountered below the seat earth at RBH03.

[3] The rotary boreholes encountered bedrock at depths of between 3.80 and 4.80m begl, but does not distinguish between the overlaying Made Ground and natural superficial soils.

4.4 Coal Mining Risk

Three rotary open-hole boreholes were drilled to a depth of 30.00m begl across the proposed development area, to confirm the presence/absence of shallow workings within the 36 Yard coal seam beneath the site.

No coal was encountered during the investigation and no voids or worked or soft / broken ground or discoloured flush / arisings to suggest that coal has been worked at shallow depth beneath the site. Having reviewed potential coal mining legacy issues, it is considered that the proposed development is unlikely to be subject to surface instabilities relating to coal mining legacy issues.

It should be noted that the comments made in this section relate to the proposed development area as identified in Figure 2. Should future development be considered on the site out-with this area, the mining risk would need reassessing.

4.5 Groundwater

During the fieldwork groundwater was encountered within a natural sand horizon at a depth of 3.00m begl at WS02.

Subsequent monitoring of groundwater level from wells established at WS01, WS03 and RBH02 is currently on-going. From four of the six monitoring visits so far completed, groundwater has been recorded in two of the wells at depths of 2.63-3.10m begl at WS01 and 3.78-4.52m begl at RBH02. The results of the groundwater monitoring (with 2 monitoring visits remaining) are included in Appendix I.

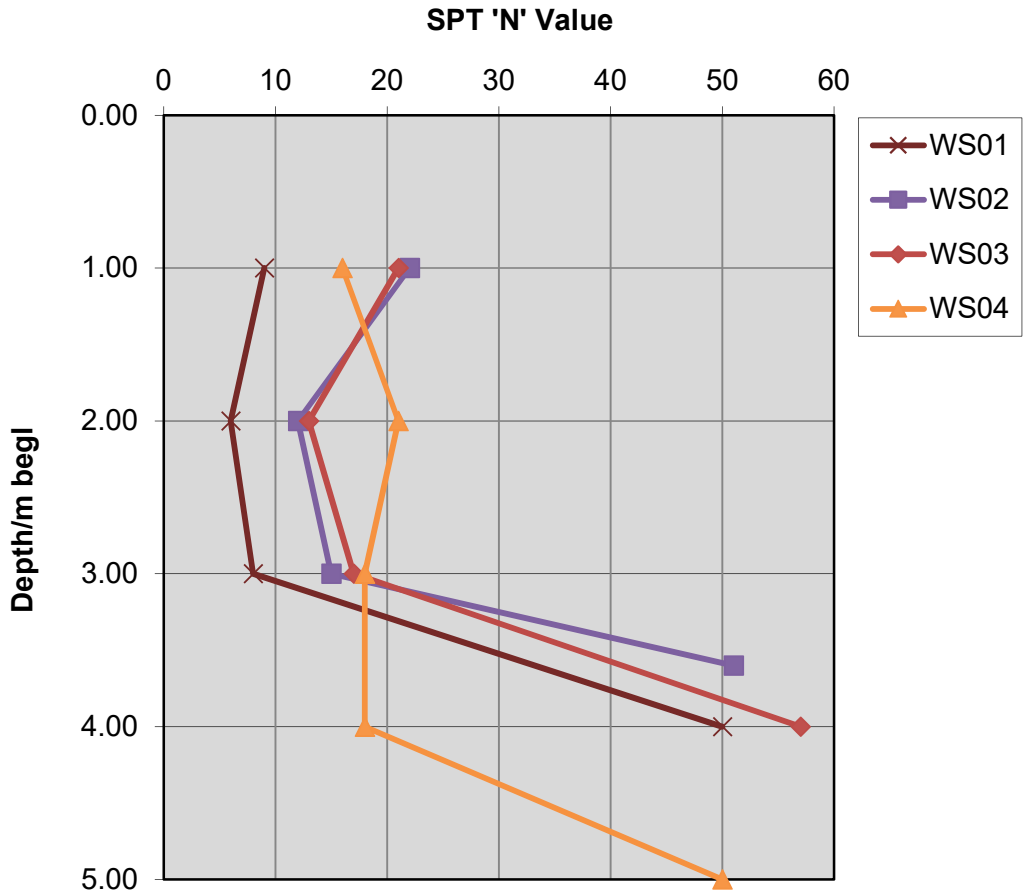
4.6 Visual and Olfactory Evidence of Contamination

Some small white angular fragments of material in a light red brown soil matrix were observed at 1.40m begl at WS02 which were suspected to be an asbestos containing material (ACM) and allocated for the appropriate testing (see photo 10 in Appendix C).

No olfactory signs of significant potential contamination were observed during the investigation.

4.7 Soil Strength

Standard Penetration Tests (SPTs) were carried out in the window sample boreholes at 1.00m intervals. The SPT ‘N’ values are recorded on the exploratory hole logs provided in Appendix B and are shown as follows.



The N value recorded within the natural soils ranged from 8 to 18 indicating soft to stiff cohesive material and medium dense granular material. The N values recorded within the weathered mudstone bedrock at the points of sampler refusal at 3.60-5.00m begl were at or above 50 and are consistent with the field description of weathered mudstone bedrock.

5.0 GEOTECHNICAL ASSESSMENT

5.1 Proposed Works

The proposed development is for the construction of five residential dwellings in accordance with the proposed layout shown on Figure 2 (see Appendix A).

5.2 Ground Conditions

The area investigated is underlain by Made Ground to depths of between 2.55 and 3.65m begl[4]. This comprises a slightly gravelly silty topsoil above both granular fill of gravelly sand and sandy gravels and cohesive fill comprising gravelly clay

The fill includes gravels of sandstone, mudstone, limestone, quartzite, slate, coal, rock aggregate, concrete, brick / tile and slag with cobbles of sandstone, mudstone, concrete and rock aggregate and possible boulders. The fill also included occasional fragments of ceramic drain, tarmac, glass, pottery, metal, plastic, polythene and reinforced plastic packaging straps. A large proportion of the granular fill was described as building rubble at WS03.

Some of the clay fill was described as organic and a rotting odour was noted locally in a layer of granular fill.

Natural soils below the Made Ground comprise predominantly soft to very stiff grey and brown orange clay, sometimes with gravels of mudstone to thicknesses of between 0.10 and 1.60m. A medium dense gravelly sand was encountered to a thickness of 0.20m beneath the clay at WS02.

Mudstone bedrock was encountered at all locations from depths of 3.20-5.00m begl and was penetrated to a depth of 30.00m begl in the rotary boreholes. The rotary boreholes also encountered a 1.30-1.80m thick bed of seat earth at 7.00-9.80m begl. A 2.80m thick bed of sandstone was also encountered below the seat earth in one of the boreholes.

The rotary drilling encountered solid strata with no evidence of any past shallow mining, such as voids and worked or soft / broken ground.

During the fieldwork groundwater was encountered within a sand horizon in the natural strata at a depth of 3.00m begl at WS02. Subsequent monitoring of groundwater level has recorded groundwater in two of the wells at depths of 2.63-3.10m begl (WS01) and 3.78-4.52m begl (RBH02).

5.3 Site Preparation

Based on observations of the excavated materials, standard plant is likely to be suitable for most excavations undertaken onsite, with heavier plant required to excavate to greater depths.

[4] The rotary boreholes also encountered bedrock at depths of between 3.80 and 4.80m begl, but some of the superficial strata recorded in the rotary holes may include natural soils.

Excavations where access is required should be supported in accordance with CIRIA RR97 (Ref. J).

Excavations should be regularly inspected by a competent person to ensure continued safety. Further advice on the safety of excavations is given in *Health and Safety in Construction* (Ref. K).

Groundwater has been recorded during the monitoring of on-site groundwater level in two of the three monitoring wells at depths from 2.63m begl. Unless excavations are to be undertaken to this depth, it is unlikely that a shoring and sump arrangement will be required for the control of groundwater. It should be noted that groundwater levels can vary on a seasonal basis and therefore may be higher during winter months.

5.4 Geotechnical Laboratory Results

Five samples of cohesive material were taken from the natural soils at varying depths between 2.60 and 4.56m begl and underwent testing for plasticity and moisture content. The testing results are provided in Appendix E and show that the cohesive soils were reported as clays of high to extremely high plasticity and are therefore highly compressible.

The plasticity indices have been used to calculate a worst case modified plasticity index equating to high volume change potential. As such localised heave precautions may be required where any slabs encounter the natural cohesive soils.

The plasticity characteristics of clays are typically considered in relation to any vegetation or trees that may exist in close proximity to the finished foundation design. Consideration of features such as tree roots and appropriate design depths are addressed in Chapter 4.2 of the NHBC standards 2020 (Ref. L). If considered relevant, these results should be compared to the guidance by an appropriately qualified design engineer.

The Design Sulphate Class for the use of concrete in structures has been derived in accordance with BRE Special Digest 1 (Ref. M) as DS-2 and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-4z. This is based on the following:

- The characteristic value for sulphate in soil (2:1 leachate equivalent) being 500mg/l;
- The characteristic value for pH in soil being pH5.5;
- Anticipated mobile groundwater;
- Calculations for oxidisable sulphides indicating that pyrite in natural ground is unlikely to be present;
- Having no need to take into account magnesium concentrations because sulphate concentrations in soil are less than 3000mg/l.

5.5 Foundations

The calculated N values from the SPT results equate to the natural soils from a depth of 3.00m begl being classified as soft to stiff cohesive material with an approximate safe bearing capacity varying between 65 and 155kN/m^2 and medium dense granular material with a presumed allowable bearing capacity of 100-300kN/m^2.The N values / plasticity indices also indicate the natural soils to be highly compressible.

On this basis it is considered that the use of traditional foundations would be inappropriate because of the following:

- The depth of excavation required to break through the Made Ground at 2.55-3.65m begl which is unsuitable as a founding medium because of its variable nature; and
- The depth of excavation required to reach a suitable founding medium within natural material can only be found at depths in excess of 3.00m begl.

An appropriate alternative foundation solution would be to use a reinforced strip footing / ring beam supported by mini piles driven through the fill and highly compressible natural soils into the weathered mudstone. This should also alleviate any excessive differential settlement.

It is also possible that excessive differential settlement may occur in areas of proposed hardstanding, access roads and parking areas resulting in cambering, undulations, surface cracks and potholes. Possible remedial options for further consideration could include the use of mini piles to support areas of hardstanding or the use of linked Continually Reinforced Concrete Pavements. Excavations should also be inspected and any soft spots removed and replaced with a suitably approved compacted fill to further alleviate differential settlement.

5.6 Slope Stability Assessment

Schematic cross-sections near to exploratory holes WS01, WS03 and WS04 on the north eastern and eastern facing slope are shown on the topographic survey drawing presented as Figure 4.

The height of the slope varies between 1.10-1.40 (WS01) and 4.30-4.40m (WS03, WS04) and the angle of slope varies between 20 and 30 degrees. The higher slope between WS03 and WS04 is also the steepest at an approximate gradient of 1 in 1.75.

Overall the fill materials within the slopes are generally gravelly clays/granular materials of varying consistency which includes some waste and organic matter. From the walkover for the Phase 1 desk study, there were no obvious visible signs or evidence of slope instability, however some areas were inaccessible due to the density of vegetation.

The slope angle on the steeper sections is slightly over-steepened for the types of material and so it is considered that the steep sections of slope are currently stable due to the density of vegetation reinforcing the existing fill layers of gravelly clay/granular materials. It is likely that should there be de-vegetation or general excavations on the steeper slopes, slope failures may occur.

5.7 Material Reuse

Based on a review of the laboratory testing, it is considered that any fill material excavated as part of the works would be considered unsuitable for use on site as a general fill, because of its variable nature

6.0 CONTAMINATION ASSESSMENT

6.1 Assessment Criteria for Soils

A generic quantitative risk assessment (GQRA) for human health has been undertaken in which the chemical testing results for soils have been assessed against generic assessment criteria (GAC), also known as Soil Screening Values (SSVs), with reference values obtained from the following:

1. Suitable 4 Use Levels (S4ULs) for human health risk assessment (Ref. N). This specifies S4ULs for a range of common contaminants above which the concentrations could pose an unacceptable risk to the health of site users which may warrant further investigation or remediation. S4ULs are specified for 6 categories of land use (residential with and without homegrown produce, allotments, commercial, public open space near residential housing and public parks).
2. Category 4 Screening Levels (C4SLs) (Ref. O). These were issued for a small number of substances to determine if a site is suitable for a proposed use and if such a site may be deemed to be contaminated in accordance with Part 2A of the Environmental Protection Act 1990. The C4SLs are specified for the same 6 categories of land use listed under 1 (above).
3. Soil Generic Assessment Criteria (GAC) for Human Health Risk Assessment (Ref. P). GACs are specified for 4 categories of land use (residential with and without homegrown produce, allotments and commercial).

For the purposes of this assessment the analytical results on the soil samples have been compared against the values for residential use with home grown produce, reflecting the presumed inclusion of private gardens associated with the proposed residential dwellings.

For total cyanide, thiocyanate, polychlorinated biphenyls (PCBs) and some of the semi-volatile organic compounds (SVOCs) which are not covered in the above assessment criteria, reference has been made to the United States Environmental Protection Agency (USEPA) Regional Screening Levels for resident soil (May 2020).

For the assessment of polyaromatic hydrocarbons (PAHs) and petroleum hydrocarbons (TPHs), assessment values relevant to a soil organic matter (SOM) content of 2.5% have been used based on the average SOM value determined from across the area investigated of 2.13%.

A conceptual (source-pathway-receptor) model is required for the site in order to establish a risk. In this instance, the model would simply consist of any contamination (the ‘source’) in the ground passing via a ‘pathway’ (direct contact, or by plant uptake from a derivative soil) to reach a ‘receptor’ (human, site operative, resident or visitor).

6.2 Assessment of Results on Soils

The chemical laboratory results are provided in Appendix F and the soil contamination screening assessment for human health is provided in Appendix G with any exceedances above the soil screening values (SSVs) highlighted. This has identified the following:

- Asbestos fibres (amosite) in 1 no. sample at WS01 within the shallow Made Ground (0.80-1.00m begl). Subsequent testing for quantification (%) of asbestos within the sample determined a value below the detection limit of <0.001%. No asbestos fibres were detected in samples tested above and below the affected sample, or in any of the other samples from the site, indicating the affected sample to be an isolated occurrence.
- Elevations slightly above the SSV in up to 3 polyaromatic hydrocarbon (PAH) compounds in 3 no. samples from the shallow Made Ground (WS02 at 0.02-0.25m begl and WS03 (2 samples) at 0.07-0.87m begl). Profiling of the PAH contamination with depth shows that no exceedances above relevant SSVs were determined in samples below the affected samples (see Table 5).

Table 5: Elevations in PAHs above Soil Screening Values (GACs)

PAH Compound	GAC[1] (mg/kg)	Concentrations Determined (mg/kg)					
Sampling Point		**WS02**			**WS03**		
Depth (m)		0.02-0.25	0.85-1.00	1.42-1.75	0.07-0.40	0.53-0.87	2.30-2.70
Benzo(b)fluoranthene	3.3	3.0	<0.1	0.3	5.2	4.7	<0.1
Benzo(a)pyrene	5.0	3.7	<0.1	0.2	6.2	6.7	<0.1
Dibenzo(a,h)anthracene	0.28	0.4	<0.1	<0.1	0.8	0.9	<0.1

1. LQM CIEH S4ULs at 2.5% soil organic matter & C4SL for benzo(a)pyrene

- An elevation above the SSV for copper in 1 no. sample at WS03 within the deep Mae Ground (2.30-2.70m begl). The concentration determined was 5700mg/kg, compared to the SSV of 2400mg/kg. No exceedances above the SSV for copper were determined in the 2 no. samples above the affected sample or in any of the other samples from across the site, indicating the affected sample to be an isolated occurrence.
- An elevation above the SSV for sulphide in the same sample as the elevated copper (WS03). The concentration determined was 490mg/kg, compared to the tentative SSV of 200mg/kg[5]. No exceedances above the SSV for sulphide were determined in the 2 no. samples above the affected sample or in any of the other samples from across the site, indicating the affected sample to be an isolated occurrence.

In respect of the elevated PAHs, assessment of the PAH testing data using PAH profiling and double ratio plot tools[6] shows the profile of the PAHs do not closely resemble that for coal tar mixtures (coal tar is carcinogenic) and the most likely source would appear to be combustion soot.

Other Soil Determinands

Four soil samples were analysed for petroleum hydrocarbons (TPHs) and benzene, ethylbenzene, toluene and xylenes (BTEX) and methyl tert-butyl ether (MTBE) and the concentrations determined were all below the relevant SSVs with many also being below limits of detection.

[5] The SSV is 'tentative' because there is no SSV for sulphide applicable within the UK and therefore secondary generic assessment criteria has been used in the form of a Dutch Intervention value (used with caution and as a preliminary indicator only).
[6] Land Quality Management Ltd.

Following receipt of the initial results, further testing was requested on two of the samples for polychlorinated biphenyls (PCBs) and volatile and semi-volatile organic compounds (VOC & SVOCs). Samples were selected from those with the highest petroleum hydrocarbon concentrations.

The analyses determined the majority of substances to be below detection limits. Slightly elevated concentrations in several SVOCs were determined, but these were well below their respective SSVs. Whilst 2 no. SVOCs were elevated which have no SSV, their low concentrations indicate that these are also not significant.

Soil pH ranged from pH4.7 (very strongly acidic) within the deep Made Ground at WS01 (2.80-2.90m begl) to pH10.4 (very strongly alkaline) within the deep Made Ground at WS03 (2.30-2.70m begl)[7], with an average of pH7.65 across the development area as a whole, indicative of slightly alkaline soil conditions.

6.3 Removal of Materials from Site

No Waste Acceptance Criteria (WAC) testing for the removal of any excavated soils for disposal to an appropriately licensed landfill has been undertaken. If surplus soils are to be removed for appropriate off-site disposal as part of the proposed development, landfill operators are likely to require the results of WAC testing on the soils which should be supplemented with the testing data appended to this report.

6.4 Controlled Waters Screening Assessment

The screening assessment on controlled waters (surface water and groundwater) has been completed following the sampling and chemical analysis of 3 no. surface water samples taken from Sledbrook Dike (downstream, mid-point to the site and upstream). The samples were analysed for a comprehensive suite of determinands which also included landfill leachate indicators (electrical conductivity and biochemical oxygen demand) and landfill markers (ammoniacal nitrogen and chloride).

The soil samples in which the highest concentrations in PAHs were determined (WS03 at 0.07-0.40m) and copper (WS03 at 2.30-2.70m) were also subjected to soil leachate testing[8] to determine the propensity for PAHs and copper from these locations to leach into groundwater.

Whilst some groundwater has been recorded from two of the wells during the monitoring programme, there has been an insufficient head of water and / or insufficient recharge within the wells to provide the required volume of water for chemical testing.

During the sampling from Sledbrook Dike, no visual or olfactory indicators of potential contamination were observed from the samples.

[7] With the exception of these two extremes, pH values ranged between pH6.3 and pH8.8.
[8] Soil leachate testing conducted in accordance with BE EN 12457-2 (10:1).

6.5 Assessment Criteria for Controlled Waters

A GQRA has been undertaken in which the chemical laboratory results from the surface water and soil leachate testing have been assessed against health or environmental 'screening' criteria, termed Generic Assessment Criteria (GAC) selected from the following published guidance:

- Water Supply (Water Quality) Regulations 2000 (UK drinking water standards);
- Maximum Allowable Concentrations (MAC) under the Environmental Quality Standards (EQS) for inland surface waters;
- Annual Average (AA) concentrations under the EQS for inland surface waters;
- WHO Guidelines for Drinking Water Quality, third edition dated 2004;
- Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996;
- Drinking Water Directive;
- Surface Water Directive;
- Drinking Water Inspectorate, London, 2006.

6.6 Assessment of Results for Controlled Waters

The chemical laboratory results on the water and soil leachate testing are included in Appendix F and the screening assessment is provided in Appendix H, with any exceedances highlighted.

The assessment has identified no elevations above the assessment criteria in any of the parameters tested in the surface water samples. Whilst there is no GAC for sulphide, the concentrations determined were low or below detection limits and not considered significant. Furthermore, copper and the PAH compounds present within the soil samples above their SSVs at WS03 were not found to be potentially leachable at concentrations above their GACs. On this basis the risk to controlled waters from the Made Ground on site is assessed to be low.

7.0 GROUND GAS RISK ASSESSMENT

7.1 Gas Monitoring Programme

The Phase 1 report identified several potential sources for the generation of ground gas (principally carbon dioxide and methane) within 250m of the site. The nearest potential sources were identified to be the on-site historical landfill for commercial waste and recorded shallow coal mine workings. The report therefore recommended a programme of gas monitoring as part of further intrusive investigations.

A programme of gas monitoring involving visits approximately every two weeks over a three month period (equating to six visits in total) has been undertaken from standpipe installations established at window sampling locations WS01 and WS03 and rotary borehole location RBH02. The wells extended to recorded average depths of 3.21m (WS01), 3.40m (WS03) and 4.82m begl (RBH02).

7.2 Gas Monitoring Results

The results of the gas monitoring are provided in Appendix I and show that concentrations in carbon dioxide have ranged from below the limit of detection (<0.1%) to 12.8% by volume in air (v/v). Elevated concentrations in methane have also been recorded with concentrations ranging from below the limit of detection (<0.1% v/v) to 1.7% v/v which is less than the lower explosive limit for methane of 5% v/v.

Low concentrations in carbon monoxide were also recorded from all three monitoring wells during the first visit and from one of the wells during the second visit, with concentrations ranging between 1 and 57 parts per million (ppm). The highest concentration also exceeded the HSE eight hour time weighted exposure limit of 30ppm[9]. No detectable concentrations of hydrogen sulphide gas have been recorded.

Depleted levels of oxygen were recorded at all three monitoring well locations, with the minimum concentrations being 0.1% v/v at WS01 and 0.9% v/v at RBH02.

The maximum borehole gas flow rate was 2.1 l/hr, although the majority of borehole flow rate measurements were below the limit of detection (<0.1 l/hr), with two readings being negative (indicating a slight suction).

Atmospheric pressure during the monitoring visits has ranged between 971 and 993 millibars (mb), with optimal monitoring conditions prevalent on the following occasions:

- Visit 1 – Low atmospheric pressure of 982-983mb with falling pressure trend;
- Visit 3 – Low atmospheric pressure of 971-972mb with falling pressure trend;
- Visit 4 – Low atmospheric pressure of 980mb with falling pressure trend;
- Visit 5 – Low atmospheric pressure of 992-993mb with falling pressure trend.

7.3 Assessment of Results

The gas monitoring results have been assessed in accordance with CIRIA Report C665 (Ref. E) by determining the Gas Screening Values (GSVs). These are calculated by multiplying the maximum gas concentrations with maximum recorded gas flow.

[9] CIRIA C758D *Abandoned mine workings manual*, CIRIA, 2019.

On this basis the GSV for methane has been calculated to be (1.7/100 x 2.1) 0.036 l/hr and the GSV for carbon dioxide has been calculated to be (12.8/100 x 2.1) 0.269 l/hr. As the GSV for carbon dioxide is the worst case value, this has been used in the following assessment.

The type of development proposed at the site falls into Situation B under CIRIA C665 and therefore the GSVs can be assessed against the National House Building Council (NHBC) 'traffic light system'. This is a standalone guidance[10] specifically for protective measures applied to low-rise housing with a ventilated clear underfloor void (150mm). The CIRIA C665 guidance reproduces this system from the NHBC document and is presented in the following Table.

Table 6: NHBC 'Traffic Light System'

Traffic Light Classification	Methane		Carbon Dioxide	
	Typical Maximum Concentration (% v/v)	Gas Screening Value (l/hr)	Typical Maximum Concentration (% v/v)	Gas Screening Value (l/hr)
Green				
	1	0.16	5	0.78
Amber 1				
	5	0.63	10	1.56
Amber 2				
	20	1.56	30	3.13
Red				

Note
1 The worst gas regime identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which traffic light and GSV is allocated.
2 Generic GSVs are based on guidance contained within latest revision of Department of the Environment and the Welsh Office (2004 edition) *The Building Regulations: Approved Document C* and used a sub-floor void of 150mm thickness.
3 The small room eg downstairs toilet with dimensions 1.50 x 1.50 x 2.50m, with a soil pipe passing into the sub-floor void.
4 The GSV (in litres per hour) is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration of the particular gas being considered.
5 The 'typical maximum concentrations' can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgement will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
6 The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

Under the NHBC's Traffic Light System, whilst the calculated GSVs for both methane and carbon dioxide fall within the 'Green' classification, the typical maximum gas concentration for carbon dioxide is at a level which warrants a higher classification of 'Amber 2'. This means that high level ground gas protection measures are required for low rise housing with a 150mm deep underfloor void under this classification, the general scope of which is given in the Table below, taken from the NHBC Guidance and CIRIA C665.

[10] '*Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present*', Report Edition 4, NHBC & RSK Group Plc, March 2007.

Table 7: Gas Protection Measures from NHBC Guidance

Traffic Light Classification	Protection Measures Required
Green	Gas protection measures not considered necessary.
Amber 1	Low-level ground gas protection measures are required, using a membrane and ventilated sub-floor void that creates a permeability contrast to limit the ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. Ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours
Amber 2	High-level ground gas protection measures are required, creating a permeability contrast to prevent ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BR 414. **Membranes used should always be fitted by a specialist contractor and should be fully certified.** As with Amber 1, ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Red	Standard residential housing is not normally acceptable without further Ground Gas Risk Assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases. In certain circumstances, active protection methods could be applied, but only when there is a legal agreement assuring the management and maintenance of the system for the life of the property.

It should be noted that CIRIA C735[11] requires the design and installation of gas protection measures to be undertaken by qualified contractors. The measures once installed will also need to verified by a qualified contractor or consultant (not the installer) and a verification report prepared for submission to the Local Authority.

[11] CIRIA C735 *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases*, CIRIA, 2014.

8.0 REFINED CONCEPTUAL SITE MODEL & ENVIRONMENTAL RISK ASSESSMENT

8.1 Refined Conceptual Site Model

The Preliminary Conceptual Site Model (CSM) forming part of the Environmental Risk assessment in the Phase 1 desk study has been revised following completion of the Phase 2 investigation and is presented in the following table.

Table 8: Refined Conceptual Site Model

Potential Pollutant (Source)	Potential Linkage (Pathway)	Receptor
On Site: Car parking (former hotel and open land). Historic landfill (commercial waste). Made Ground associated with former car park. Past shallow coal mining. Geological fault. Soil contamination: – Isolated asbestos fibres; – Isolated copper and sulphide in soils; – Sporadic low level PAHs in soil; – Isolated very strongly acidic soil; – Isolated very strongly alkaline soil. Potential asphyxiating or explosive ground gases. ***Off Site***: Small buildings of unspecified use (19m S). Colliery (64m SW, 250m SE, 253m NW). Mineral railway & embankment (120m W). Made Ground (113m SW, 117m SW, 125m SE, 134m S, 224m SW). Brickworks & associated spoil (132m SE). Gravel pit / quarry (134m SE). Open storage of unspecified materials (136m SW). Unspecified tipping (181m W, 252m W). Slag heap - Crowedge mine (237m SE). Hepworth works 331m SW). Past shallow coal mining. Geological fault. Building demolition (former hotel).	Migration and inhalation of gases / vapours. Inhalation of soil, water or dust. Dermal contact with / ingestion of contaminated soil, water, dust. Migration / leaching, runoff and percolation through soils and rock joints. Volatisation of contaminants to indoor or outdoor air. Service pipes. Historic water wells within 150m of the site. Physical disturbance. Ground instability / differential settlement	Construction workers. Site end users (house occupants and visitors). Neighbouring occupants Groundwater in Secondary A Aquifer. Surface water features (adjacent Sledbrook Dike) Property (proposed housing, existing adjoining housing, road infrastructure and downstream grazing livestock). Ecology (Open Mosaic Habitat).

8.2 Revised Environmental Risk Assessment

This section aims to expand the CSM to assess the level of risk for each potential pollutant linkage and the revised assessment is provided in Table 9 (next page).

Table 9: Revised Environmental Risk Assessment

Receptor	Potential Pollutant Linkage	Estimated Degree of Risk to Receptor
Construction Workers	Migration and inhalation of ground gas (methane & carbon dioxide).	Low / Moderate
	Inhalation of soil, water or dust.	Low*
	Dermal contact with/ ingestion of contaminated soil / water / dust.	Low*
	Volatisation of contaminants to indoor or outdoor air.	Low*
Site End Users	Migration and inhalation of ground gas (methane & carbon dioxide).	High
	Inhalation of soil/water or dust.	Low / Moderate
	Dermal contact with/ingestion of contaminated soil/water/dust.	Low / Moderate
	Volatisation of contaminants to indoor or outdoor air.	Low
Neighbouring Occupants	Migration and inhalation of ground gas (methane & carbon dioxide).	Moderate / /High
	Migration, accumulation and ignition of methane.	Low
	Migration / leaching / runoff.	Low**
	Inhalation of soil, water or dust.	Low**
	Dermal contact with/ingestion of contaminated soil / water/dust.	Low**
Surface Water	Migration / leaching / runoff.	Low**
Groundwater	Migration / leaching / runoff.	Low**
Property (Land & Buildings)	Migration, accumulation and ignition of methane (on and offsite buildings).	Low
	Migration / leaching / runoff.	Low **
	Ground instability / differential settlement (to on-site development).	Moderate/High
Ecological Systems	Migration / leaching / runoff.	Low**

* Assumes basic PPE is used (including gloves and long sleeved overalls).
** Assumes good site construction practice, including, control of runoff / spillages and dust control.

In this risk assessment, an overall **Low to High** risk is applicable based on the outputs from the intrusive site investigation.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Overview

Based on the proposed development of the site for five residential dwellings with private gardens, it is considered that the site presents an overall **Low to High** environmental risk. The main risks relate to the following:

- To the proposed buildings from ground instability or differential settlement arising from the depth of variable Made Ground on site extending to more than 2.55m begl and the close proximity of proposed buildings to the top of a steep embankment where there is a potential for slope instability.
- To construction workers working in excavations and confined spaces from the accumulation of carbon dioxide gas.
- To construction workers and site end users from isolated to sporadic soil contamination within the Made Ground.
- To site end users from the accumulation of carbon dioxide gas within proposed buildings arising from the historic landfill on site.
- To neighbouring residents from the accumulation of carbon dioxide gas from migration diverted to their homes as a result of the proposed development capping the landfill.

The ground investigation undertaken for this report involved 4 no. window sampling boreholes and 3 no. rotary open hole boreholes, with the installation of gas monitoring standpipes at three of the locations.

The purpose of the investigation was to characterise the nature and chemical status of the Made Ground to assess the human health risk and risk to controlled waters, assess the potential ground gas risk from the development, investigate the presence, depth and disposition of potential shallow coal mine workings and to ascertain geotechnical parameters to inform foundation design.

The area of the proposed development is underlain by Made Ground to depths of between 2.55 and 3.65m begl and comprising a slightly gravelly silty topsoil above granular soils of gravelly sand and sandy gravels and cohesive soils of gravelly clay.

The fill constituents include gravels of sandstone, mudstone, limestone, quartzite, slate, coal, rock aggregate, concrete, brick and slag with cobbles of sandstone, mudstone, concrete and rock aggregate and possible boulders of the same, occasional fragments of ceramic drain, tarmac, glass, pottery, metal, plastic, polythene and reinforced plastic packaging straps. Some of the clay fill was described as organic and a rotting odour was noted locally in a layer of granular fill. The granular fill was described as building rubble between 1.20 and 3.00m begl at WS03.

Natural soils below the Made Ground comprise predominantly soft to very stiff grey and brown orange clay soils to thicknesses of between 0.10 and 1.60m and sometimes incorporating gravels of mudstone. A medium dense gravelly sand was encountered to a thickness of 0.20m beneath the clay at WS02. Mudstone bedrock was encountered at all locations from depths of 3.20-5.00m begl.

Perched groundwater was recorded within a natural sand horizon at a depth of 3.00m begl at WS02 during the fieldwork and subsequent monitoring has consistently recorded groundwater in two of the wells at depths of between 2.63 and 4.52m begl.

9.2 Geotechnical

Based on observations of the excavated materials, standard plant is likely to be suitable for most excavations undertaken onsite, with heavier plant being required to excavate to greater depths. All excavations should be planned and due consideration given to providing temporary support or suitable battering.

Groundwater has been recorded during the monitoring of on-site groundwater level in two of the three monitoring wells (WS01 & RBH02) at depths from 2.63m begl. It is therefore unlikely that dewatering of excavations will be required unless excavations extend to this depth. It should also be noted that groundwater levels can vary on a seasonal basis and therefore may be higher during winter months.

There is a potential for slope failure on the steeper sections of the embankment which are currently stable due to the density of vegetation reinforcing the existing fill layers. De-vegetation or general excavations on the steeper slopes should therefore be avoided to minimise this.

The Made Ground is not considered a suitable bearing stratum for foundations due to its depth and variable nature. Traditional foundations are therefore not considered appropriate and an alternative foundation solution should be proposed. This could involve a reinforced strip footing / ring beam supported by mini piles driven through the Made Ground and highly compressible natural soils into the weathered Mudstone. This will assist in alleviating any excessive differential settlement from the variable fill and from potential slope instability.

It is also possible that excessive differential settlement may occur in areas of proposed hardstanding, access roads and parking areas resulting in cambering, undulations, surface cracks and potholes. Possible remedial options for further consideration could include the use of mini piles to support areas of hardstanding or the use of linked Continually Reinforced Concrete Pavements. Excavations should also be inspected and any soft spots removed and replaced with a suitably approved compacted fill to further alleviate differential settlement.

The underlying natural clay soils have been found to have a high to extremely high plasticity and have a worst case modified plasticity index corresponding to a high volume change potential. As such localised heave precautions may be required where any slabs encounter the cohesive soils which extend from 2.55m begl.

The plasticity characteristics of clays are typically considered in relation to any vegetation or trees that may exist in close proximity to the finished foundation design. Consideration of features such as tree roots and appropriate design depths are addressed in Chapter 4.2 of the NHBC standards 2020. If considered relevant, these results should be compared to the guidance by an appropriately qualified design engineer.

The Design Sulphate Class for the use of concrete in foundation structures has been derived in accordance with BRE Special Digest 1 as DS-2 and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-4z.

9.3 Contamination

The soil contamination assessment for human health has identified the following:

- Isolated amosite (brown) asbestos fibres in 1 no. sample (WS01) at a depth of 0.80-1.00m begl and quantified below the minimum level (<0.001%) from a total of 11 no. samples screened for asbestos.
- Sporadic low level concentrations in up to three polyaromatic hydrocarbon (PAH) compounds slightly above soil screening values (SSVs) in 3 no. samples from the Made Ground (WS02 at 0.20-0.25m begl and WS03 (2 no. samples) at 0.07-0.87m begl), as summarised in Table 5 (see Section 6). Further assessment of the PAH testing data appears to show the most likely source of the PAH to be combustion soot.
- An isolated elevation above the SSV for copper in 1 no. sample from the deeper Made Ground (WS03 at 2.30-2.70m begl). The concentration determined was 5700mg/kg, compared to the SSV of 2400mg/kg.
- An isolated elevation above the SSV for sulphide in the same sample as the elevated copper (WS03). The concentration determined was 490mg/kg, compared to the tentative SSV of 200mg/kg.

In the context of the proposed residential redevelopment, the PAHs represent a potential risk to human health and are therefore unsuitable for inclusion in areas of proposed private garden. The application of a clean cover system to the affected garden areas is therefore recommended (see 9.7 below). This recommendation is supported by YALPAG technical guidance on *Verification requirements for cover systems* (Ref. Q) which is endorsed by Barnsley Metropolitan Borough Council and should be read alongside these recommendations.

The location of the isolated asbestos fibres was determined to have a low quantification with no asbestos detected in samples above and below the affected sample. It is therefore considered that there is no significant risk from this location (WS01) to warrant its inclusion in the clean cover system.

The controlled waters screening assessment to assess the potential risk to the water environment (surface and groundwater) has been completed based upon the testing on samples from Sledbrook Dike (downstream, mid-point to the site and upstream) and testing for leachable PAHs and copper in soil from the relevant samples elevated in these substances.

The assessment has not identified elevations above the assessment criteria in any of the parameters tested in the surface water samples. Copper and the PAH compounds present within the soil samples above their SSVs at WS03 were also not found to be potentially leachable at concentrations above their GACs. On this basis the risk to Sledbrook Dike and groundwater within the Secondary A bedrock aquifer from the proposed development has been assessed to be low.

9.4 Ground Gas

The gas monitoring programme involving six monitoring visits has detected methane concentrations ranging between the limit of detection of <0.1% and 1.7% by volume in air (v/v) and carbon dioxide concentrations between the limit of detection and 12.8% v/v. The elevated concentrations in carbon dioxide in combination with the maximum borehole gas flow rate equate to an 'Amber 2' classification under the NHBC 'Traffic Light System'. This means that high-level ground gas protection measures are required for low rise housing with a 150mm deep underfloor void.

A risk to neighbouring residents has also been identified from the accumulation of carbon dioxide gas migrating to the adjoining residences as a result of the development proposals which will essentially form a cap to the landfill and thereby possibly change the preferential migration pathway for gas off site. The construction of a gravel filled vent trench along the southern site boundary is therefore recommended to minimise this risk.

This report should be supplied to the appointed designer who will need to consider all options in formulating a detailed design specification for the gas protection measures for inclusion in a Remediation Statement with reference to BRE 414[12], BS 8485:2015+A1:2019[13] and other guidance, as appropriate. The design will need to be incorporated into a Remediation Statement in accordance with planning condition 11 for submission to, and approval by the Local Authority.

For information on verification requirements, reference should be made to the YALPAG technical guidance on the *Verification requirements for gas protection systems* (Ref. R). A Verification Plan for the proposed gas protection system will need to be included in the Remediation Statement.

9.5 Coal Mining Risk

The Coal Authority, as a Statutory Consultee in the planning process, has the right to object to surface development it considers may be at risk from coal mining legacy issues. The burden of discounting risk is placed on the developer.

No coal was encountered during the investigation and no voids or worked or soft / broken ground or discoloured flush / arisings to suggest that coal has been worked at shallow depth beneath the site.

Having reviewed potential coal mining legacy issues, it is considered that the proposed development is unlikely to be subject to surface instabilities relating to coal mining legacy issues. Should future development be considered on site out-with the proposed development area, the mining risk will need reassessing.

[12] BR 414 *Protective measures for housing on gas contaminated land*, Building Research Establishment, 2001.
[13] *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.*

9.6 Protection to Construction Workers

It will be necessary for construction workers to use the appropriate Personal Protection Equipment (PPE) which should include (but not necessarily be limited to) long sleeved overalls and gloves and the use of personal gas alarms when entering excavations or areas of confined space. Workers should also adhere to good site hygiene practice with the use of washing facilities before the consumption of food. Notices should be issued advising adherence to this requirement to encourage compliance.

9.7 Protection to Site End Users

The identified elevations in PAHs in soil are unsuitable for use in areas of proposed garden or soft landscaping. Soils within the affected garden areas (front and rear gardens of the dwellings on the north western side of the development area) should be removed to a minimum of 600mm below finished garden levels and replaced with imported soils that are chemically validated to be clean. Excavated soils may be recompacted below roads and/or areas of proposed permanent hardstanding that are by their very nature impermeable and break the pollution linkage between the source and receptor (site users).

The clean cover system will require to be validated as follows:

1. Site levels in the areas of garden and landscaping should be reduced to a minimum of 600mm from their finished elevation. By this point in development any services should have been laid within the appropriate guidance as it is not desirable to re-excavate the clean cover system after it has been laid.
2. Upon completion of soil excavation, any remaining areas of obvious discoloration, staining or odorous ground, should also be removed from site. All soils should be removed to a licensed waste management facility. The finished site levels should then be surveyed in order to accurately establish the base depths for the clean cover system. The cover thickness should then be verified by a second levelling survey following placement of the clean soils.
3. An alternative option to conducting levelling surveys (in 2 above) is to excavate verification pits to the base of the installed clean cover and record measured depths / thicknesses supported by photographic evidence to show that the minimum 600mm has been achieved.

The details of the clean cover system will need to be included in the Remediation Statement in accordance with planning condition 11 and submitted for approval to the Council prior to commencement.

9.8 Removal of Materials from Site

No Waste Acceptance Criteria (WAC) testing for the removal of any excavated soils for disposal to an appropriately licensed landfill has been undertaken. If surplus soils are to be removed for appropriate off-site disposal as part of the proposed development, landfill operators are likely to require the results of WAC testing on the soils which should be supplemented with the testing data appended to this report.

Removal of surplus soils from site should be carried out by a registered waste carrier to an appropriately licensed waste management facility with waste transfer documentation being provided and retained for future reference.

9.9 Protection of Underground Services

If new services are proposed, it should be noted that the requirements vary between different service providers and it would be advisable to discuss the service providers' requirements alongside the chemical testing results appended to this report.

9.10 Decommissioning of Monitoring Wells

Prior to the commencement of development and providing that no further monitoring is required, the 3 no. monitoring wells should be decommissioned in order to eliminate these as potential migration pathways. This should involve the removal of the headworks and casing, backfilling with bentonite and capping at the surface with concrete.

9.11 Unforeseen Contamination (Discover Strategy)

From the time development commences on site, ongoing monitoring of any exposed sub-surface materials should take place. Should any unusual, oily, brightly coloured or odorous material, or unexpected buried tanks or containers be encountered, the advice of a suitably qualified specialist should be sought.

APPENDIX A

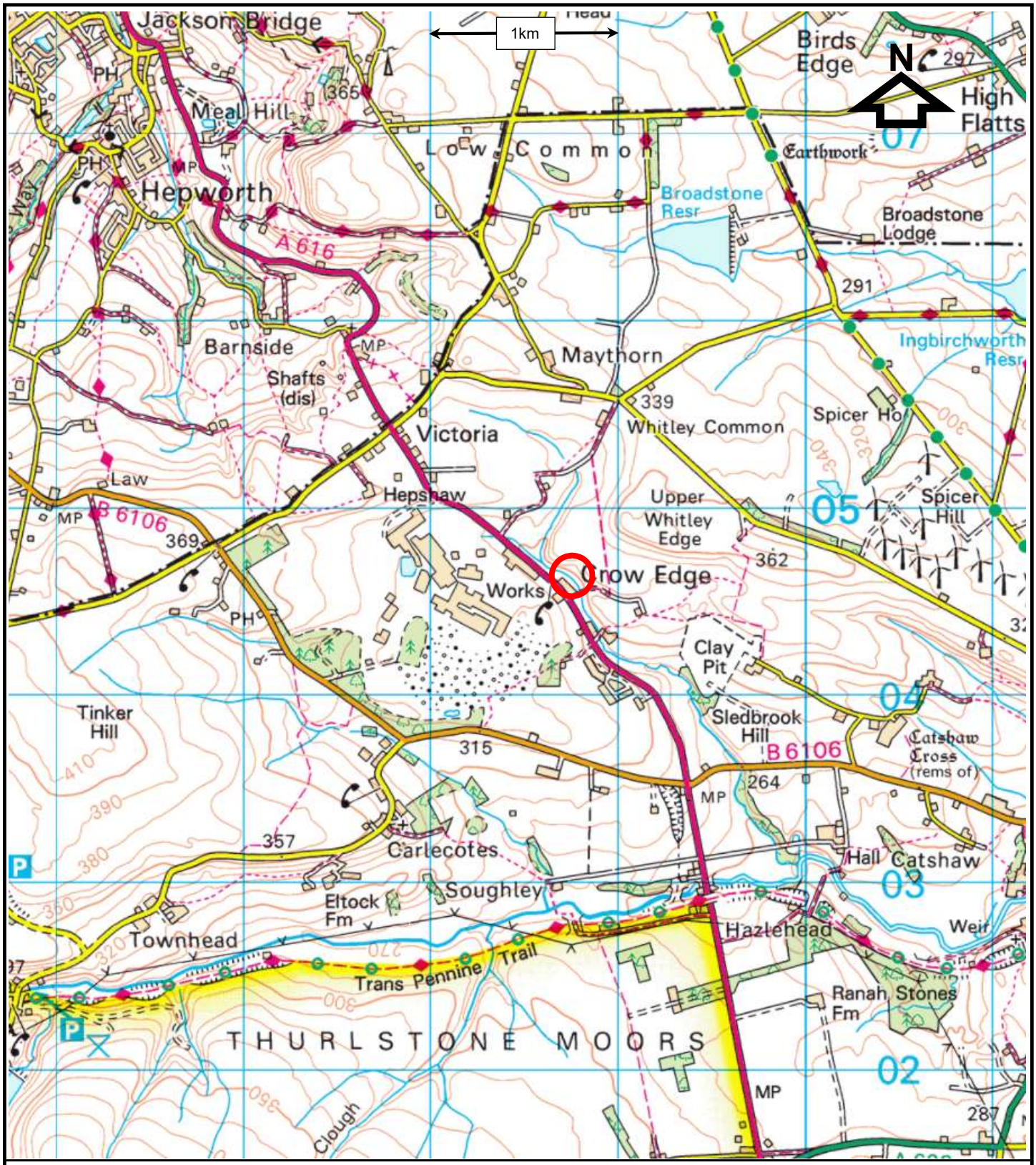
FIGURES

Figure 1: Site Location

Figure 2: Exploration Hole Locations

Figure 3: Surface Water Sampling Locations

Figure 4: Topographic Survey of Embankment



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Project No: 21066
Client: Rogers Building Supplies Ltd
Project: Land at Whams Road, Crow Edge, Hepworth, South Yorkshire, S36 4HE
Date: June 2021

Title:

Site Location

Key:

○ Site Location

Scale: Grid squares are 1km

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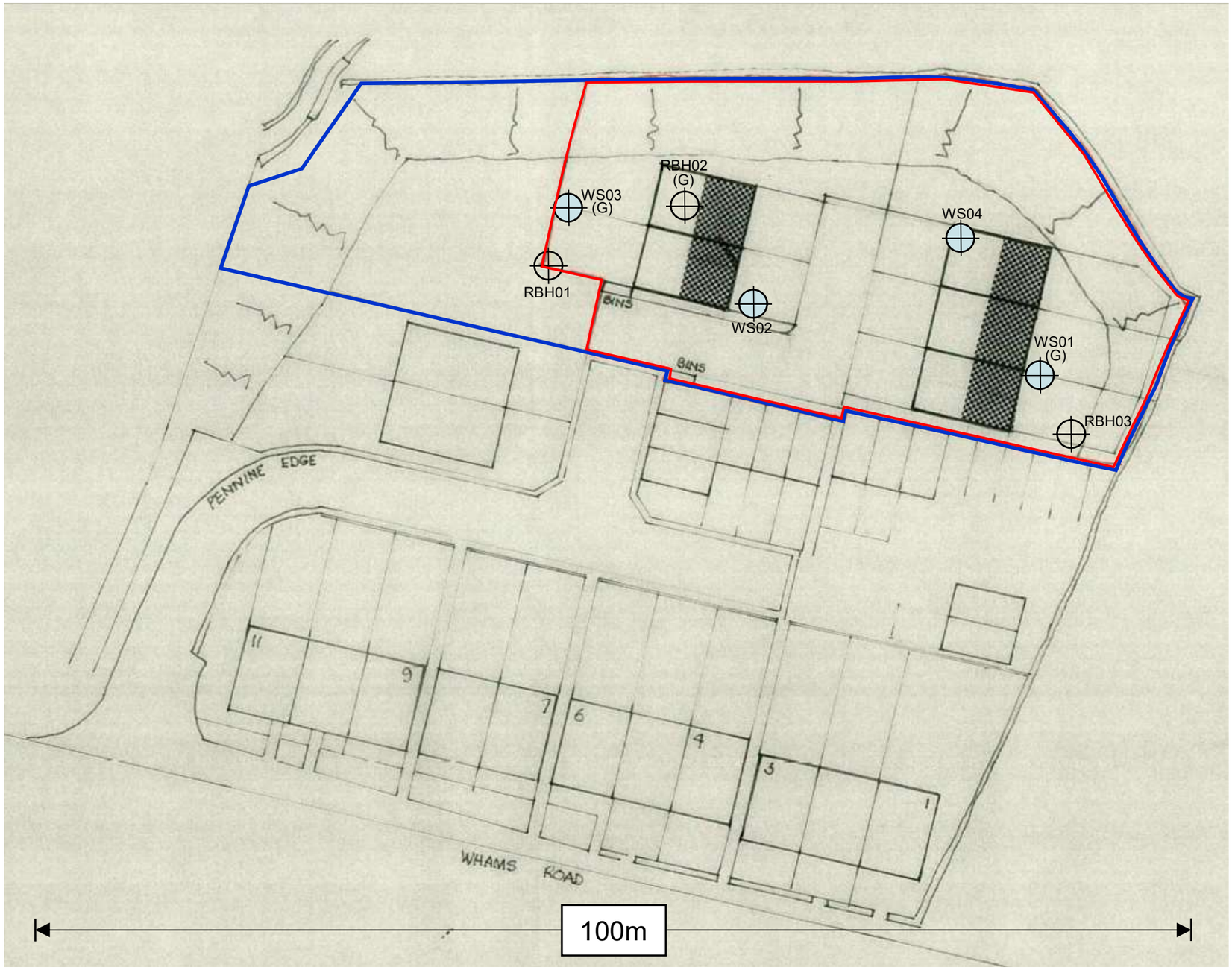
Fig: 1



Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

Key:

- Site Boundary
- Development Area
- WS01 (G) — Window Sample Location (G) Denotes Gas Monitoring Installation
- RBH02 (G) — Rotary Open Borehole Location (G) Denotes Gas Monitoring Installation

Project No: 21066

Client: Rogers Building Supplies Ltd

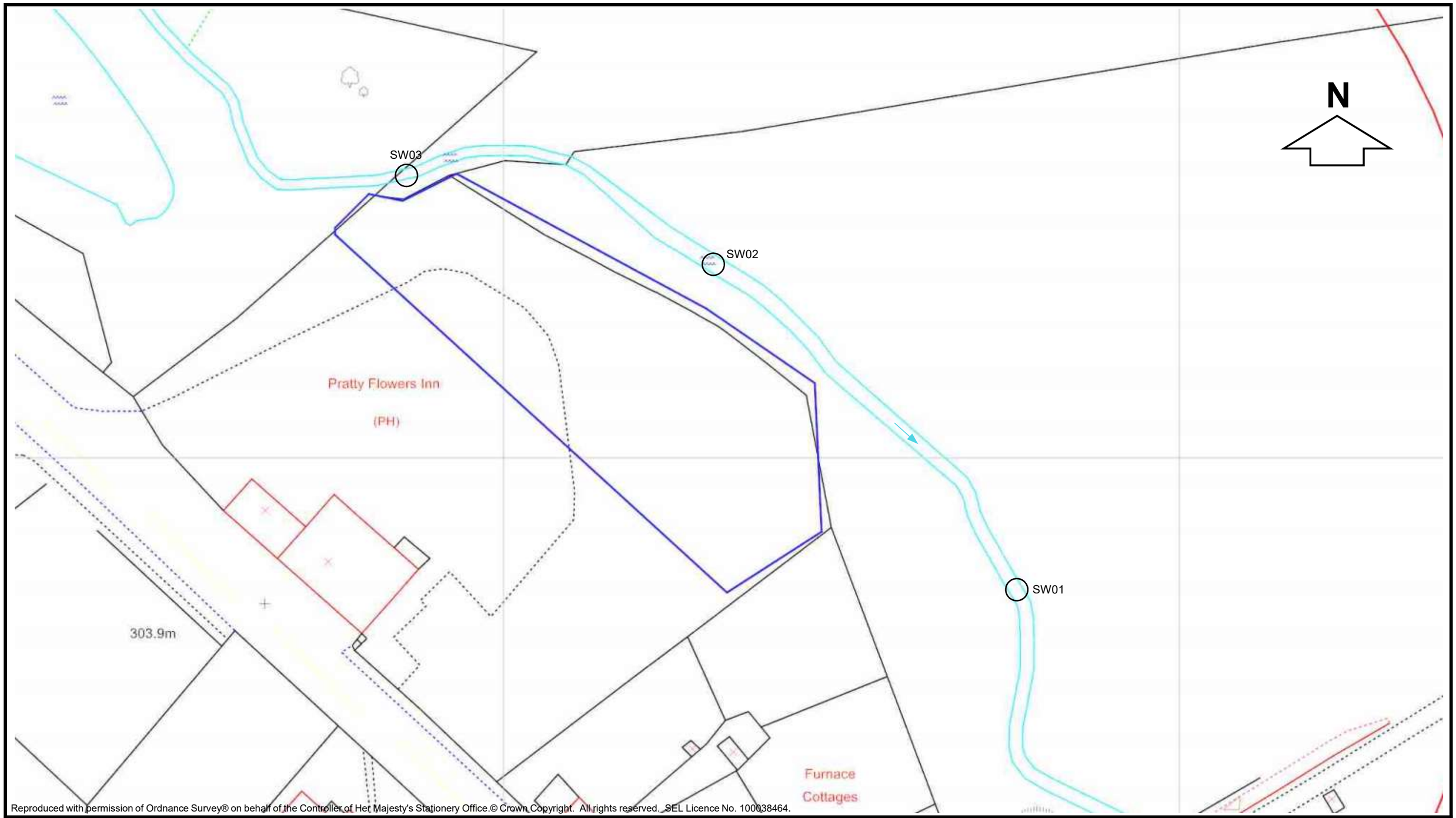
Project: Land at Whams Road, Crow Edge, Hepworth, South Yorkshire, S36 4HE

Date: July 2021

Title:

Exploration Hole Locations

Fig: 2



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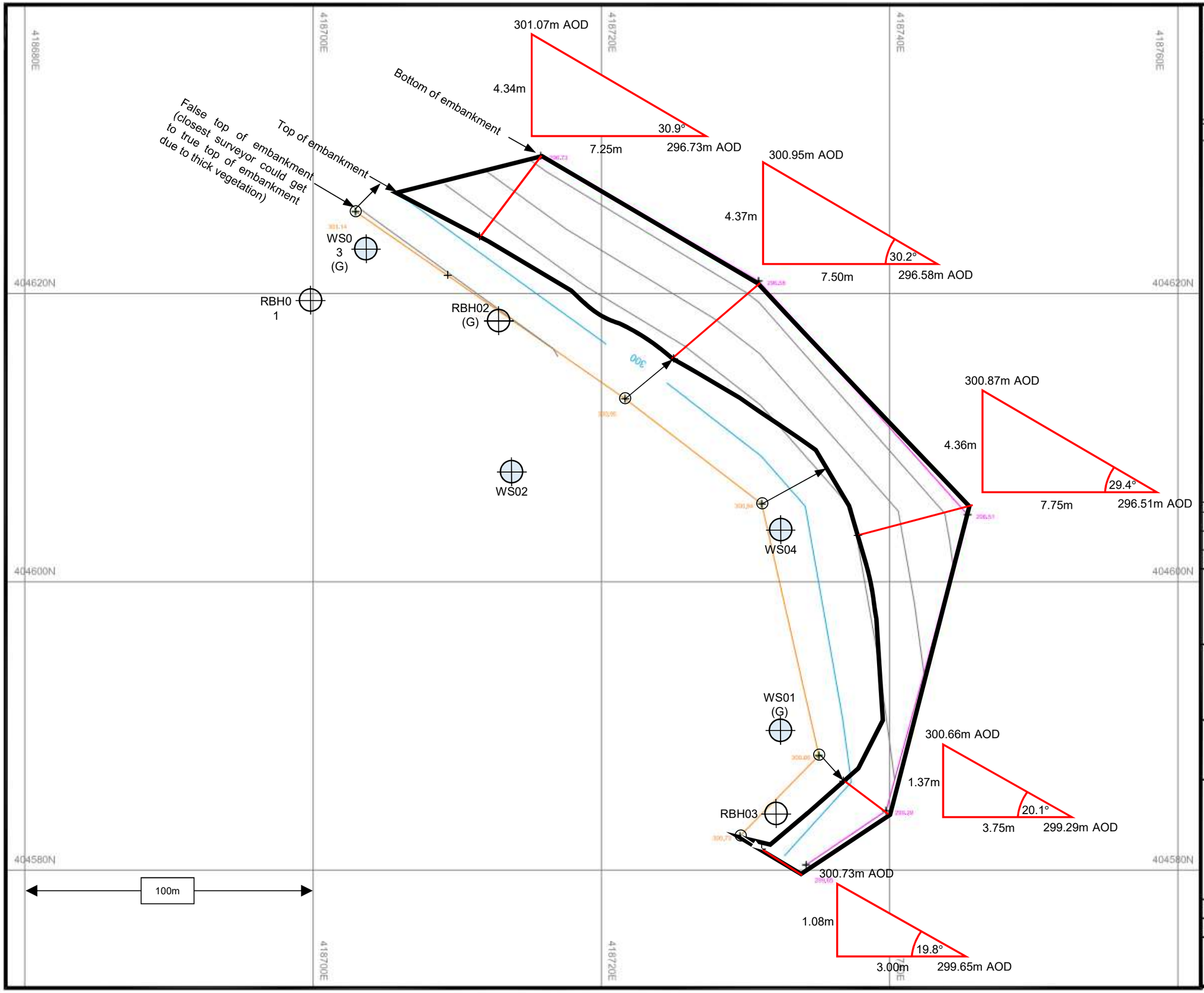
Key:
Site Boundary
SW01 Surface Water Sampling Location

Project No: 21066
Client: Rogers Building Supplies Ltd
Project: Land at Whams Road, Crow Edge, Hepworth, South Yorkshire, S36 4HE
Date: July 2021

Title:
Surface Water Sampling Locations

Fig: 3



Grid : OS National Grid.

Datum - OS Level Datum.
Using the OS GPS Network and applying OSGM02 National Geoid Model to obtain local area corrections.

Direction of North

KEY

Contour (Normal mAOD)
Contour (Prominent mAOD)
Bottom of Bank
Top of Bank

Rev	Description	Date	By

Rogers Building Supplies Ltd

Land at Whams Road,
Crows Edge

Topographic Survey

Silkstone Surveys
Land & Measured Building Surveyors
7, Hall Annex, Thorncliffe Park, Chapeltown, Sheffield, S35 2PH
mail@silkstoneenvironmental.co.uk
Tel : 0114 2573487 www.silkstoneenvironmental.co.uk

Project No. 21066	Dwg No. 21066/001	Ø
Date: 08/21 · Drawn: MS · Chkd: NP	Scale: 1:250	A3

Fig: 4

APPENDIX B

Exploratory Hole Logs

Silkstone
Environmental Ltd
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Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

WINDOW SAMPLE LOG

Project				Window Sample No
Land at Whams Road, Crow Edge, S36 4HE				**WS01**
Job No: 21066	Date: 30-06-21	Ground Level (m):	Co-Ordinates ():	
Contractor: Geospek Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.01-0.30	ES1					(0.33) 0.33	MADE GROUND: Dark grey brown slightly gravelly SILT with rootlets (TOPSOIL). Gravel is angular to subangular fine to coarse of sandstone, limestone and mudstone with fragments of ceramic pottery.		
0.80-1.00	ES2					(0.74) 1.07	MADE GROUND: Firm to stiff dark brown and locally yellowish orange gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone, coal, mudstone, concrete with occasional fragments of brick / tile / ceramic drain pipe.		
1.00		N9				(1.63) 2.70	MADE GROUND: Firm light yellow grey slightly gravelly CLAY, locally dark grey and organic. Gravel is angular fine to coarse of limestone, coal, mudstone and sandstone.		
2.00		N6							
2.25-2.50	ES3								
2.80-2.90	D4					(0.25) 2.95	Firm becoming soft light grey mottled orange slightly gravelly CLAY. Gravel is angular and fine of mudstone.		
2.90-3.00	D5								
3.00		N8				(0.85) 3.80	Soft to firm orange and grey CLAY. 3.40 Strata moist.		
3.20-3.40	D6								
						4.00	Weak dark grey stained orange thinly laminated weathered MUDSTONE.		
4.00		N50/ 190 mm					Penetrated to sampler refusal at 4.00m.		

Hole Progress and Water Observations						Window Sample Recovery			
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Dia (m)	Rec (%)

GENERAL REMARKS

1. No groundwater encountered.
2. No olfactory evidence of potential contamination.

All dimensions in metres Scale 1:31.25	Client: Rogers Building Supplies Ltd	Method/ Plant Used: Archway Competitor	Logged By: N Pickard

Silkstone Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

WINDOW SAMPLE LOG

Project				Window Sample No
Land at Whams Road, Crow Edge, S36 4HE				**WS02**
Job No: 21066	Date: 30-06-21	Ground Level (m):	Co-Ordinates ():	
Contractor: Geospek Ltd				Sheet: 1 of 1

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.02-0.25	ES1					0.20	MADE GROUND: Grey brown gravelly SILT with rootlets (TOPSOIL). Gravel is angular to subangular fine to coarse of sandstone, limestone and brick.		
0.85-1.00	ES2					(1.28)	MADE GROUND: Stiff to very stiff grey brown locally orange and yellow gravelly silty CLAY with low cobble content of angular sandstone. Gravel is angular to rounded fine to coarse of sandstone, mudstone, quartzite, tarmac and brick with fragments of ceramic drain and isolated glass. Fragments of polythene at 0.30m and polythene sheet at base.		
1.00		N22					1.12 Fragments of decaying tree branches (organic odour).		
1.40	ES3					1.48	1.40 Small white angular fragments in light red brown soil matrix.		
1.42-1.75	ES4					(0.32) 1.80	MADE GROUND: Medium dense brown locally reddish white gravelly SAND with low cobble content of subangular sandstone. Gravel is angular to subrounded fine to coarse of sandstone and slag with isolated polystyrene.		
						1.90			
						2.00	MADE GROUND: Medium dense dark grey gravelly SAND with organic (rotting) odour. Gravel is angular to subrounded fine to coarse of sandstone and possible slag.		
2.00		N12				(0.55) 2.55	MADE GROUND: Medium dense brown slightly gravelly SAND with medium cobble content of dark grey angular concrete aggregate. Gravel is angular fine to coarse of concrete with isolated metal fragment.		
2.55-2.60	D5						MADE GROUND: Medium dense grey green brown slightly gravelly SAND with low cobble content of angular sandstone. Gravel is angular fine to coarse of sandstone and rock aggregate.		
2.60-2.77	D6					(0.45) 3.00	Firm to stiff grey mottled orange CLAY.		
3.00		N15				3.20	Medium dense greenish grey brown gravelly SAND. Gravel is angular fine to coarse of sandstone.		
						3.40	Extremely weak orange brown highly weathered MUDSTONE.		
						3.60	Weak orange thinly laminated weathered MUDSTONE.		
3.60		N51/ 150 mm					Penetrated to sampler refusal at 3.60m.		

Hole Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30-06-21	00.00	3.60			3.00

Window Sample Recovery

From	To	Dia (m)	Rec (%)

GENERAL REMARKS

1. Groundwater encountered at 3.00-3.20m begl.
2. Poor returns between 3.00 and 3.20m begl.
3. Potential ACM at 1.40m begl.
4. No olfactory evidence of potential contamination.

All dimensions in metres Scale 1:31.25	Client: Rogers Building Supplies Ltd	Method/ Plant Used: Archway Competitor	Logged By: N Pickard

Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

WINDOW SAMPLE LOG

Project				Window Sample No
Land at Whams Road, Crow Edge, S36 4HE				**WS03**
Job No: 21066	Date: 30-06-21	Ground Level (m):	Co-Ordinates ():	
Contractor: Geospek Ltd				Sheet: 1 of 1

SAMPLES & TESTS

Depth	Type No	Test Result
0.07-0.40	ES1	
0.53-0.87	ES2	
1.00-1.20	ES3	
1.00		N21
2.00		N13
2.30-2.70	ES4	
3.00		N17
3.65-3.75	D5	
4.00		N57/ 225 mm

STRATA

Reduced Level	Depth (Thickness)	DESCRIPTION
	0.07	MADE GROUND: Brown slightly gravelly slightly sandy SILT with rootlets (TOPSOIL). Gravel is angular to subangular fine to coarse of sandstone and brick.
	(0.33) 0.40	MADE GROUND: Medium dense brown gravelly slightly silty SAND. Gravel is angular to subrounded fine to coarse of sandstone, limestone, brick, rock aggregate, coalesced aggregate and ceramic drain fragments. 0.20 Fragments of polythene.
	0.53	MADE GROUND: Stiff brown orange grey gravelly CLAY. Gravel is angular fine to coarse of sandstone, concrete and brick.
	(0.34) 0.87	MADE GROUND: Medium dense dark grey sandy GRAVEL with low cobble content of subrounded sandstone and pockets of clay. Gravel is angular to subrounded fine to coarse of sandstone, coal, brick and concrete with fragments of glass and pottery.
	1.00	MADE GROUND: Firm to stiff orange brown gravelly CLAY. Gravel is angular to subrounded fine to coarse of sandstone and concrete.
	(0.80) 1.20	MADE GROUND: Very stiff grey brown gravelly CLAY. Gravel is angular to rounded fine to coarse of sandstone, mudstone, quartzite and brick. 1.00 Sparsely vegetated surface (clover and lichen). Possible former ground level.
	(0.50) 2.00	MADE GROUND: Medium dense grey brown yellow and red sandy GRAVEL with low to medium cobble content of subangular sandstone and mudstone and possible low boulder content of angular mudstone. Gravel is angular to subangular fine to coarse of sandstone and mudstone (BUILDING RUBBLE).
	(0.50) 2.50	MADE GROUND: Medium dense brown and light yellow and white gravelly SAND. Gravel is subangular to subrounded fine to coarse of sandstone (BUILDING RUBBLE). 2.40 Length of reinforced plastic packing strap and small fragment of red plastic.
	(0.65) 3.00	MADE GROUND: Medium dense light grey brown and green sandy GRAVEL with medium to high cobble content and possible low boulder content of angular weak concrete. Gravel is angular fine to coarse of sandstone, concrete and rock aggregate (BUILDING RUBBLE).
	3.65	MADE GROUND: Medium dense light grey yellow and brown slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse of sandstone with occasional fragments of rusted metal (old reinforcement) and reinforced plastic packaging strip.
	(0.25) 4.00	Stiff to very stiff brown orange laminated gravelly CLAY. Gravel is angular fine to coarse of mudstone (RESIDUAL WEATHERED MUDSTONE).
		Orange thinly laminated weathered MUDSTONE. Penetrated to sampler refusal at 4.00m.

Water | Geology | Instrument/ Backfill

Hole Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Window Sample Recovery

From	To	Dia (m)	Rec (%)

GENERAL REMARKS

1. No groundwater encountered.
2. No olfactory evidence of potential contamination.

All dimensions in metres Scale 1:31.25	Client: Rogers Building Supplies Ltd	Method/ Plant Used: Archway Competitor	Logged By: N Pickard

Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

WINDOW SAMPLE LOG

Project				Window Sample No
Land at Whams Road, Crow Edge, S36 4HE				**WS04**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
21066	30-06-21			
Contractor				Sheet
Geospek Ltd				1 of 1

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.05-0.40	ES1					(0.75) 0.75	MADE GROUND: Dark grey slightly gravelly clayey SILT with rootlets (TOPSOIL). Gravel is angular fine to coarse of sandstone, coal and brick. 0.20 Fragment of polythene.		
						1.00	MADE GROUND: Medium dense light yellow slightly clayey gravelly COBBLES of angular sandstone. Gravel is angular to subangular fine to coarse of sandstone and occasional slate.		
1.00		N16				(0.50) 1.50	MADE GROUND: No returns. 1.00 Timber board.		
1.50-1.70	ES2					(0.78) 2.28	MADE GROUND: Stiff to very stiff grey brown slightly gravelly CLAY with medium cobble content of angular sandstone, concrete and rock aggregate. Gravel is angular fine to coarse of sandstone, concrete and occasional brick and coal.		
1.85-1.95	ES3								
2.00-2.30	ES4								
2.00		N21					2.25 Fragment of blue nylon cord.		
3.00		N18				(1.12) 3.40	MADE GROUND: Stiff to very stiff grey brown locally orange slightly gravelly CLAY with low cobble content of angular sandstone. Gravel is angular to subangular fine to coarse of sandstone, mudstone and occasional brick and coal (REWORKED NATURAL CLAY). 2.90 Small fragment of electrical wire. 3.05 Fragments of timber.		
3.10-3.40	ES5								
3.47-3.67	D6					(0.50) 3.90	Firm to stiff grey mottled orange CLAY with low cobble content of angular sandstone.		
3.90-4.00	D7					(0.66) 4.56	Firm to stiff, becoming very stiff orange and grey CLAY.		
4.00		N18							
4.30-4.56	D8								
						(0.44) 5.00	Stiff to very stiff grey brown and orange becoming dark grey gravelly CLAY. Gravel is angular fine to coarse of mudstone (RESIDUAL WEATHERED MUDSTONE).		
5.00		N50/ 115 mm					Penetrated to sampler refusal at 5.00m.		

Hole Progress and Water Observations						Window Sample Recovery			
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Dia (m)	Rec (%)

GENERAL REMARKS

1. No groundwater encountered.
2. No olfactory evidence of potential contamination.

All dimensions in metres Scale 1:37.5	Client Rogers Building Supplies Ltd	Method/ Plant Used Archway Competitor	Logged By N Pickard

Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH01**
Job No: 21066	Date: 28-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet 1 of 2

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(4.80) 4.80	Landfill materials (drillers description)		
						(5.00) 9.80	Grey Mudstone (dillers description)		
						(1.80) 11.60	Seat earth/fire clay (drillers description)		
							Grey Mudstone (drillers description)		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

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Environmental Ltd
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Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH01**
Job No: 21066	Date: 28-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet: 2 of 2

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(18.40)	Grey Mudstone (drillers description) *(continued)*		
						30.00			

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

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www.silkstoneenvironmental.co.uk

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7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH02**
Job No: 21066	Date: 29-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(4.80) 4.80	Landfill material (drillers description)		
						(4.70) 9.50	Grey Mudstone (drillers description)		
						(1.50) 11.00	Seat earth/fire clay (drillers description)		
							Grey Mudstone		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Gas well installed to 5m. Rest backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

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Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
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Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH02**
Job No: 21066	Date: 29-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet 2 of 2

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(19.00)	Grey Mudstone *(continued)*		
						30.00			

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Gas well installed to 5m. Rest backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

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www.silkstoneenvironmental.co.uk

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7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH03**
Job No: 21066	Date: 30-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet 1 of 2

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(3.80) 3.80	Fill (drillers description)		
						(3.20) 7.00	Grey Mudstone (drillers description)		
						(1.30) 8.30	Seat earth/fire clay (drillers description)		
						8.70	Grey Mudstone (drillers description)		
						(2.80) 11.50	Grey Sandstone (drillers description)		
							Grey Mudstone (drillers description)		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

Silkstone Environmental Ltd
7 Hall Annex, Thorncliffe Park
Chapeltown, S35 2PH
Telephone: 0114 2573487

BOREHOLE LOG

Project				BOREHOLE No
Land at Whams Road, Crow Edge				**RBH03**
Job No: 21066	Date: 30-06-21	Ground Level (m)	Co-Ordinates ()	
Contractor: Ace Drilling Services				Sheet 2 of 2

SAMPLES & TESTS				STRATA					
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(18.50)	Grey Mudstone (drillers description) *(continued)*		
						30.00			

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Drilling using water flush.
2. Borehole terminated at 30m bgl due to reaching required depth.
3. No groundwater.
4. Backfilled with bentonite.

All dimensions in metres Scale 1:125	Client: Rodgers Building Suppliers Ltd	Method/ Plant Used: Beretta T41-2	Logged By: J Corbett

APPENDIX C

Photographic Record

Photo 1: Current Site Condition – Site access from Pennine Edge (road), looking north east (window sampling rig is set up on WS03).

Photo 2: Current Site Condition – View of north western end of site looking west (window sampling rig is set up on WS03).

Photo 3: Current Site Condition – View across the site looking south east towards WS01 (near orange hi vis), also showing rotary rig set up on RBH03.

Photo 4: Current Site Condition – View north east along the top of the embankment extending along the north eastern edge of the site.

Photo 5: WS01 – Retrieved sample tubes following penetration to 4.00m begl (depth progressing from right to left and from top (1.00-2.00m) to bottom (3.00-4.00m)).

Photo 6: WS01 – Close up of weathered mudstone bedrock encountered from 3.80m begl.

Photo 7: WS01 – Lockable metal cover to gas monitoring installation.

Photo 8: WS02 – Retrieved sample tubes following penetration to 3.60m begl (depth progressing from right to left and from top (1.00-2.00m) to bottom (3.00-3.60m)).

Photo 9: WS02 – Close up of weathered mudstone bedrock encountered from 3.20m begl.

Photo 10: WS02 – Close up of sample recovered from 1.40m begl incorporating small white angular fragments of potential asbestos containing material (ACM).

Photo 11: WS03 – Retrieved sample tubes following penetration to 4.00m begl (depth progressing from right to left and from top (1.00-2.00m) to bottom (3.00-4.00m)).

Photo 12: WS04 – Retrieved sample tubes following penetration to 5.00m begl (depth progressing from right to left and from top (1.00-2.00m) to bottom (4.00-5.00m)).

Photo 13: RBH02 – Borehole location upon completion showing cover to gas monitoring well installation (light brown area near gorse bush).

APPENDIX D

Coal Authority Permit

The Coal Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 22219

Name and Address of Permit Holder:

Silkstone Environmental Ltd
7 Hall Annexe
Thorncliffe Park
Chapeltown
Sheffield
S35 2PH

Site Location:

Land at
Whams Road
Crow Edge
Hepworth
S36 4HE

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

Investigation by three boreholes to 30m to determine presence of shallow coal seam

within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of 12 months from the granted date shown below. *The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

Conditions:

- *Water flush*
- *Gas Monitoring CO, CH_4, CO_2, O_2, H_2S at borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole sealing without delay and to withstand site level changes*

Signed: Simeon Burgess Granted Date: ***14/06/2021***

For and on behalf of The Coal Authority

Nominated Representative: Simeon Burgess, Permitting Manager;
The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG
Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

The Coal Authority

Granted Permit Boundary

Permit Ref: 22219

Permit Boundary:

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APPENDIX E

Geotechnical Laboratory Testing Results

#

LABORATORY REPORT

4043

Contract Number: PSL21/5499

Report Date: 05 August 2021

Client's Reference: 21066

Client Name: Silkstone Environmental
7 Hall Annex
Thorncliffe Park
Chapeltown
Sheffield
S35 2PH

For the attention of: Nick Pickard

Contract Title: Land at Whams Road, Crow Edge

Date Received: 6/7/2021
Date Commenced: 6/7/2021
Date Completed: 5/8/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)	R Berriman (Quality Manager)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technician)	M Fennell (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
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e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS01		D	2.90	3.00	Brown mottled grey slightly gravelly CLAY. with some organic material
WS01		D	3.20	3.40	Brown mottled grey slightly gravelly CLAY. with some organic material
WS02		D	2.60	2.77	Brown mottled grey slightly gravelly slightly sandy very silty CLAY.
WS04		D	3.47	3.67	Brown mottled grey slightly gravelly slightly sandy CLAY.
WS04		D	4.30	4.56	Brown mottled grey slightly gravelly CLAY. with some organic material

SUMMARY OF SOIL CLASSIFICATION TESTS

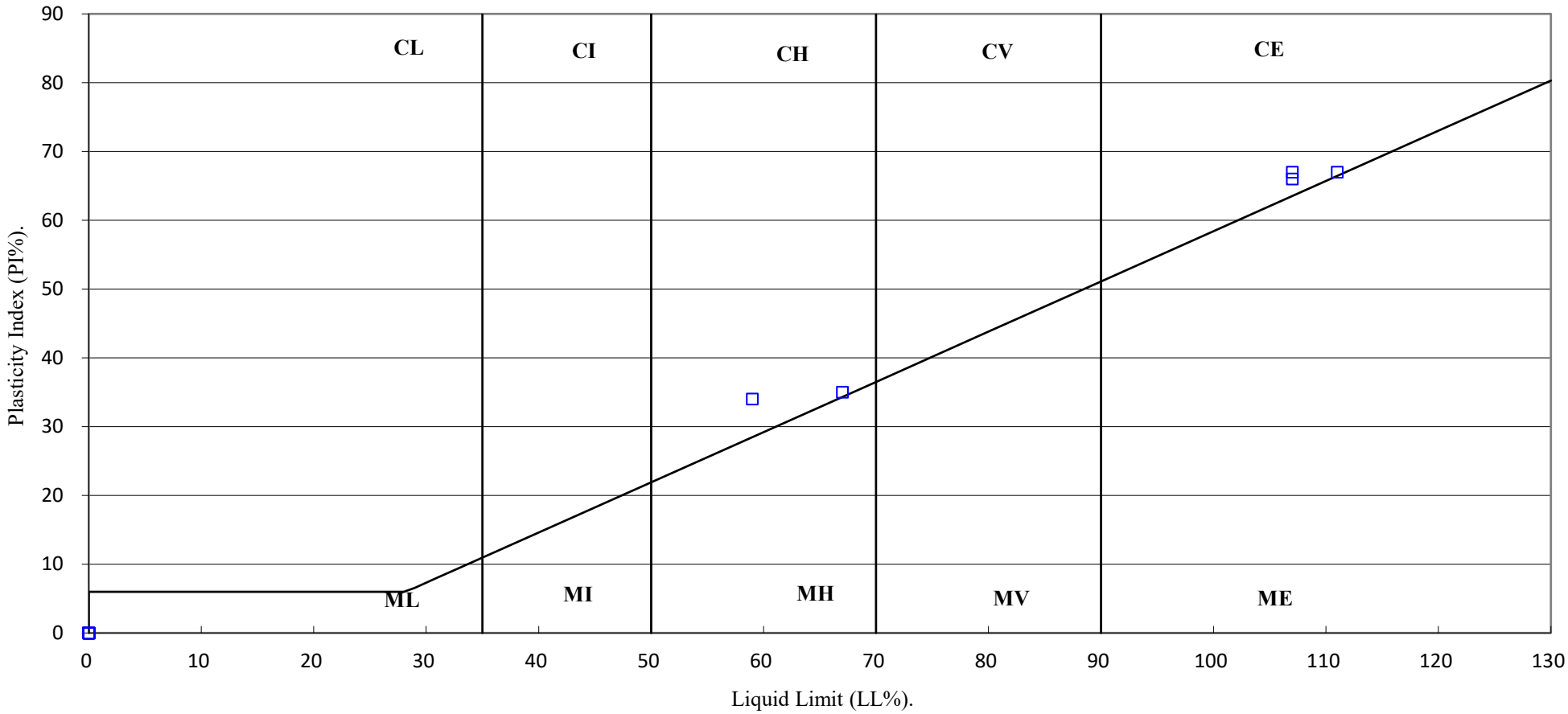
(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS01		D	2.90	3.00	65			107	40	67	98	Extremely High Plasticity CE
WS01		D	3.20	3.40	77			111	44	67	98	Extremely High Plasticity CE
WS02		D	2.60	2.77	39			67	32	35	98	High Plasticity CH
WS04		D	3.47	3.67	26			59	25	34	98	High Plasticity CH
WS04		D	4.30	4.56	27			107	41	66	98	Extremely High Plasticity CE

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Land at Whams Road, Crow Edge	Contract No: PSL21/5499
			Client Ref: 21066

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Land at Whams Road, Crow Edge	Contract No: PSL21/5499
			Client Ref: 21066

APPENDIX F

Chemical Laboratory Testing Results

Certificate of Analysis

Certificate Number	21-13935-1	*Issued:*	22-Jul-21

Client Silkstone Environmental Ltd.
7 Hall Annex
Thorncliffe Park
Chapeltown
Sheffield
S35 2PH

Our Reference 21-13935-1

Client Reference 21066

Order No SEL 21066-01

Contract Title Land at Whams Road, Crow Edge

Description 18 Soil samples, 2 Leachate samples, 3 Water samples.

Date Received 02-Jul-21

Date Started 02-Jul-21

Date Completed 22-Jul-21

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 21-13935, extra testing.**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

2139

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870234	1870235	1870236	1870237	1870239
			.Sample ID	WS01	WS01	WS01	WS02	WS02	WS02
			Depth	0.80-1.00	2.25-2.50	2.80-2.90	0.02-0.25	0.85-1.00	2.55-2.60
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Asbestos Quantification	DETSC 1102	0.001	%	< 0.001					
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	9.7	8.5		9.2	4.7	
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.7	0.5		0.6	0.4	
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.3		0.3	0.2	
Chromium	DETSC 2301#	0.15	mg/kg	41	36		82	35	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0		< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	48	29		59	34	
Lead	DETSC 2301#	0.3	mg/kg	64	25		47	28	
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l			< 10			< 10
Mercury	DETSC 2325#	0.05	mg/kg	0.05	< 0.05		0.07	< 0.05	
Nickel	DETSC 2301#	1	mg/kg	27	20		29	29	
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5		< 0.5	< 0.5	
Zinc	DETSC 2301#	1	mg/kg	240	64		89	80	
Inorganics									
pH	DETSC 2008#		pH	7.9	7.8	4.7	8.3	7.7	6.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	< 0.1		< 0.1	0.1	
Thiocyanate	DETSC 2130#	0.6	mg/kg	2.7	< 0.6		< 0.6	< 0.6	
Organic matter	DETSC 2002#	0.1	%	2.6	1.0		2.2	1.9	
Chloride Aqueous Extract	DETSC 2055	1	mg/l			12			3.7
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l			4.6			8.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	75	470	130	58	73	55
Sulphide	DETSC 2024*	10	mg/kg	56	64		56	72	
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	0.06	0.06	0.03	0.02	0.06
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07		0.14	0.06		0.06
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg		1500			502	
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5			< 1.5		
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2			< 1.2		
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5			1.7		
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	11			< 3.4		
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	12			< 10		
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01			< 0.01		
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	1.1			2.9		
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	0.9			4.6		

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870234	1870235	1870236	1870237	1870239
			.Sample ID	WS01	WS01	WS01	WS02	WS02	WS02
			Depth	0.80-1.00	2.25-2.50	2.80-2.90	0.02-0.25	0.85-1.00	2.55-2.60
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	13			20		
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	100			46		
Aromatic C5-C35	DETSC 3072*	10	mg/kg	120			73		
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	130			78		
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01			< 0.01		
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01			< 0.01		
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01			< 0.01		
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01			< 0.01		
MTBE	DETSC 3321	0.01	mg/kg	< 0.01			< 0.01		
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.4		< 0.1	< 0.1	
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	0.4		0.1	< 0.1	
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	0.4		0.3	< 0.1	
Fluorene	DETSC 3301	0.1	mg/kg	0.1	0.3		0.6	< 0.1	
Phenanthrene	DETSC 3301	0.1	mg/kg	0.8	0.2		4.4	0.2	
Anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1		1.1	< 0.1	
Fluoranthene	DETSC 3301	0.1	mg/kg	1.9	< 0.1		6.6	0.4	
Pyrene	DETSC 3301	0.1	mg/kg	2.0	< 0.1		6.2	0.4	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.0	< 0.1		3.2	< 0.1	
Chrysene	DETSC 3301	0.1	mg/kg	1.2	< 0.1		3.6	< 0.1	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.9	< 0.1		3.0	< 0.1	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1		1.7	< 0.1	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	1.1	< 0.1		3.7	< 0.1	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.9	< 0.1		2.6	< 0.1	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1		0.4	< 0.1	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.9	< 0.1		2.6	< 0.1	
PAH Total	DETSC 3301	1.6	mg/kg	12	1.8		40	< 1.6	
PCBs									
PCB 77	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 81	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 105	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 114	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 118	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 123	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 126	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 156	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 157	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 167	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 169	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 189	DETSC 3401*	0.01	mg/kg	< 0.01					

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870234	1870235	1870236	1870237	1870239
			.Sample ID	WS01	WS01	WS01	WS02	WS02	WS02
			Depth	0.80-1.00	2.25-2.50	2.80-2.90	0.02-0.25	0.85-1.00	2.55-2.60
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3		< 0.3	< 0.3	

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870240	1870241	1870242	1870243	1870244	1870247
			.Sample ID	WS03	WS03	WS03	WS03	WS04	WS04
			Depth	0.07-0.40	0.53-0.87	2.30-2.70	3.65-3.75	0.05-0.40	3.10-3.40
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Asbestos Quantification	DETSC 1102	0.001	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.5		6.5		13	6.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.2		3.1		0.4	0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.3		0.3		0.3	0.2
Chromium	DETSC 2301#	0.15	mg/kg	70		160		51	35
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0		< 1.0		< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	50	97	5700		130	29
Lead	DETSC 2301#	0.3	mg/kg	41		94		140	26
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l				< 10		
Mercury	DETSC 2325#	0.05	mg/kg	0.05		< 0.05		0.13	< 0.05
Nickel	DETSC 2301#	1	mg/kg	25		76		21	21
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5		1.3		0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	100		130		100	79
Inorganics									
pH	DETSC 2008#		pH	8.1		10.4	7.1	8.8	7.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1		< 0.1		0.3	0.2
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6		< 0.6		2.9	0.8
Organic matter	DETSC 2002#	0.1	%	2.5		0.9		4.2	1.7
Chloride Aqueous Extract	DETSC 2055	1	mg/l				2.6		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l				5.6		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	38		570	34	88	30
Sulphide	DETSC 2024*	10	mg/kg	92	150	490		44	96
Sulphur as S, Total	DETSC 2320	0.01	%	0.06		0.22	0.03	0.04	0.03
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.33			0.04		0.04
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg			8130		850	
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5					< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2					< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5					< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4					< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10					< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01					< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	1.5					< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	2.6					< 0.5

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870240	1870241	1870242	1870243	1870244	1870247
			.Sample ID	WS03	WS03	WS03	WS03	WS04	WS04
			Depth	0.07-0.40	0.53-0.87	2.30-2.70	3.65-3.75	0.05-0.40	3.10-3.40
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	22					< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	89					< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	110					< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	120					< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01					< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01					< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01					< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01					< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01					< 0.01
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.1	0.3	< 0.1		< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	0.2	0.4	< 0.1		0.2	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.5	0.3	< 0.1		0.2	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	2.6	2.3	0.1		1.0	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	0.9	0.9	< 0.1		0.3	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	11	8.9	0.2		2.0	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	10	9.2	0.2		2.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	5.8	5.3	< 0.1		1.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	6.4	6.2	< 0.1		1.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	5.2	4.7	< 0.1		0.9	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	3.1	2.7	< 0.1		0.5	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	6.2	6.7	< 0.1		1.2	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	4.3	4.7	< 0.1		0.8	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.8	0.9	< 0.1		0.2	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	4.0	4.4	< 0.1		0.9	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	61	58	< 1.6		13	< 1.6
PCBs									
PCB 77	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 81	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 105	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 114	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 118	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 123	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 126	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 156	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 157	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 167	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 169	DETSC 3401*	0.01	mg/kg	< 0.01					
PCB 189	DETSC 3401*	0.01	mg/kg	< 0.01					

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870240	1870241	1870242	1870243	1870244	1870247
			.Sample ID	WS03	WS03	WS03	WS03	WS04	WS04
			Depth	0.07-0.40	0.53-0.87	2.30-2.70	3.65-3.75	0.05-0.40	3.10-3.40
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3		< 0.3		< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1875330	1875331
			.Sample ID	WS02	WS03
			Depth	1.42-1.75	1.00-1.20
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Asbestos Quantification	DETSC 1102	0.001	%		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg		
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		
Cadmium	DETSC 2301#	0.1	mg/kg		
Chromium	DETSC 2301#	0.15	mg/kg		
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		
Copper	DETSC 2301#	0.2	mg/kg		38
Lead	DETSC 2301#	0.3	mg/kg		
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		
Mercury	DETSC 2325#	0.05	mg/kg		
Nickel	DETSC 2301#	1	mg/kg		
Selenium	DETSC 2301#	0.5	mg/kg		
Zinc	DETSC 2301#	1	mg/kg		
Inorganics					
pH	DETSC 2008#		pH		
Cyanide, Total	DETSC 2130#	0.1	mg/kg		
Thiocyanate	DETSC 2130#	0.6	mg/kg		
Organic matter	DETSC 2002#	0.1	%		
Chloride Aqueous Extract	DETSC 2055	1	mg/l		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		
Sulphide	DETSC 2024*	10	mg/kg		76
Sulphur as S, Total	DETSC 2320	0.01	%		
Sulphate as SO4, Total	DETSC 2321#	0.01	%		
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg		
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		

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Summary of Chemical Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1875330	1875331
			.Sample ID	WS02	WS03
			Depth	1.42-1.75	1.00-1.20
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		
Aromatic C5-C35	DETSC 3072*	10	mg/kg		
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg		
Benzene	DETSC 3321#	0.01	mg/kg		
Ethylbenzene	DETSC 3321#	0.01	mg/kg		
Toluene	DETSC 3321#	0.01	mg/kg		
Xylene	DETSC 3321#	0.01	mg/kg		
MTBE	DETSC 3321	0.01	mg/kg		
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	
Phenanthrene	DETSC 3301	0.1	mg/kg	0.2	
Anthracene	DETSC 3301	0.1	mg/kg	0.1	
Fluoranthene	DETSC 3301	0.1	mg/kg	0.5	
Pyrene	DETSC 3301	0.1	mg/kg	0.4	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.2	
Chrysene	DETSC 3301	0.1	mg/kg	0.3	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.1	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.2	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.3	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.2	
PAH Total	DETSC 3301	1.6	mg/kg	2.9	
PCBs					
PCB 77	DETSC 3401*	0.01	mg/kg		
PCB 81	DETSC 3401*	0.01	mg/kg		
PCB 105	DETSC 3401*	0.01	mg/kg		
PCB 114	DETSC 3401*	0.01	mg/kg		
PCB 118	DETSC 3401*	0.01	mg/kg		
PCB 123	DETSC 3401*	0.01	mg/kg		
PCB 126	DETSC 3401*	0.01	mg/kg		
PCB 156	DETSC 3401*	0.01	mg/kg		
PCB 157	DETSC 3401*	0.01	mg/kg		
PCB 167	DETSC 3401*	0.01	mg/kg		
PCB 169	DETSC 3401*	0.01	mg/kg		
PCB 189	DETSC 3401*	0.01	mg/kg		

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1875330	1875331
			.Sample ID	WS02	WS03
			Depth	1.42-1.75	1.00-1.20
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		

Summary of Chemical Analysis
Soil VOC/SVOC Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870240
			.Sample ID	WS01	WS03
			Depth	0.80-1.00	0.07-0.40
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
VOCs					
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Soil VOC/SVOC Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870240
			.Sample ID	WS01	WS03
			Depth	0.80-1.00	0.07-0.40
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01
SVOCs					
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	0.2	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	0.3	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	0.4	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Soil VOC/SVOC Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870233	1870240
			.Sample ID	WS01	WS03
			Depth	0.80-1.00	0.07-0.40
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	0.5	0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870248	1870249	1870250
			.Sample ID	SW1	SW2	SW3
			Depth			
			Other ID			
			Sample Type	WATER	WATER	WATER
			Sampling Date	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Metals						
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.39	0.37	0.34
Boron, Dissolved	DETSC 2306*	12	ug/l	260	280	230
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	0.19	0.21	0.21
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.47	3.2	0.41
Copper, Dissolved	DETSC 2306	0.4	ug/l	4.1	4.3	4.1
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.92	0.57	0.59
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	12	12	13
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.87	0.84	0.79
Zinc, Dissolved	DETSC 2306	1.3	ug/l	12	12	12
Inorganics						
Conductivity	DETSC 2009	1	uS/cm	682	684	685
pH	DETSC 2008		pH	7.3	7.2	7.1
Biochemical Oxygen Demand, Total	DETSC 2031	1	mg/l	1.7	3.6	1.2
Cyanide, Total Low Level	DETSC 2131	0.1	ug/l	< 0.1	< 0.1	< 0.1
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.029	0.024	0.025
Chloride	DETSC 2055	0.1	mg/l	74	76	75
Sulphate as SO4	DETSC 2055	0.1	mg/l	93	93	92
Sulphide	DETSC 2208	10	ug/l	18	< 10	14
Sulphur as S, Total	DETSC 2320*	10	mg/l	41	41	41
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	17
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	1.6
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	20
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1870248	1870249	1870250
			.Sample ID	SW1	SW2	SW3
			Depth			
			Other ID			
			Sample Type	WATER	WATER	WATER
			Sampling Date	30/06/2021	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	21
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0
PAHs						
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.01	0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	< 0.20
Phenols						
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

			Lab No	1875328	1875329
			.Sample ID	WS03	WS03
			Depth	0.07-0.40	2.30-2.70
			Other ID		
			Sample Type	LEACHATE	LEACHATE
			Sampling Date	30/06/2021	30/06/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Preparation					
BS EN 12457 10:1	DETSC 1009*			Y	Y
Metals					
Copper, Dissolved	DETSC 2306	0.4	ug/l		11
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	
Acenaphthene	DETSC 3304	0.01	ug/l	0.02	
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	
Fluoranthene	DETSC 3304	0.01	ug/l	0.04	
Pyrene	DETSC 3304	0.01	ug/l	0.05	
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.01	
Chrysene	DETSC 3304	0.01	ug/l	0.01	
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.04	
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.02	
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.02	
PAH Total	DETSC 3304	0.2	ug/l	0.24	

Key: * -not accredited. n/s -not supplied.

Summary of Asbestos Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1870232	WS01 0.01-0.30	SOIL	NAD	none	Colin Patrick
1870233	WS01 0.80-1.00	SOIL	Amosite	small bundle of Amosite fibres	Colin Patrick
1870234	WS01 2.25-2.50	SOIL	NAD	none	Colin Patrick
1870237	WS02 0.85-1.00	SOIL	NAD	none	Colin Patrick
1870238	WS02 1.40	SOIL	NAD	none	Colin Patrick
1870240	WS03 0.07-0.40	SOIL	NAD	none	Colin Patrick
1870241	WS03 0.53-0.87	SOIL	NAD	none	Colin Patrick
1870242	WS03 2.30-2.70	SOIL	NAD	none	Colin Patrick
1870244	WS04 0.05-0.40	SOIL	NAD	none	Colin Patrick
1870245	WS04 1.50-1.70	SOIL	NAD	none	Colin Patrick
1870246	WS04 2.00-2.30	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis

Soil Samples

Our Ref 21-13935-1
Client Ref 21066
Contract Title Land at Whams Road, Crow Edge

Lab No	1870233
.Sample ID	WS01
Depth	0.80-1.00
Other ID	
Sample Type	
Sampling Date	30/06/2021
Sampling Time	

Test	**Method**	**Units**	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	**< 0.001**
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	<0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na
Breakdown of Gravimetric Analysis (a)			
Mass of Sample		g	641.08
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	
Breakdown of Detailed Gravimetric Analysis (b)			
% Amphibole bundles in sample		Mass %	<0.001
% Chrysotile bundles in sample		Mass %	na
Breakdown of PCOM Analysis (c)			
% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na
Breakdown of Potentially Respirable Fibre Analysis (d)			
Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Information in Support of the Analytical Results

Our Ref 21-13935-1
Client Ref 21066
Contract Land at Whams Road, Crow Edge

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1870232	WS01 0.01-0.30 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870233	WS01 0.80-1.00 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870234	WS01 2.25-2.50 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870235	WS01 2.80-2.90 SOIL	30/06/21	PT 1L		
1870236	WS02 0.02-0.25 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870237	WS02 0.85-1.00 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870238	WS02 1.40 SOIL	30/06/21	PT 1L		
1870239	WS02 2.55-2.60 SOIL	30/06/21	PT 1L		
1870240	WS03 0.07-0.40 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870241	WS03 0.53-0.87 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870242	WS03 2.30-2.70 SOIL	30/06/21	GJ 250ml, PT 1L		
1870243	WS03 3.65-3.75 SOIL	30/06/21	PT 1L		
1870244	WS04 0.05-0.40 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870245	WS04 1.50-1.70 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870246	WS04 2.00-2.30 SOIL	30/06/21	PT 1L		
1870247	WS04 3.10-3.40 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1870248	SW1 WATER	30/06/21	GB 1L x2, GV x2, PB 1L	pH/Cond/TDS (1 days)	
1870249	SW2 WATER	30/06/21	GB 1L x2, GV x2, PB 1L	pH/Cond/TDS (1 days)	
1870250	SW3 WATER	30/06/21	GB 1L x2, GV x2, PB 1L	pH/Cond/TDS (1 days)	
1875328	WS03 0.07-0.40 LEACHATE	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1875329	WS03 2.30-2.70 LEACHATE	30/06/21	GJ 250ml, PT 1L		
1875330	WS02 1.42-1.75 SOIL	30/06/21	GJ 250ml, GJ 60ml, PT 1L		
1875331	WS03 1.00-1.20 SOIL	30/06/21	GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

APPENDIX G

Soil Contamination Screening Assessment for Human Health

DETS Job No. 21-13935-1
Client: Rogers Building Supplies Ltd
Client Project Name: Land at Whams Road, Crow Edge
Client Project Ref: 21066

SEL Soil Contamination Screening Assessment

			Lab No	GAC (Residential with Home Grown Produce)	Source of GACs	1870232	1870233	1870234	1870235	1870236	1870237	1870238	1875330	1870239	1870240	1870241	1875331	1870242	1870243	1870244	1870245	1870246	1870247
			Sample ID			WS01	WS01	WS01	WS01	WS02	WS02	WS02	WS02	WS02	WS03	WS03	WS03	WS03	WS03	WS04	WS04	WS04	WS04
			Depth			0.01-0.30	0.80-1.00	2.25-2.50	2.80-2.90	0.02-0.25	0.85-1.00	1.40	1.42-1.75	2.55-2.60	0.07-0.40	0.53-0.87	1.00-1.20	2.30-2.70	3.65-3.75	0.05-0.40	1.50-1.70	2.00-2.30	3.10-3.40
			Other ID																				
			Sample Type			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date			30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time			n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**																				
Metals																							
Arsenic	DETSC 2301#	0.2	mg/kg	37	LQM/CIEH S4UL 2015		9.7	8.5		9.2	4.7				8.5			6.5		13			6.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	290	LQM/CIEH S4UL 2015		0.7	0.5		0.6	0.4				0.2			3.1		0.4			0.2
Cadmium	DETSC 2301#	0.1	mg/kg	11	LQM/CIEH S4UL 2015		0.4	0.3		0.3	0.2				0.3			0.3		0.3			0.2
Chromium	DETSC 2301#	0.15	mg/kg	910	LQM/CIEH S4UL 2015		41	36		82	35				70			160		51			35
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	6	LQM/CIEH S4UL 2015		< 1.0	< 1.0		< 1.0	< 1.0				< 1.0			< 1.0		< 1.0			< 1.0
Copper	DETSC 2301#	0.2	mg/kg	2400	LQM/CIEH S4UL 2015		48	29		59	34				50	97	38	5700		130			29
Lead	DETSC 2301#	0.3	mg/kg	200	DEFRA C4SL 2014		64	25		47	28				41			94		140			26
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						< 10					< 10					< 10				
Mercury	DETSC 2325#	0.05	mg/kg	40	LQM/CIEH S4UL 2015		0.05	< 0.05		0.07	< 0.05				0.05			< 0.05		0.13			< 0.05
Nickel	DETSC 2301#	1	mg/kg	130	LQM/CIEH S4UL 2015		27	20		29	29				25			76		21			21
Selenium	DETSC 2301#	0.5	mg/kg	250	LQM/CIEH S4UL 2015		< 0.5	< 0.5		< 0.5	< 0.5				< 0.5			1.3		0.5			< 0.5
Zinc	DETSC 2301#	1	mg/kg	3700	LQM/CIEH S4UL 2015		240	64		89	80				100			130		100			79
Asbestos																							
Asbestos fibres in soil (Stage 1)	DETSC1101			Presence	N/A	NAD	Amosite	NAD			NAD	NAD			NAD	NAD		NAD		NAD	NAD	NAD	
Comment							Small bundle of amosite fibres																
Asbestos quantification (Stage 2)			%				<0.001																
Inorganics																							
pH (4.7-10.4, average=84.2/11=7.65)	DETSC 2008#		pH				7.9	7.8	4.7	8.3	7.7			6.3	8.1			10.4	7.1	8.8			7.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	23	USEPA RSL 2020 (Res. soil)		0.2	< 0.1		< 0.1	0.1				0.1			< 0.1		0.3			0.2
Thiocyanate	DETSC 2130#	0.6	mg/kg	16	USEPA RSL 2020 (Res. soil)		2.7	< 0.6		< 0.6	< 0.6				< 0.6			< 0.6		2.9			0.8
Organic matter (Average=17/8=2.13)	DETSC 2002#	0.1	%				2.6	1.0		2.2	1.9				2.5			0.9		4.2			1.7
Chloride Aqueous Extract	DETSC 2055	1	mg/l						12					3.7					2.6				
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						4.6					8.9					5.6				
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l				75	470	130	58	73			55	38			570	34	88			30
Sulphide	DETSC 2024*	10	mg/kg	200	Dutch Intervention value		56	64		56	72				92	150	76	490		44			96
Sulphur as S, Total	DETSC 2320	0.01	%				0.03	0.06	0.06	0.03	0.02			0.06	0.06			0.22	0.03	0.04			0.03
Sulphate as SO4, Total	DETSC 2321#	0.01	%				0.07		0.14	0.06				0.06	0.33				0.04				0.04
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg					1500			502							8130		850			
Petroleum Hydrocarbons				GAC at 2.5% SOM																			
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	78	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	230	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	65	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	330	LQM/CIEH S4UL 2015		< 1.5			< 1.5					< 1.5								< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	2400	LQM/CIEH S4UL 2015		< 1.2			< 1.2					< 1.2								< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	92,000	LQM/CIEH S4UL 2015		< 1.5			1.7					< 1.5								< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	92,000	LQM/CIEH S4UL 2015		11			< 3.4					< 3.4								< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				12			< 10					< 10								< 10
Aromatic C5-C7 (benzene)	DETSC 3321*	0.01	mg/kg	140	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aromatic C7-C8 (toluene)	DETSC 3321*	0.01	mg/kg	290	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	83	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	180	LQM/CIEH S4UL 2015		1.1			2.9					1.5								< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	330	LQM/CIEH S4UL 2015		0.9			4.6					2.6								< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	540	LQM/CIEH S4UL 2015		13			20					22								< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	1500	LQM/CIEH S4UL 2015		100			46					89								< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg				120			73					110								< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg				130			78					120								< 10
Benzene	DETSC 3321#	0.01	mg/kg	0.17	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	110	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	290	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	410	LQM/CIEH S4UL 2015		< 0.01			< 0.01					< 0.01								< 0.01
MTBE	DETSC 3321	0.01	mg/kg	84	CL:AIRE GAC 2010 (RWHGP)		< 0.01			< 0.01					< 0.01								< 0.01
PAHs				GAC at 2.5% SOM																			
Naphthalene	DETSC 3301	0.1	mg/kg	5.6	LQM/CIEH S4UL 2015		< 0.1	0.4		< 0.1	< 0.1		< 0.1		< 0.1	< 0.1		< 0.1		< 0.1			< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	420	LQM/CIEH S4UL 2015		< 0.1	0.4		0.1	< 0.1		< 0.1		0.1	0.3		< 0.1		< 0.1			< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	510	LQM/CIEH S4UL 2015		< 0.1	0.4		0.3	< 0.1		< 0.1		0.2	0.4		< 0.1		0.2			< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	400	LQM/CIEH S4UL 2015		0.1	0.3		0.6	< 0.1		< 0.1		0.5	0.3		< 0.1		0.2			< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	220	LQM/CIEH S4UL 2015		0.8	0.2		4.4	0.2		0.2		2.6	2.3		0.1		1.0			< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	5400	LQM/CIEH S4UL 2015		0.3	< 0.1		1.1	< 0.1		0.1		0.9	0.9		< 0.1		0.3			< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	560	LQM/CIEH S4UL 2015		1.9	< 0.1		6.6	0.4		0.5		11	8.9		0.2		2.0			< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	1200	LQM/CIEH S4UL 2015		2.0	< 0.1		6.2	0.4		0.4		10	9.2		0.2		2.1			< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	11	LQM/CIEH S4UL 2015		1.0	< 0.1		3.2	< 0.1		0.2		5.8	5.3		< 0.1		1.1			< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	22	LQM/CIEH S4UL 2015		1.2	< 0.1		3.6	< 0.1		0.3		6.4	6.2		< 0.1		1.1			< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	3.3	LQM/CIEH S4UL 2015		0.9	< 0.1		3.0	< 0.1		0.3		5.2	4.7		< 0.1		0.9			< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	93	LQM/CIEH S4UL 2015		0.5	< 0.1		1.7	< 0.1		0.1		3.1	2.7		< 0.1		0.5			< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	5	DEFRA C4SL 2014		1.1	< 0.1		3.7	< 0.1		0.2		6.2	6.7		< 0.1		1.2			< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	36	LQM/CIEH S4UL 2015		0.9	< 0.1		2.6	< 0.1		0.3		4.3	4.7		< 0.1		0.8			< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.28	LQM/CIEH S4UL 2015		0.2	< 0.1		0.4	< 0.1		< 0.1		0.8	0.9		< 0.1		0.2			< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	340	LQM/CIEH S4UL 2015		0.9	< 0.1		2.6	< 0.1		0.2		4.0	4.4		< 0.1		0.9			< 0.1
PAH Total	DETSC 3301	1.6	mg/kg				12	1.8		40	< 1.6		2.9		61	58		< 1.6		13			< 1.6
Phenols				GAC at 2.5% SOM																			
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	550	LQM/CIEH S4UL 2015		< 0.3	< 0.3		< 0.3	< 0.3				< 0.3			< 0.3		< 0.3			< 0.3

APPENDIX H

Controlled Waters Screening Assessment

Silkstone Environmental Ltd
www.silkstoneenvironmental.co.uk

DETS Job No. 21-13935
Client: Rogers Building Supplies Ltd
Client Project Name: Land at Whams Road, Crow Edge
Client Project Ref: 21066

SEL Controlled Waters Screening Assessment

			Lab No	GAC	1870248	1870249	1870250	1875328	1875329
			Sample ID		SW1	SW2	SW3	WS03	WS03
			Depth					0.070-0.40	2.30-2.70
			Other ID						
			Sample Type		WATER	WATER	WATER	LEACHATE	LEACHATE
			Sampling Date		30/06/2021	30/06/2021	30/06/2021	30/06/2021	30/06/2021
			Sampling Time		n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	10[1]	0.39	0.37	0.34		
Boron, Dissolved	DETSC 2306*	12	ug/l	1000[1]	260	280	230		
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	5[1]	0.19	0.21	0.21		
Chromium, Dissolved	DETSC 2306	0.25	ug/l	50[1]	0.47	3.2	0.41		
Copper, Dissolved	DETSC 2306	0.4	ug/l	2000[1]	4.1	4.3	4.1		11
Lead, Dissolved	DETSC 2306	0.09	ug/l	10[1]	0.92	0.57	0.59		
Mercury, Dissolved	DETSC 2306	0.01	ug/l	1[1]	< 0.01	< 0.01	< 0.01		
Nickel, Dissolved	DETSC 2306	0.5	ug/l	20[1]	12	12	13		
Selenium, Dissolved	DETSC 2306	0.25	ug/l	10[1]	0.87	0.84	0.79		
Zinc, Dissolved	DETSC 2306	1.3	ug/l	3000-5000[2]	12	12	12		
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	2500[7]	682	684	685		
pH	DETSC 2008		pH	6.5-10[1]	7.3	7.2	7.1		
Biochemical Oxygen Demand, Total	DETSC 2031	1	mg/l	<5[8]	1.7	3.6	1.2		
Cyanide, Total Low Level	DETSC 2131	0.1	ug/l	50[1]	< 0.1	< 0.1	< 0.1		
Cyanide, Total	DETSC 2130	40	ug/l	50[1]	< 40	< 40	< 40		
Thiocyanate	DETSC 2130	20	ug/l		< 20	< 20	< 20		
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.5[1]	0.029	0.024	0.025		
Chloride	DETSC 2055	0.1	mg/l	250[1]	74	76	75		
Sulphate as SO4	DETSC 2055	0.1	mg/l	250[1]	93	93	92		
Sulphide	DETSC 2208	10	ug/l		18	< 10	14		
Sulphur as S, Total	DETSC 2320*	10	mg/l		41	41	41		
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	15,000[6]	< 0.1	< 0.1	< 0.1		
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	15,000[6]	< 0.1	< 0.1	< 0.1		
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	300[6]	< 0.1	< 0.1	< 0.1		
Aliphatic C10-C12	DETSC 3072*	1	ug/l	300[6]	< 1.0	< 1.0	< 1.0		
Aliphatic C12-C16	DETSC 3072*	1	ug/l	300[6]	< 1.0	< 1.0	< 1.0		
Aliphatic C16-C21	DETSC 3072*	1	ug/l		< 1.0	< 1.0	17		
Aliphatic C21-C35	DETSC 3072*	1	ug/l		< 1.0	< 1.0	1.6		
Aliphatic C5-C35	DETSC 3072*	10	ug/l		< 10	< 10	20		
Aromatic C5-C7	DETSC 3322	0.1	ug/l	10[6]	< 0.1	< 0.1	< 0.1		
Aromatic C7-C8	DETSC 3322	0.1	ug/l	700[6]	< 0.1	< 0.1	< 0.1		
Aromatic C8-C10	DETSC 3322	0.1	ug/l	800[6]	< 0.1	< 0.1	< 0.1		
Aromatic C10-C12	DETSC 3072*	1	ug/l	90[6]	< 1.0	< 1.0	< 1.0		
Aromatic C12-C16	DETSC 3072*	1	ug/l	90[6]	< 1.0	< 1.0	< 1.0		
Aromatic C16-C21	DETSC 3072*	1	ug/l	90[6]	< 1.0	< 1.0	< 1.0		
Aromatic C21-C35	DETSC 3072*	1	ug/l	90[6]	< 1.0	< 1.0	< 1.0		
Aromatic C5-C35	DETSC 3072*	10	ug/l		< 10	< 10	< 10		
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l		< 10	< 10	21		
Benzene	DETSC 3322	1	ug/l	10[6]	< 1.0	< 1.0	< 1.0		
Toluene	DETSC 3322	1	ug/l	700[6]	< 1.0	< 1.0	< 1.0		
Ethylbenzene	DETSC 3322	1	ug/l	300[6]	< 1.0	< 1.0	< 1.0		
Xylene	DETSC 3322	1	ug/l	500[6]	< 1.0	< 1.0	< 1.0		
MTBE	DETSC 3322	1	ug/l	15[10]	< 1.0	< 1.0	< 1.0		
PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	2.4[5]	< 0.05	< 0.05	< 0.05	< 0.05	
Acenaphthylene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	DETSC 3304	0.01	ug/l		0.01	< 0.01	< 0.01	0.02	
Fluorene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	< 0.01	
Phenanthrene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	DETSC 3304	0.01	ug/l	0.4[4]	< 0.01	< 0.01	< 0.01	< 0.01	
Fluoranthene	DETSC 3304	0.01	ug/l	1[4]	0.01	0.01	0.01	0.04	
Pyrene	DETSC 3304	0.01	ug/l		0.01	0.01	< 0.01	0.05	
Benzo(a)anthracene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	0.01	0.01	
Chrysene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	0.01	0.01	
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	0.04	
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.1[1]	< 0.01	< 0.01	< 0.01	0.02	
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	(Combined)	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.01[1]	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l		< 0.01	< 0.01	< 0.01	0.02	
PAH Total	DETSC 3304	0.2	ug/l		< 0.20	< 0.20	< 0.20	0.24	
Phenols									
Phenol - Monohydric	DETSC 2130	0.1	mg/l	7.7[5]	< 0.1	< 0.1	< 0.1		

Notes
1.Water Supply (Water Quality) Regulations 2000 (UK drinking water standards)
2.Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996
3.Environment Agency Environmental Quality Standards in Appendix A to H1 Annex D-basic surface water
4.MAC-EQS for inland surface waters
5.AA-EQS for surface water quality
6.WHO Guidelines for Drinking Water Quality, third edition dated 2004
7.Drinking Water Directive
8.Surface Water Directive
9. USEPA RSL for tapwater 2020
10. Drinking Water Inspectorate, London, 2006

APPENDIX I

Gas & Groundwater Monitoring Results

Silkstone Environmental Ltd www.silkstoneenvironmental.co.uk	Project: Land at Whams Road, Crow Edge, S36 4HE	Client: Rogers Building Supplies Ltd	Contract No: 21066

GAS AND GROUNDWATER MONITORING RECORD

		Gas Readings										
Hole ID	Date	Oxygen (%)	Carbon Dioxide (%)	Methane (%)	LEL (%)	Flow (l/hr)	Relative Pressure (mb)	Ambient Pressure (mb)	Pressure Trend	Water Level (mBGL)	Base of Hole (mBGL)	Remarks
WS01	01/07/21	16.0	2.9	0.2	4.0	<0.1	-0.10	983	Falling	2.82	3.22	57 ppm CO & No H2S
	14/07/21	10.0	7.0	0.2	4.0	1.2	1.19	985	Rising	2.63	3.22	Zero CO & H2S
	27/07/21	4.3	10.6	<0.1	0.0	-1.2	-1.31	972	Falling	3.00	3.20	Zero CO & H2S
	11/08/21	2.0	12.8	<0.1	0.0	-1.9	-17.74	980	Falling	3.10	3.20	Zero CO & H2S
	26/08/21	0.1	12.7	<0.1	0.0	2.1	0.04	992	Falling	3.02	3.22	Zero CO & H2S
	10/09/21	20.6	0.4	<0.1	0.0	<0.1	-0.08	974	Rising	3.06	3.20	Zero CO & H2S
RBH02	01/07/21	20.1	<0.1	0.2	4.0	<0.1	-0.08	982	Falling	4.52	4.85	11 ppm CO & No H2S
	14/07/21	7.1	1.0	0.1	2.0	<0.1	0.00	984	Rising	3.78	4.82	1 ppm CO & No H2S
	27/07/21	3.6	2.1	<0.1	0.0	<0.1	0.00	971	Falling	3.96	4.80	Zero CO & H2S
	11/08/21	1.3	3.0	<0.1	0.0	<0.1	-0.02	980	Falling	3.80	4.80	Zero CO & H2S
	26/08/21	0.9	2.7	<0.1	0.0	<0.1	-0.07	992	Falling	4.26	4.80	Zero CO & H2S
	10/09/21	5.2	2.0	1.7	34.0	<0.1	-0.07	974	Rising	4.19	4.82	Zero CO & H2S
WS03	01/07/21	10.6	0.1	<0.1	0.0	<0.1	-0.07	982	Falling	Dry	3.42	4 ppm CO & No H2S
	14/07/21	8.9	0.1	<0.1	0.0	<0.1	0.01	985	Rising	Dry	3.42	Zero CO & H2S
	27/07/21	7.7	0.2	<0.1	0.0	<0.1	0.00	972	Falling	Dry	3.41	Zero CO & H2S
	11/08/21	7.5	0.3	0.1	2.0	<0.1	-0.03	980	Falling	Dry	3.41	Zero CO & H2S
	26/08/21	7.3	0.2	<0.1	0.0	<0.1	-0.06	993	Falling	Dry	3.38	Zero CO & H2S
	10/09/21	9.5	0.4	<0.1	0.0	<0.1	-0.04	974	Rising	Dry	3.37	Zero CO & H2S

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend:Falling
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: Hot & Sunny/ clear blue sky	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (°C)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		01/07/2021	16:40	<0.1	<0.1	20.8	-	0	0	22.0	982	-	-	2 mins duration.
WS01		01/07/2021	16:42	0.2	2.9	16.0	20.4	0	57	22.0	983	<0.1	-0.10	2 mins duration.
RBH02		01/07/2021	16:48	0.2	<0.1	20.1	3.6	0	11	22.0	982	<0.1	-0.08	2 mins duration.
WS03		01/07/2021	15:06	<0.1	0.1	10.6	49.2	0	4	22.0	982	<0.1	-0.07	2 mins duration.

Notes:

SILKSTONE ENVIRONMENTAL LTD

Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: Hot & Sunny/ clear blue sky

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		01/07/2021	16:45			2.82	3.22	0.40	N		
RBH02		01/07/2021	16:51			4.52	4.85	0.33	N		
WS03		01/07/2021	15:09			Dry	3.42	0.00	N		

Notes:

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend: Rising
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: Hot & Sunny/ Breezy/ Blue sky	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (^oC)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		14/07/2021	16:10	<0.1	<0.1	20.6	-	0	0	22.0	984	-	-	2 mins duration.
WS01		14/07/2021	15:50	0.2	7.0	10.0	62.8	0	0	22.0	985	1.2	1.19	2 mins duration.
RBH02		14/07/2021	15:58	0.1	1.0	7.1	64.8	0	1	22.0	984	<0.1	0.00	2 mins duration.
WS03		14/07/2021	16:05	<0.1	0.1	8.9	57.2	0	0	22.0	985	<0.1	0.01	2 mins duration.

Notes:

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Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: Hot & Sunny/ Breezy/ Blue sky

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		14/07/2021	15:53			2.63	3.22	0.59	N		
RBH02		14/07/2021	16:01			3.78	4.82	1.04	N		
WS03		14/07/2021	16:08			Dry	3.42	0.00	N		

Notes:

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record		Sheet 3 of 6	
Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend:Falling
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: 90% cloud cover/ Cool/ Light wind	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (^oC)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		27/07/2021	15:10	<0.1	<0.1	20.8	0.3	0	0	20.0	971	-	-	2 mins duration.
WS01		27/07/2021	15:14	<0.1	10.6	4.3	68.6	0	0	20.0	972	-1.2	-1.31	2 mins duration.
RBH02		27/07/2021	15:28	<0.1	2.1	3.6	80.6	0	0	20.0	971	<0.1	0.00	2 mins duration.
WS03		27/07/2021	15:35	<0.1	0.2	7.7	62.7	0	0	20.0	972	<0.1	0.00	2 mins duration.

Notes:

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Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: R Drown	Weather Conditions: 90% cloud cover/ Cool/ Light wind

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		27/07/2021	15:17			3.00	3.20	0.20	N		
RBH02		27/07/2021	15:31			3.96	4.80	0.84	N		
WS03		27/07/2021	15:38			Dry	3.41	0.00	N		

Notes:

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record		Sheet 4 of 6	
Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend: Falling
Client: Rogers Building Supplies Ltd	Survey Personnel: A Hives	Weather Conditions: Overcast	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (^oC)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		11/08/2021	10:04	<0.1	<0.1	21.0	-	0	0	21	980	-	-	2 mins duration.
WS01		11/08/2021	10:06	<0.1	12.8	2.0	-	0	0	21	980	-1.9	-17.74	2 mins duration.
RBH02		11/08/2021	10:01	<0.1	3.0	1.3	-	0	0	21	980	<0.1	-0.02	2 mins duration.
WS03		11/08/2021	09:55	0.1	0.3	7.5	-	0	0	21	980	<0.1	-0.03	2 mins duration.

Notes:

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Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: A Hives	Weather Conditions: Overcast

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		11/08/2021	10:10			3.10	3.20	0.10	N		
RBH02		11/08/2021	10:03			3.80	4.80	1.00	N		
WS03		11/08/2021	09:58			Dry	3.41	0.00	N		

Notes:

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record		Sheet 5 of 6	
Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend:Falling
Client: Rogers Building Supplies Ltd	Survey Personnel:R.Drown	Weather Conditions: Sunny/ Dry/ Blue sky	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (^oC)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		26/08/2021	13:52	<0.1	<0.1	20.6	-	0	0	18	992	-	-	2 mins duration.
WS01		26/08/2021	13:55	<0.1	12.7	0.1	86.6	0	0	18	992	2.1	0.04	2 mins duration.
RBH02		26/08/2021	14:06	<0.1	2.7	0.9	92.6	0	0	18	992	<0.1	-0.07	2 mins duration.
WS03		26/08/2021	14:11	<0.1	0.2	7.3	64.8	0	0	18	993	<0.1	-0.06	2 mins duration.

Notes:

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SILKSTONE ENVIRONMENTAL LTD

Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: R. Drown	Weather Conditions: Sunny/ Dry/ Blue sky

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		26/08/2021	13:58			3.02	3.22	0.20	N		
RBH02		26/08/2021	14:09			4.26	4.80	0.54	N		
WS03		26/08/2021	14:14			Dry	3.38	0.00	N		

Notes:

SILKSTONE ENVIRONMENTAL LTD

Gas Monitoring Record		Sheet 6 of 6	
Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Equipment: Geotechnical Instruments GA 2000	Pressure Trend:Rising
Client: Rogers Building Supplies Ltd	Survey Personnel: R. Drown	Weather Conditions: 80% cloud cover/ breezy	

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	CH_4 (in %)	CO_2 (in %)	O_2 (in %)	N_2 (in %)	H2S (ppm)	CO (ppm)	Temp (^oC)	Atmos. Pressure (mb)	Flow (l/h)	Rel. Pressure (mb)	Comments
Background		10/09/2021	12:03	<0.1	<0.1	20.5	-	0	0	19	974	-	-	2 mins duration.
WS01		10/09/2021	11:47	<0.1	0.4	20.6	1.2	0	0	19	974	<0.1	-0.08	2 mins duration.
RBH02		10/09/2021	11:53	1.7	2.0	5.2	71.7	0	0	19	974	<0.1	-0.07	2 mins duration.
WS03		10/09/2021	11:59	<0.1	0.4	9.5	54.1	0	0	19	974	<0.1	-0.04	2 mins duration.

Notes:

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Borehole Waters Monitoring Record

Site Name:Land at Whams Road, Crow Edge, S36 4HE	Project Ref. 21066	Survey Reference:
Client: Rogers Building Supplies Ltd	Survey Personnel: R. Drown	Weather Conditions: 80% cloud cover/ breezy

Monitoring Point	Description / Grid Ref.	Date (DD/MM/YY)	Time HH:MM	Surface Level M AOD	Cover Level M AOD	Depth to Water M bgl	Depth to Base M bgl	Water Head M	Sample Taken Y/N	Water Level M AOD	Comments
WS01		10/09/2021				3.06	3.20	0.14	N		
RBH02		10/09/2021				4.19	4.82	0.63	N		
WS03		10/09/2021				Dry	3.37	0.00	N		

Notes: