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Geo-environmental
Ground Investigation Report

ON

PROPOSED RESIDENTIAL DEVELOPMENT

AT

HEATON GRANGE, BATLEY

FOR

WHARFEDALE Ltd

SEPTEMBER 2020
Rev A

E20/7738/R001A

Prepared by

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0.0 EXECUTIVE SUMMARY

SITE	The site is located on land to the northwest of Heaton Grange, Batley. The main body of the site is square, with an extension heading eastwards from the northeast corner. The site is predominantly grassed and overgrown with mature tree growth to the south west, west and north. The south eastern corner has been used for the storage of building materials. The site slopes from south west to north east at an average grade of 1 in 11. The northern boundary has a 5m vertical rock face down to the adjacent industrial unit. The western boundary banks down sharply to a 1-2m highway stone retaining wall retaining the height above the adjacent Mill Lane.
HISTORY	The site has been shown as undeveloped except for a single small structure shown on site in 1956 only. Historically there has been quarrying to the west and south west of the site up to 1922 and a gas works 71m north from 1893-1995.
GEOLOGY	No superficial deposits or artificial ground are recorded on the site. The site is underlain by the Emley Rock Formation, consisting of Sandstone. The nearest fault line is located approximately 50m north of the site. The site was used as a registered landfill for construction and demolition waste and excavated materials up until 1988. Site investigation works have proved a shallow band of demolition waste extending from the south western corner to the north east a maximum of 1.9m deep. The remainder of the site and the waste is underlain by sands and clays with a relatively shallow sandstone bedrock in the lower northern end and mudstone bedrock in the south. The bedrock was encountered at depths of 0.2-3.3m below existing ground levels.
MINING/QUARRYING	The Phase 1 Desk Study by Mason Clark Associates contains a Coal Authority Report that states that the property is in the likely zone of influence from workings in two seams of coal at 150m to 330m depth and last worked in 1965. Any ground movements associated with these workings should have finished. Historically there has been quarrying immediately south west and west of the site.
HYDROLOGY	The nearest surface water feature is Batley Beck approximately 115m north west of the site.

The site is not located within any Environment Agency defined flood zones or shown to be at risk of flooding from rivers or the sea.

HYDROGEOLOGY

The groundwater vulnerability map for the area indicates that the site overlies rocks designated as a Secondary (A) aquifer.
No groundwater was recorded during the trial pit excavations, window sampling or gas monitoring to date.

HAZARDOUS GAS

The property is not in an area requiring radon protection measures.
Gas monitoring has been undertaken on two occasions to date and recorded no methane and a maximum carbon dioxide concentration of 9.0%.
Due to the elevated carbon dioxide levels, we would recommend the gas regime on this site be currently classified as Amber 1 by the NHBC traffic light system, or CS2 by BS 8485:2015 Table 2.

CONTAMINATION

No elevated levels of heavy or phytotoxic metals or PAH compounds were recorded in the samples from site.
A single sample from the made ground of TP02 proved positive for asbestos.

REMEDIATION

The topsoil on site has proved clean from contamination. We would therefore recommend that the topsoil is scraped and screened to remove unsuitable material and then stockpiled behind protective fencing for eventual re-use on site to soft landscaped areas. However, there is potentially insufficient topsoil on site and clean material will need to be imported to site.
As only one sample proved positive for asbestos we would recommend this is treated as a hotspot and the contaminated material removed from site. Samples from the perimeter of the excavation should be taken to prove all contaminated material has been removed from site. Should these prove positive for asbestos, consideration should be given to whether to remove further material from site or undertake quantitative analysis on the asbestos.

FOUNDATIONS

The made ground is not considered a suitable founding material, all foundations should extend through this to the underlying natural strata. We would therefore suggest that the proposed two/three storey residential constructions should be constructed on strip/trench fill footings to the natural strata beneath.
Due to the steep nature of the site, and the depth of fill encountered, it is possible that piled foundations will be required for plots in the north east of the site. This should be reviewed upon confirmation of the final site levels.

Due to the presence of trees adjacent the site, the foundation depths will need to be deepened in accordance with NHBC Chapter 4.2

DRAINAGE

Infiltration methods have proved that the lower northern areas of the site are suitable for the use of soakaways. However, it is recommended that further investigation work is undertaken, including the use of dye-testing, to confirm that there will be no re-emergence of surface water from the vertical rock face to the north of the site that will adversely affect the lower industrial estate.
In addition to this, locations for proposed soak-a-ways to service the adoptable highway should be agreed with the Lead Local Flood Authority and Local Authority Highways Department and further testing undertaken in these areas.

1.0 INTRODUCTION

1.1 As requested by Martin Walsh Architectural on behalf of Wharfedale Ltd, this practice carried out ground and contamination investigation works for a proposed development on land north west of Heaton Grange, Batley.

1.2 The purpose of the report was to:-

1.2.1 Identify the nature of the near surface strata, in order to enable recommendations to be made as to the most economic foundation solution for the proposed residential development.

1.2.2 To identify any areas of contaminated ground.

1.2.3 Propose a suitable outline remediation strategy, which will enable the site to be developed safely, to the satisfaction of the overseeing regulators and in compliance with the current environmental standards.

1.2.4 Determine if infiltration methods would be a suitable form of surface water disposal.

1.3 Soil sampling was undertaken via trial pits and window sampling to determine the near surface strata. Distributed samples were taken for testing to ascertain the nature of the soils and fills present.

1.4 The conclusions and recommendations made in this report are limited to the findings of the preliminary Geotechnical Survey. The report is made on condition that Haigh Huddleston & Associates will not in any circumstances be liable for loss, arising directly or indirectly from ground conditions encountered between trial pits and window samples, which have not been revealed by the investigation.

1.5 Any opinion given on the possible configuration of strata between trial pit and window sample locations and below maximum depth of the investigation is for guidance only. Any remarks on groundwater conditions made are based solely on observations made at the time of investigation. Kindly note that levels may differ from those reported due to seasonal variations or other influences.

1.6 Furthermore, there is the possibility that any trial pits or window samples undertaken as part of the investigatory works may be within the influence of existing or proposed foundations or excavations. Haigh Huddleston & Associates cannot be held responsible for any failure of any excavations, foundations or structures within the influence of the trial pits or window samples.

2.0 THE SITE

2.1 The site is located on land to the northwest of Heaton Grange, Batley and lies around OS Grid Reference 425040, 423450. A site location plan is attached in Appendix A at the rear of the report.

2.2 The main body of the site is square, with an extension heading eastwards from the north eastern corner. The western boundary of the site is formed by Mill Lane which falls away sharply to the north and immediately north is an industrial estate approximately 5m lower that the site. There are residential properties to the south and east and beyond Mill Lane to the west. The site area is approximately 0.38 Ha.

2.3 The site is accessed from Heaton Grange in the south eastern corner. The area immediately adjacent Heaton Grange has been used as a storage area for shipping containers and other materials, particularly where adjacent the residential properties to the east. During the site investigation and subsequent gas monitoring, the site has been overgrown by tall grass up to 1m high and low shrubs. Mature tree growth is noted in the south western corner and adjacent to the western and northern boundaries.

2.4 The western boundary is formed by a stone wall retaining the site 1-2m above Mill Lane and topped by a chainlink fence which continues around the southern boundary. The northern boundary is formed by a palisade fence and the eastern boundary is formed by a mix of post and rail and post and panel fencing.

2.5 The site falls at an average grade of approximately 1 in 11 from a high point of 72.6m AOD in the south western corner to a low point of 62m AOD in the north eastern corner. In the north western corner the site banks down sharply approximately 4-5m to Mill Lane. On the northern boundary there is a 4-5m vertical rock face down to the industrial estate to the north of the site. On the eastern boundary, there is a 1-2m banking down to the adjacent property.

3.0 SITE HISTORY

3.1 The Phase 1 Desk Study by Mason Clark Associates (Ref: 10837 dated July 2011) has been consulted and below is a brief description outlining the significant developments that may affect future construction on the site.

3.2 The site itself has shown no significant development since the earliest plan in 1854. A single small structure was shown in the north of the site in 1956 only.

3.3 In the vicinity of the site, the following potential sources of contamination were identified:

- Sandstone quarry 14m south west shown from 1854-1893
- Quarry 36m west from 1893-1922
- Gas works 71m north from 1893-1995
- Land immediately north of site used for industrial development from 1956 onwards.

4.0 SITE GEOLOGY & MINING

4.1 The BGS Digital Geological map of Great Britain at 1:10,000 has been consulted and we would report as follows:-

4.2 No artificial or superficial deposits are shown directly overlying the site.

4.3 The site is underlain by the Emley Rock Formation consisting of Sandstone.

4.4 The nearest fault line is approximately 50m north of the site.

4.5 The Phase 1 Desk Study by Mason Clark Associates contains a Coal Authority Report that states that the property is in the likely zone of influence from workings in two seams of coal at 150m to 330m depth and last worked in 1965. Any ground movements associated with these workings should have finished.

4.6 There are no known mine entries within, or within 20m of, the site boundary.

4.7 There have been no claims for subsidence damage within 50m of the site boundary.

4.8 The property is not in an area where the Coal Authority has granted or is determining a grant to extract coal using underground methods, or that is likely to be affected by planned future workings. However, reserves of coal exist in the local area which could be worked at some time in the future.

4.9 There are no detailed deep BGS boreholes recorded in the vicinity of the site.

5.0 ENVIRONMENTAL CONSIDERATIONS

5.1 Radon

The property is not in a Radon Affected Area, as less than 1% of properties are above the action level.

No Radon Protective Measures are necessary.

5.2 Landfill Sites

The Phase 1 Desk Study by Mason Clark Associates states that the site may have erroneously been recorded as a registered landfill on the Sensitivity Map until 1988. Potential construction and demolition waste on site including excavated materials. The former gas works 71m north is recorded as historical landfill.

5.3 Flood Risk

The site is not located in a currently defined Environment Agency floodzone or at risk of flooding from rivers and the sea.

5.4 Groundwater

The groundwater vulnerability map for the area indicates that the site overlies bedrock designated as a Secondary (A) aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not within a currently defined (Groundwater) Source Protection Zone (SPZ).

There are three recorded water abstraction licenses within 250m of the site. One is located 179m north east of the site and the remaining two are 191m west of the site.

There are four recorded Licensed Discharge Consents within 250m of the site. Two of these are 130m north west of the site, one is 142m north of the site and the last is 210m west of the site. All of them are storm water overflows to Batley Beck.

There are two recorded pollution incidents to controlled waters within 250m of the site. These were a Category (1) Major Incident involving heating oil 34m north west of the site and a Category (3) Minor Incident involving paints/dyes 240m north west of the site.

The nearest surface water feature is Batley Beck approximately 115m north west of the site.

6.0 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 The initial stage in assessing the risks posed from contaminated land during the redevelopment of a site is to prepare a conceptual model. A generalised conceptual model can be developed highlighting the main pollutant linkages through a contaminant ► pathway ►receptor model for a residential development. In order to prepare the conceptual model for a particular site the following parameters need to be reviewed as discussed below.

6.2 Contamination of existing land can be caused by a number of factors, including:-

i) Possible historical/current industrial activities.
ii) Disposal of waste materials.
iii) Storage of materials.
iv) A number of natural processes can also lead to hazardous gases and elevated heavy metals.

6.3 Potential pathways can include ground and surface water, permeable strata, existing services providing a conduit and voided ground. Potential receptors can include human health, ecosystems, controlled waters and building structures. There are a number of ways that a receptor can be exposed to the contaminant these include, inhalation, direct contact, ingestion, dermal contact and uptake.

6.4 Sources of potential contamination, that could affect the proposed development, from either on or off site activities would include the following:-

i) Possible ground gas migration from historical landfills north of site.
ii) Possible demolition material on site.

Based on the above activities the potential for some contamination to exist on site is considered to be low.

6.5 Considering the proposed residential end use, there will be two possible human receptor groups exposed to the existing onsite contamination:-

a) Site operatives during development.
b) End users, future site residents (the critical receptor is a 6 year-old girl).

6.6 Human receptors may be exposed to site contamination by a number of possible pathways. These pathways are summarised in Table 1 below.

Table 1- Potential Human Exposure Pathways

Human Exposure Pathway	Site Residents	Construction Workers
Soil Ingestion	YES	YES
Consumption of Home Grown Vegetables	YES	NO
Dermal Contact	YES	YES
Dust Inhalation	YES	YES
Gases/Vapours	YES	NO

6.7 The construction workers will come into contact with any contaminated soil to a far greater extent than future residents. The exposure pathways are generally through dermal contact and indirect ingestion. However their exposure will be for a limited time and the provision and correct use of personnel protective equipment and adequate welfare facilities during construction should restrict their risks to acceptable levels.

6.8 Future site residents can be protected in the long term development of the site via a suitable remediation strategy that ensures any proposed contaminated materials remaining on-site are suitably isolated beneath an effective capping layer.

6.9 The risk of pollution to controlled waters by existing contamination is considered low. There have been no historical uses of the site, or in the immediate vicinity of the site, likely to cause contamination.

6.10 No specific areas of ecological importance have been identified in the initial desk top study. Therefore the site is considered to be in a low risk environmental setting. The potential for phototoxic materials to exist at shallow depth should be considered, these could pose a potential risk to new planting and soft landscaping areas within the proposed development.

6.11 The proposed planning drawings indicate residential properties with private garden areas and hard paved site access and parking areas. The presence of elevated sulphates and hydrocarbons could affect the long term integrity of buried concrete

structures, including foundations and drainage pipes. Plastic water supply pipes can also be damaged by the presence of hydrocarbon contamination.

7.0 FIELDWORK

7.1 Trial pit excavations were undertaken on the 30th July 2020 using a JCB 3CX with back actor and 600mm bucket. Eight trial pits were undertaken in total, seven of which were used for soak-a-way testing. In addition to this, six window samples were undertaken on site. Three of these window samples were fitted with gas monitoring stations to determine if ground gas generation would adversely affect the site.

7.2 Materials encountered in the trial pits and window samples were examined and categorised. Trial pit and window sample logs are contained within Appendix B of the report.

7.3 The soakaway tests were undertaken in accordance with the method specified in BRE Digest 365 Soakaway Design. An instantaneous supply of water was provided via an IBC. In general, the trial pits were filled and the water levels were recorded against time as the water permeated into the natural strata. The water level was monitored over an extended time period to determine the infiltration rate for the sand strata.

7.4 The site investigation works were designed to achieve comprehensive site coverage within the proposed development area.

7.5 Soil samples were removed from the natural and made ground deposits within the trial pits. The samples were removed by operatives wearing gloves and placed into airtight clean plastic containers and glass bottles for transportation to the laboratory.

7.6 A total of eight samples from the natural and made ground deposits were recovered from the trial holes for chemical analysis. The testing was carried out by a UKAS accredited laboratory to nationally or accredited in-house methods. The results of the contamination testing are contained within Appendix C of this report.

7.7 A suite of common potential contaminants consisting of heavy metals, phytotoxic metals, sulphates, sulphides and poly-aromatic hydrocarbons was analysed for, including a range of metals and inorganic substances and asbestos.

7.8 All samples were stored in airtight containers within cool boxes at approximately 4°c until delivery to the laboratory within 48 hours.

8.0 RESULTS OF THE INVESTIGATION

8.1 GEOTECHNICAL INVESTIGATION

8.1.1 A copy of the trial hole and window sample logs providing a complete record of strata encountered beneath the proposed development is presented in Appendix B.

8.1.2 The fieldwork generally proved a shallow depth of topsoil and clays overlying a mudstone or sandstone bedrock. A shallow depth of demolition material runs from the south western corner to the north eastern corner of the site.

8.1.3 At the surface of TP01. TP02, TP05 and TP06 was a layer of demotion waste and excavated material consisting of re-engineered clays, gravels, occasional bricks, concrete paving slabs, concrete kerbs, sands and clay pipework. The depth of fill material varied from 0.5m to 1.9m across site, generally deeper in the north east. Beneath the fill in TP02 was a 0.3m thick layer of soft to firm dark brown clay that is possible relict topsoil.

8.1.4 The surface of the remainder of the trial pits consisted of rough grass over a dark brown loamy topsoil. The topsoil varied in thickness from 0.1m to 0.3m across site.

8.1.5 In TP04 and TP07, beneath the topsoil there was a 0.3-0.6m thick layer of medium dense light brown sands containing numerous sandstone gravels (weathered sandstone). In TP02, TP05, TP06 and TP08 there was a 0.5-1.1m thick layer of soft to firm orangish brown sandy clay with occasional gravels underlying the topsoil and made ground.

8.1.6 At the base of TP01-TP04 and TP06 there was a moderately weak light brown weathered sandstone excavated as horizontally bedded angular gravels. This was encountered at depths of 0.2-3.3m below existing ground levels, generally deeper towards the north east. In TP05, a 0.5m thick band of this sandstone was encountered at 0.7-1.2m below existing ground levels.

8.1.7 At the base of TP05, TP07 and TP08 in the south and east there was a moderately weak dark brown mudstone excavated as weathered clays and small angular gravels. This was encountered at 0.9-2.2m below existing ground levels, becoming deeper towards the south-west.

8.1.8 At the base of TP01 and TP02 there was a moderately strong grey/brown mudstone excavated as shaley gravels. This was encountered at a depth of 1.8m below existing ground levels in both trial pits.

8.1.9 The window samples undertaken on site proved up to 1.6m of fill and clays overlying the sandstone and mudstone bedrock. Refusals were recorded within the mudstone and sandstone.

8.1.10 Standard Penetration Test 'N' values taken at 1.0m depth increments within the window samples and boreholes and are summarised in Table 2 below:-

Table 2 Summary of SPT (N Values)

Depth (m)	1.00-1.45	2.00-2.45	2.80-3.25
WS01	10	20	REFUSAL
WS02	12	REFUSAL	-
WS03	REFUSAL	-	-
WS04	REFUSAL	REFUSAL	-
WS05	46	REFUSAL	-
WS06	14	REFUSAL	-

8.1.11 The SPT values show medium dense fill in WS01 and firm to stiff clays overlying the mudstone and sandstone. Refusals were recorded within the mudstone and sandstone strata.

8.1.12 As discussed previously in the report, seven of the eight trial pits were used to carry out soakaway tests in order to obtain infiltration rates across the site.

8.1.13 The infiltration rate has been calculated in each case between the 75% and 25% full values as recommended in the BRE Digest 365. The soakaway results are included in Appendix B and are summarised Table 3 below:-

Table 3 Summary of infiltration rates

SOAKAWAY NUMBER	INFILTRATION RATE m/s x10^{-4}
TP01*	5.774
TP02 – TEST 1	2.252
TP02 – TEST 2	1.626
TP02 – TEST 3	1.207
TP03*	6.392
TP04*	6.901
TP05	ABANDONED - STATIONARY WATER LEVEL
TP06	0.256
TP08	0.129

8.1.14 For soakaways marked '*', the water was emptying the soakaway as soon as it entered so it was not possible to time the water emptying in the usual manner. Instead, a conservative estimate has been obtained by calculating the depth of water in the trial pit for the water that was delivered from the IBC. This is considered a conservative estimate as the depth of water did not increase as much as in the calculation, so in reality there was a smaller contact area for the water to infiltrate into.

8.1.15 TP01-TP04 along the northern and western boundaries recorded high infiltration rates of 1.2-6.9 x 10^{-4} m/s within the weathered sandstone on site. TP05 was undertaken in the mudstone adjacent the southern boundary and was abandoned due to the water level remaining stationary. TP06 and TP08 in the centre and south east recorded moderate infiltration rates of 1.3-2.6 x 10^{-5} m/s.

8.1.16 It should be noted that although no re-emergence of surface water was noted on the vertical rock face to the north of the site, only a relatively small volume of water was used with the infiltration rate testing. More robust testing, including the use of dyes, should be undertaken to confirm there is no re-emergence of water that will adversely affect the industrial estate to the north.

8.1.17 The result of the geotechnical analysis undertaken on the samples of clayey soil indicates the clay to be of intermediate (Plasticity Index 16-24%). If the modified results are calculated, taking into account the percentage of material retained on a

425micron sieve, the results correspond to a medium shrinkage clay. The test certificates are contained in Appendix C.

8.2 GROUNDWATER

8.2.1 No groundwater was encountered during the trial pit investigation.

8.2.2 No groundwater strikes were recorded during the window sample investigation. No groundwater was present in the single round of gas monitoring undertaken to date.

8.2.3 It should be recognised that ground water levels may vary throughout the year. During periods of heavy rainfall the groundwater levels may be substantially higher than the results revealed in these investigations.

8.3 GAS MONITORING

8.3.1 As discussed previously WS01G, WS02G and WS05G were installed with gas standpipes and lockable covers. Gas testing is currently being undertaken on site and to-date the wells have been monitored on two occasions following the installation of the standpipes.

8.3.2 A standard gas monitoring procedure has been followed in accordance with CIRIA guidance, including measurement of the following:-

i) Methane, Oxygen and Carbon Dioxide concentrations.
ii) Atmospheric Pressure.
iii) Gas Flow Rate.
iv) Standing water level.

8.3.3 The result of the monitoring undertaken to-date is summarised in Table 4 below. A complete set of results will be reported on completion of the intended testing programme.

Table 4 - Summary of Recorded Gas Levels.

Borehole No.	Date	Oxygen %	Carbon Dioxide %	Methane %	Flow Rate (l/hr)	Depth to Water (m)	Atmospheric Pressure (mb)
WS01G	27/08/20	20.3	0.5	ND	ND	DRY	1004
	09/09/20	20.0	0.6			DRY	1012
WS02G	27/08/20	-	-	-	-	DRY	-
	09/09/20	19.7	9.0	ND	ND	DRY	1012
WS05G	27/08/20	18.4	2.0	ND	ND	DRY	1004
	09/09/20	18.8	2.2	ND	ND	DRY	1013

8.3.4 A maximum carbon dioxide concentration of 9.0% was recorded in WS02. No methane has been recorded. No flow rates were detected in the monitoring stations.

8.3.5 Due to the elevated carbon dioxide levels recorded on site, we would recommend the gas regime on this site be currently classified as **Amber 1** the NHBC traffic light system, or **CS2** by 8485:2015 Table 2.

8.3.6 The gas monitoring is ongoing and a final report confirming any gas protection measures required will be prepared when the monitoring is completed.

9.0 CONTAMINATION

9.1 HUMAN HEALTH RISK ASSESSMENT

9.1.1 The appraisal of contaminated land within the UK is based on a risk assessment approach. The method involves the principle of defining a source ► pathway ►receptor, linkage to establish a human health risk. For any risk to exist to a potential receptor from an identified contaminant there must be an unbroken source ► pathway ►target relationship.

9.1.2 In the first instance site data for the contaminant levels are compared against guidance such as the CLEA values published by DEFRA. Should the site values exceed the guidance criteria, the contamination levels are recognised to have the potential to pose a risk to human health. Two scenarios are then available:-

a) To break or remove one of the source ► pathway ►receptor linkages, by specifying an appropriate level of remedial work. Examples of remedial action may include the removal of the contaminated material or alternatively specifying a sufficient capping layer.

b) The alternative approach is to provide a more detailed human health site specific risk assessment. This will involve examining factors such as soil properties, exposure assumptions, groundwater flows and contamination composition.

9.2 CONTAMINATION RESULTS

9.2.1 As stated above, in order to put the analytical results into context, the data has in the first instance been assessed in relation to several sets of guidelines: -

9.2.2 The analytical results have been assessed via an initial screening assessment with regard to the current Contaminated Land Exposure Assessment model (CLEA UK) for human health, which has been produced for the Environment Agency and the Department of Environment, Food and Rural Affairs (DEFRA). The CLEA model provides Soil Guideline Values (SGVs) for a limited range of contaminants only, and these are based on risk to human health. As such they do not take into account potential risks to other receptors eg groundwater and third party land.

9.2.3 It is proposed to redevelop the site for residential properties with private garden areas. Soil results have therefore been assessed against the CLEA SGV's for residential use with plant uptake, as these are considered to be the most suitable guidelines to protect the most critical targets from contaminants via all possible exposure routes.

9.2.4 Where no CLEA SGV has been published, Generic Assessment Criteria (GAC) based on guidelines from the Chartered Institute of Environmental Health (CIEH) and Land Quality Management Ltd (LQM) S4UL document residential land use with plant uptake has been used. Where there is no GAC, guidance limits have been adopted from sources referenced in the table below.

9.2.5 A new approach has now been adopted for the calculation of SGV based on an acceptably low level of risk. These Category 4 Screening Levels (C4SL) have been calculated for six substances to date by modifying the toxilogical/exposure parameters within CLEA. C4SLs have been used as tier 1 trigger levels within this assessment, superseding the previous CIEH and LQM SGVs.

9.2.6 Assessment of risk is considered as a tiered approach. Assessment based on non intrusive means is considered Tier 1 assessment, comparison against SGVs and GACs is a Tier 2 assessment, and the generation of and comparison with Site Specific Assessment Criteria (SSAC) is a Tier 3 assessment and is conducted where deemed appropriate following the Tier 2 assessment.

9.2.7 The sulphate and acid concentrations have been compared against the BRE digest "Concrete in Aggressive Ground" parts 1-4. This will enable the concrete class to be specified in relation to possible contact with aggressive soils.

9.2.8 The results of the chemical analysis are presented on the laboratory analysis sheets with Appendix C. A summary of the significance of the results is presented in Table 5.

Table 5

Comparison of contaminant against accepted guidance values for residential use with plant uptake

CONTAMINANT	SGV MG/KG	CONCENTRATION IN ALL SOILS. MG/KG	No. OF SAMPLES EXCEEDING GUIDANCE VALUES	PERCENTAGE OF SAMPLES EXCEEDING GUIDELINE VALUE
Arsenic	37 (4)	7.0-31	0/8	
Cadmium	22 (4)	<0.1-2.2	0/8	
Chromium (Total)	130 (2)	12-28	0/8	
Lead	200 (4)	14-140	0/8	
Mercury (Total)	1.2 (1)	<0.05-0.42	0/8	
Selenium	250 (1)	<0.5-1.0	0/8	
Copper	2400 (1)	19-91	0/8	
Nickel	180 (1)	17-22	0/8	
Zinc	3700 (1)	52-160	0/8	
Sulphate	0.24 (3)	0.02-0.19	0/8	
Thiocyanate	50	<0.6-6.0	0/8	
Sulphide	250	<10-28	0/8	
Naphthalene	2.3 (1)	<0.1-0.2	0/8	
Benzo(a)pyrene	5 (4)	<0.1-1.0	0/8	
PAH (Total)	40	<1.6-9.8	0/8	
Phenols	760 (1)	<0.3-0.7	0/8	
Asbestos	No fibres	Amosite	1/8	12.5%
pH	6-8	5.7-8.2	0/8	

(2) DEFRA CLR SGV's withdrawn used for initial comparison

(3) BS 8110 1985 Table 6.1

(4) Category 4 Screening Levels

9.2.9 No elevated levels of phytotoxic or heavy metals were found in the samples taken from site.

9.2.10 No elevated levels of PAH (Total) or individual PAH compounds were recorded in the samples taken from site.

9.2.11 The sample of made ground from TP02 at 0.7m depth proved positive for asbestos, this was amosite present in microscopic loose fibrous asbestos debris.

9.2.12 No elevated sulphate levels were recorded in the samples taken from site. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 “Concrete in aggressive ground”.

9.3 QUALITATIVE RISK ASSESSMENT

9.3.1 The Qualitative Risk Assessment is based upon the previously discussed source ► pathway ►receptor principle. In relation to the proposed site these may be described as follows:-

9.3.2 **SOURCE**

i) Asbestos found in made ground from TP02 at 0.7m.
ii) No elevated levels of ground gas.

9.3.3 **PATHWAYS**

i) Ingestion of contamination material.
ii) Inhalation of contaminated particles.
iii) Dermal contact with the known contamination.
iv) Leaching to controlled waters.

9.3.4 **RECEPTORS**

i) Residential site users.
ii) Construction and maintenance workers.
iii) Controlled waters.
iv) The building structure.

9.3.5 Each of the receptors will now be appraised and attribute the likely risks involved.

i) Residential site users.

Based on the chemical results obtained it is considered that there is currently a **low** risk to end users from localised ground contamination on-site.

No elevated levels of heavy or phytotoxic metals or PAH compounds were recorded in the samples from site.

A single sample from TP02 at a depth of 0.7m proved positive for Amosite asbestos. ed in the samples taken from site.

The topsoil on site has proved suitable for re-use on site. We would therefore recommend that the topsoil is scraped and screened to remove unsuitable material and then stockpiled behind protective fencing for eventual re-use on site to soft landscaped areas. However, there is potentially insufficient topsoil on site and clean material will need to be imported to site.

As only one sample proved positive for asbestos so we would recommend this is treated as a hotspot and the contaminated material removed from site. Samples from the perimeter of the excavation should be taken to prove all contaminated material has been removed from site. Should these prove positive for asbestos, consideration should be given to whether to remove further material from site or undertake quantitative analysis on the asbestos.

A maximum carbon dioxide concentration of 9.0% was recorded in WS02G. No methane has been recorded. No flow rates were detected in the monitoring stations. Based on the maximum concentrations and gas flow rates measured, the gas regime found on this site can be currently classified as **Amber 1** by the NHBC traffic light system, or **CS2** by BS 8485:2015 Table 2.

The gas monitoring is ongoing and a final report confirming any gas protection measures required will be prepared when the monitoring is completed.

ii) Construction and Maintenance Workers.

It is considered that there is a **low** risk to construction and maintenance workers from the redevelopment of the site.

Construction workers should always wear PPE including overalls, boots and gloves when handling the contaminated materials onsite. In addition eating, drinking and smoking should be restricted to designated areas where the above hygiene facilities are available.

iii) Controlled Waters

A single sample from the made ground proved positive for asbestos, it is therefore considered unlikely that there is a risk to groundwater and controlled waters from existing contamination on site.

iv) Building Structures.

Service providers should be forwarded the final validated chemical levels in order for them to provide an accurate specification for the apparatus to be provided. New services should be surrounded and backfilled with clean material to afford some protection to the apparatus and allow any future maintenance work to be undertaken in clean material.

No elevated sulphate levels were recorded in the samples of soil at the surface. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 “Concrete in aggressive ground”.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 GEOTECHNICAL ASSESSMENT

10.1.1 The fieldwork generally proved a shallow depth of made ground and clays with a mudstone or sandstone bedrock. For initial design purposes we would envisage a safe bearing capacity of 100kN/m2 where foundations are cited into the clay strata and 150kN/m2 where foundations are extended onto the solid mudstone or sandstone strata.

10.1.2 The made ground is not considered a suitable founding material, all foundations should extend through this to the underlying natural strata. We would therefore suggest that the proposed two/three storey residential constructions should be constructed on strip/trench fill footings founded entirely onto the clay strata. Where mudstone/sandstone is encountered within the excavations, the foundations should be deepened to lie entirely onto the mudstone/sandstone strata to avoid differential settlement. The foundation widths will vary dependent upon the line loadings calculated.

10.1.3 All foundations should be placed below a line of 45˚ drawn up from the base of any services or other structures.

10.1.4 Where existing foundations or structures are encountered during construction, these should be totally removed from the excavations to enable the new foundations to be constructed without obstructions.

10.1.5 However, it should be noted that in the north east of the site that levels may need to be raised above existing ground levels due to the existing steep slope of the site and allowable adoptable highway gradients. In this instance, due to the depth of made ground in this area of the site, piling or other methods, may be the better foundation option. We would recommend that the final foundation design is to be determined following detailed examination of the final site levels. This area of the site is indicated on the planning layout in Appendix A.

10.1.6 We would therefore suggest that in the north east of the site, the proposed two/three storey traditional house construction should be constructed on piled foundations with a reinforced concrete suspended ground beam. The following general comments

relating to piling are provided for guidance, and further advice should be sought from a specialist-piling contractor.

10.1.7 Piled foundations should extend and be socketed into the underlying bedrock. Pile records should be checked to ensure a minimum 3m pile length and that similar pile lengths are achieved throughout a plot and between adjacent structures.

10.1.8 The safe working load that may be supported on a pile is dependent on the pile diameter, its founding depth and the method of installation. As piles would be founded in bedrock, they will be essentially end bearing, although there may also be some shaft adhesion within the infilled materials. It is essential that pile design allows for negative skin friction.

10.1.9 It is recommended that flexible service connections are used on this site, especially where they enter the buildings, in order to avoid any possible damage due to self-settlement of the weak strata once the site is developed.

10.1.10 Driven piles may lessen the volume of potentially contaminated made ground requiring off-site disposal, compared with continuous flight auger piled foundations. However, driving can induce some ground vibration. Assessment of any vibration risk to adjacent structures and/or existing site features should be undertaken by pile designer.

10.1.11 On completion of the piling works, pile testing should be undertaken to confirm the adequacy and load carrying capacity of the installed piles.

10.1.12 Should any shallow obstructions occur, i.e. large boulders, they should either be grubbed-up, or alternatively replacement piles installed. The pile logs should be checked prior to the piling rig departing site, to ensure consistent pile lengths are installed throughout the site.

10.1.13 The new houses can be built off ring beams designed to span the piles. In order to bond them to the piles, the tops of the piles must be tied to the reinforcement within the ground beams. This can be achieved by a variety of methods dependent upon the type of piles adopted.

10.1.14 For piled foundations suspended floor slabs should be utilised. A pre-cast 'Beam and Block' concrete ground floor construction could be utilised, and suspended across the ring beams.

10.1.15 At present it is not anticipated that excessive ground water control measures will be required. Please note that ground water flows can vary throughout the year and a further assessment should be undertaken if construction work is proposed following a prolonged rainfall event.

10.1.16 No elevated sulphate levels were recorded in the samples of soil at the surface. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 "Concrete in aggressive ground".

10.1.17 Wherever any foundations are located near existing or proposed new trees, their foundations must be sited below the root growth zone. Reference should be made to the NHBC standards Chapter 4.2 "Building Near Trees" which provides guidance on foundation criteria, depths and construction. All services should be similarly protected. Plasticity testing of the clays on site has shown them to be of medium volume change potential.

10.2 SURFACE WATER DRAINAGE

10.2.1 The site investigation works for the site have generally proved clays and made ground overlying a mudstone or sandstone bedrock.

10.2.2 The soak-a-way tests undertaken throughout the site proved highly variable infiltration rates from 2.68×10^{-4} m/s to the test being abandoned due to no drop in the water level. The dispersal of the surface water was primarily through the underlying sandstone, with higher infiltration rates recorded in the northern lower end of the site. The lower infiltration rates were recorded in the south where a mudstone bedrock was encountered.

10.2.3 We would therefore propose that infiltration methods would be a suitable long term method of surface water disposal. However, due to the elevated nature of the site with regards to the land to the north, further investigation work should be undertaken to confirm there is no re-emergence of the surface water through the sheer

sandstone face. It is recommended that dye-testing is used to identify the water used in further infiltration tests does not re-emerge.

10.2.4 In addition to this, locations for proposed soak-a-ways to service the adoptable highway should be agreed with the Lead Local Flood Authority and Local Authority Highways Department. Additional infiltration testing should be undertaken in these locations to confirm the exact infiltration rates to be used for the designs of the adoptable soak-a-ways.

10.3 GROUND FLOOR SLAB – GAS MEASURES

10.3.1 As discussed previously, gas monitoring stations were installed in three of the window sample locations on site due to the possibility of ground gas migration from historical recorded landfill sites to the north of the development and potential infill material on site.

10.3.2 A maximum carbon dioxide concentration of 9.0% was recorded in WS02G. No methane has been recorded. No flow rates were detected in the monitoring stations.

10.3.3 The proposed development consists of low rise residential housing and therefore the gas regime has been characterised in accordance with the traffic light methodology as outlined in *CIRIA Report C665*. Due to the levels of carbon dioxide recorded on site, we would recommend the gas regime on this site be currently classified as **Amber 1** by the NHBC traffic light system, or **CS2** by BS 8485:2015 Table 2.

10.3.4 No Radon Protection measures are required for the site.

10.3.5 Due to the presence of trees immediately adjacent to the site, a suspended beam & block floor will be required for the properties in accordance with NHBC Chapter 4.2. Consulting BS 8485:1015 tables 5-7 we would recommend the following to achieve a score of 4.5 due to the elevated levels of carbon dioxide:

- Fully vented minimum 250mm deep void below suspended slab. **2.5 Points**
- Continuous membrane across the cavity/party walls. **0 Points**
- Cavity tray in the external walls. **0 Points**

- Fully sealed service entries and ducts to manufactures specification. **0 Points**

- Beam and block floor construction **0 Points**

- A Visqueen Gas Barrier meeting all of the following criteria:
  - Sufficiently impervious to gasses with a methane gas transmission rate <40.0ml/day/m2/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1 manometric method).
  - Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions.
  - Sufficiently strong to withstand in-service stresses (eg. Settlement if placed below a floor slab).
  - Sufficiently strong to withstand the installation process and following trades until covered (eg. Penetrations from steel fibres in fibre reinforced concrete, penetration from reinforcement ties, tearing due to Working above it, dropping tools etc.)
  - Capable, after installation, of providing a complete barrier to the entry of the relevant gas.
  - Verified in accordance with CIRIA C735 [N1] **2.0 Points**

Total **4.5 Points**

10.3.6 A detailed analysis of the results and any gas protection measures required will be confirmed on completion of the on-site gas testing in a separate report.

10.4 CONTAMINATION ASSESSMENT

10.4.1 No elevated levels of heavy or phytotoxic metals or PAH compounds were recorded in the samples from site.

10.4.2 A single sample from TP02 at a depth of 0.7m proved positive for Amosite asbestos.

10.4.3 As only one sample proved positive for asbestos so we would recommend this is treated as a hotspot and the contaminated material removed from site. Samples from the perimeter of the excavation should be taken to prove all contaminated material has been removed from site. Should these prove positive for asbestos, consideration should be given to whether to remove further material from site or undertake quantitative analysis on the asbestos.

10.4.4 However, there is potentially insufficient topsoil on site and clean material will need to be imported to site.

10.4.5 Should any further suspected areas of contamination be exposed during site strip/construction, an engineer should be contacted to determine if additional chemical testing should be undertaken. The on-site staff should maintain a photographic record and dates of any exposed contaminated material.

10.4.6 Due to the relatively small amount of topsoil on site, topsoils and subsoils will need to be imported to site to provide a minimum 300mm growing medium to soft landscaped areas on site. All material should be tested and certified prior to bringing to site to confirm it is free from contaminants.

10.4.7 If the imported material is from a Greenfield site, a minimum of 3 samples or 1 per 250m^3 of imported material should be taken for testing, whichever is greater. If it is from a brownfield site, a minimum of 6 samples, or 1 per 100m^3 of imported material should be taken for testing, whichever is greater. Material provided by a commercial supplier should be certified to the same level of testing, with the certificate less than two months old.

10.4.8 All imported certified material should be placed immediately. If this is not possible, or the material is not certified and sampling is to be carried out prior to being laid, it should be securely stored on site prior to use to prevent possible contamination from any materials on site.

10.4.9 Any areas of made ground/fill removed from site should be taken to a licensed waste site and full documentation should be obtained. Any material to be taken off-site should be suitably quarantined prior to removal to prevent cross contamination. Any relevant chemical test results should be given to the landfill operator, so that they can determine if this material is suitable to be disposed of in their licensed landfill.

11.0 SUGGESTED FURTHER WORK

11.1 Gas monitoring to be completed and final assessment on gas protection measures to be made.

11.2 Further investigation into the use of soak-a-ways to be undertaken.

11.3 Removal and validation of the asbestos hotspot identified on site.

11.4 Foundation designs to be reviewed based on final site levels.

12.0 APPROVALS

12.1 Proposals for the remediation of contaminated land may require the approval of numerous bodies.

These include:

a) Kirklees Council Health Department as required by the building and planning regulations.

b) The NHBC or similar as they will provide the insurance costs to cover the property.

c) The Environment Agency if there are risks of contamination to ground or surface water systems. They will also require notification if material is removed from site and taken to an appropriate tip.

d) Relevant highways and drainage authorities and other service companies may also wish to know about the level of contaminants.

Prepared by

M.Dean. BSc., HND

Checked by

M. Huddleston. MEng

September 2020

APPENDIX A

Site Location Plan

Dwg No. E20/7738/03 – Site Investigation Plan

Dwg No. E20/7738/32 - Typical Site Conceptual Model

Planning Layout

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Dewsbury
WF12 7BU

Client : Wharfedale Limited

Job Title: Heaton Grange, Hanging Heaton

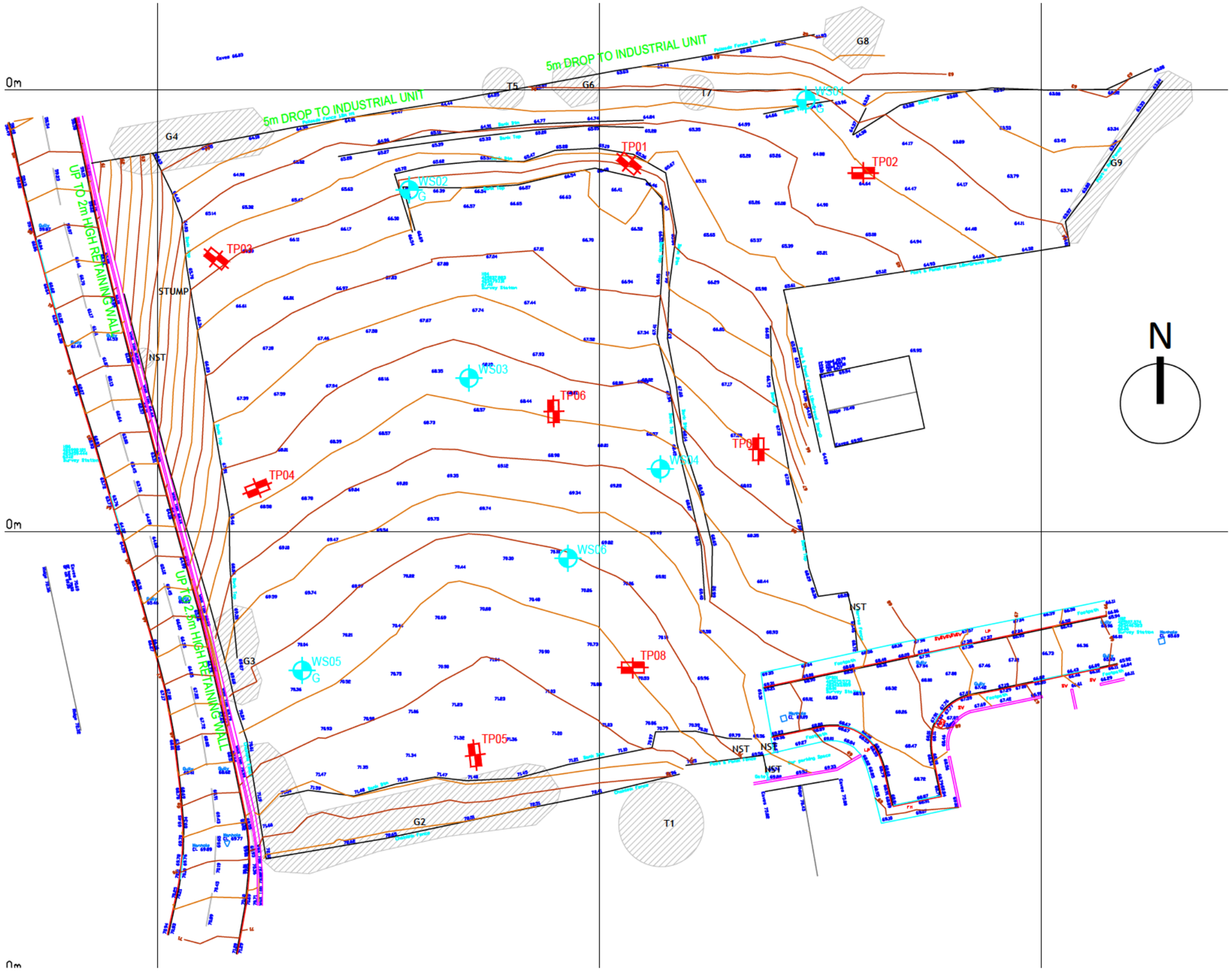
Job Number : E20/7738

LOCATION PLAN

OS Grid Reference : SE250234
Easting : 425092
Northing : 423433

Topographical Survey carried out using GPS.

N



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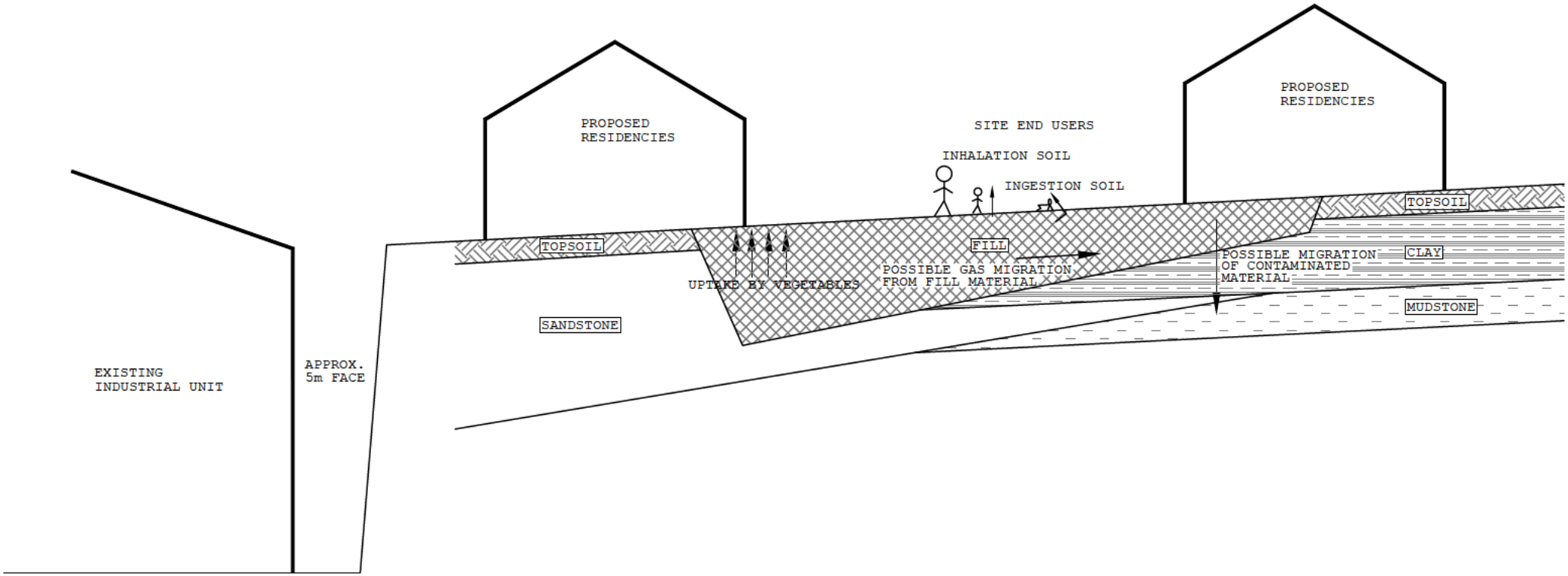
Client
WHARFEDALE LTD

Project
HEATON GRANGE,
HANGING HEATON

Detail
SITE INVESTIGATION PLAN

PRELIMINARY ISSUE

Scale	Dwn	Chkd	Date	Dwg No.
1:500	CM		Sep'20	E20/7738/03



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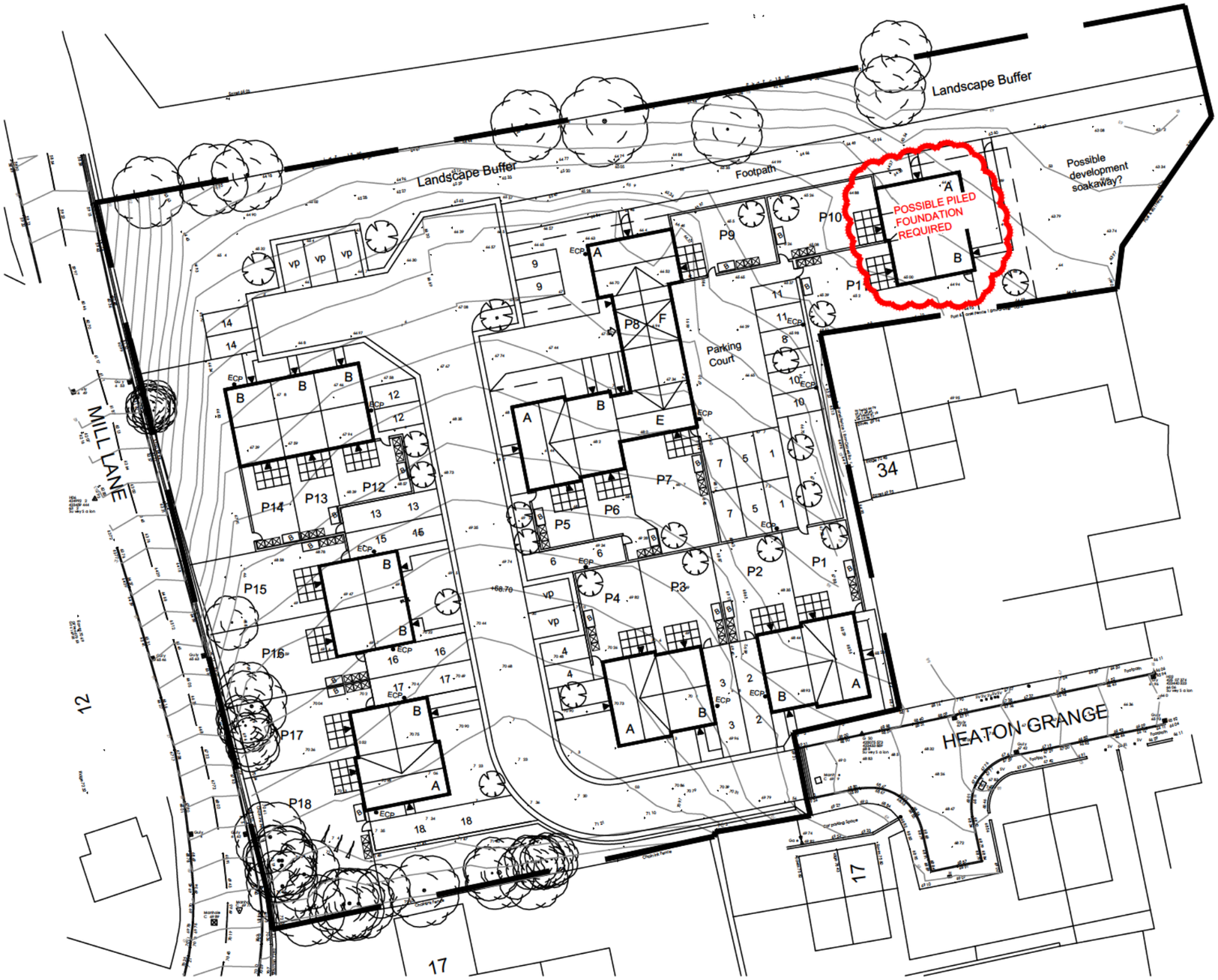
Client
Wharfedale Ltd

Project
Heaton Grange, Hanging Heaton

Detail
Typical Site Conceptual Model

Scale	Dwn	Chkd	Date	Dwg No.
NTS	MD		Sep'20	E20/7738/32



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Client
WHARFEDALE LTD

Project
HEATON GRANGE
HANGING HEATON

Detail
PLANNING LAYOUT

PRELIMINARY ISSUE

Scale	Dwn	Chkd	Date	Dwg No.
1:500	CM		Sep'20	E20/7738

APPENDIX B

Trial Hole Logs

Window Sample Logs

Soakaway Test Results

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FORM HHA 5

TRIAL HOLE NO. 1

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
	0.4	Made ground consisting of re-engineered clays, gravels occasional brick, paving slab and concrete kerb. Sample taken at 0.4m.
0.5		
1.0		
	1.1	
1.5		Moderately weak light brown highly weathered sandstone excavated as angular gravels. Predominantly horizontally bedded loosely compacted.
2.0	**2.0**	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.4m.
Sides of excavation remained stable	NO – unstable within sandstone.
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 2

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
0.5		Made ground. Clayey fill with gravel and concrete paving.
	0.7	Sample taken at 0.7m.
1.0		
1.5		
	1.9	
2.0		Soft/firm dark brown clay (possible former topsoil).
	2.2	
2.5		Firm light brown very sandy clay with occasional sandstone gravels.
3.0		
	3.3	
3.5	**3.5**	Moderately weak light brown weathered sandstone difficult to excavate.
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES @ 0.7m.
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 3

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
	0.2	Rough grass over loamy topsoil. Sample taken at 0.1m.
0.5		Moderately weak weathered sandstone excavated as angular gravels within a sandy matrix – Loosely compacted horizontally bedded.
1.0		
1.5	**1.5**	Becoming difficult to excavate.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.1m.
Sides of excavation remained stable	NO – slightly unstable
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 4

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
	0.3	Dark brown loamy topsoil. Sample taken at 0.2m.
0.5	**0.6**	Medium dense light brown sands with numerous sandstone gravels.
1.0	**1.9**	Moderately weak light brown horizontally bedded sandstone excavated as tabular gravels. Sample taken at 1.0m.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.2m and 1.0m.
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 5

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
0.5	**0.5**	Made ground. Clay, gravels, sands, bricks. Sample taken at 0.5m.
1.0 **1.5**	**1.6**	Firm light brown very sandy clay with numerous sandstone gravels.
2.0	**2.2**	Moderately weak dark brown mudstone excavated as completely weathered clays.
2.5 **3.0** **3.5** **4.0**		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.5m.
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 6

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0

0.5	**0.5**	Made ground. Sands, gravels, stones, clay pipe. Sample taken at 0.4m.
1.0	**1.0**	Soft/firm light brown very sandy clay with sandstone gravels.
1.5	**1.7**	Moderately weak light brown sandstone highly weathered horizontally bedded loosely compacted.
2.0 **2.5** **3.0** **3.5** **4.0**		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.4m.
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 7

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
	0.1	Dark brown clayey topsoil.
0.5	**0.7**	Medium dense light brown sands with numerous sandstone gravels.
1.0	**1.2**	Moderately weak light brown weathered sandstone excavated as horizontally bedded angular gravels.
1.5	**1.8**	Moderately weak grey/brown mudstone excavated as small angular gravels.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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FORM HHA 5

TRIAL HOLE NO. 8

Client :	**WHARFEDALE**	**Job No :**	**7738**
Site :	**HEATON GRANGE**	**Date :**	**30/07/2020**

0.0		
	0.1	Dark black loamy topsoil. Sample taken at 0.1m.
0.5	**0.9**	Firm orangish brown mottled grey sandy clay. Sample taken at 0.5m.
1.0		
1.5	**1.6**	Moderately weak grey/brown mudstone with occasional sandstone gravels.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES at 0.1m & 0.5m.
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

							WINDOW SAMPLE No. **1**	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample Type	Sample No.	Test	
Clay brick fill								
				1.0			SPT	2,2,2,3,2,3
			1.4	1.4				
Brown clay with sandstone cobbles								
				2.0			SPT	4,4,4,5,5,6
			2.7	2.7				
Sandstone			2.8				SPT	10,14,25,25
Install 1m Plain 1.8m Slotted								Refusal
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

							WINDOW SAMPLE No. 2	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample Type	Sample No.	Test	
Top Soil			0.5					
Light brown clay with sandstone cobbles				1.0			SPT	3,3,3,3,3,3
			1.6					
Weathered mudstone				2.0			SPT	5,10,17,24,8
			2.45					Refusal
Install 1m Plain 1m Slotted								
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

							WINDOW SAMPLE No. 3	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample Type	Sample No.	Test	
Top Soil Brown clay with sandstone cobbles			0.2 0.8					
Sandstone			1.0	1.0			SPT	15,15,39,11
No Install								Refusal
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

							WINDOW SAMPLE No. 4	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample		Test	
					Type	No.		
Clay brick fill			0.5					
Sandstone			1.0	1.0			SPT	15,17,40,10
No Install								Refusal
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

							WINDOW SAMPLE No. 5	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample Type	Sample No.	Test	
Top soil brick fill			0.4					
Clay with sandstone cobbles				1.0			SPT	5,5,10,10,13,13
			2.0	2.0			SPT	7,9,10,12,18,10
Mudstone			2.4					
								Refusal
Install 1m Plain 1m Slotted								
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

							WINDOW SAMPLE No. 6	
Equipment & Methods **DRIVE-IN WINDOW SAMPLER**	Location No. Location **Heaton Grange, Hanging Heaton**							
Carried out for **Wharfedale Ltd**	Ground level		Coordinates				Date 30st July 2020	
Description	Reduced level	Legend	Depth (thick)	Sample Tests				SPT Values
				Depth	Sample Type	Sample No.	Test	
Top soil fill			0.2					
Brown clay with sandstone cobbles				1.0			SPT	3,3,3,3,4,4
			1.4					
Sandstone			1.5					
				2.0			SPT	7,10,10,20,12
No Install								Refusal
Remarks **Gas monitoring station installed** Notes								Logged by GP Scale FIG

Soil Permeability test

TP01

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Constrution Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.7
Width	0.7
Depth	2

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
9.12	0	1160	0.99960		5.22200	
9.21	9	2000	0.00000	0.99960	1.19000	0.57739

BRE Value 0.57738960 lit/ sq.m/sec

Average Permeabilty Value: 0.577389617 lit/ sq.m/sec

Soil Permeability test

SOAKAWAY TEST 1 TP02

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.8
Width	0.7
Depth	3.4

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
9.49	0	3180	0.27720		2.36000	
9.57	8	3340	0.07560	0.20160	1.56000	0.21429
10.02	13	3400	0.00000	0.07560	1.26000	0.17872

BRE Value 0.22521940 lit/ sq.m/sec

Average Permeabilty Value: 0.196504559 lit/ sq.m/sec

Soil Permeability test

Soakaway Test 2 TP02

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.8
Width	0.7
Depth	3.4

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
10.07	0	2960	0.55440		3.46000	
10.09	2	2980	0.52920	0.02520	3.36000	0.06158
10.20	13	3160	0.30240	0.22680	2.46000	0.11809
10.25	18	3270	0.16380	0.13860	1.91000	0.21144
10.35	28	3400	0.00000	0.16380	1.26000	0.17224

BRE Value 0.16261440 lit/ sq.m/sec

Average Permeabilty Value: 0.140838268 lit/ sq.m/sec

Soil Permeability test

Soakaway Test 3 TP02

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.8
Width	0.7
Depth	3.4

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
12.50	0	2940	0.57960		3.56000	
12.57	7	3060	0.42840	0.15120	2.96000	0.11043
13.05	15	3170	0.28980	0.13860	2.41000	0.10754
13.18	28	3350	0.06300	0.22680	1.51000	0.14835
13.23	33	3400	0.00000	0.06300	1.26000	0.15162

BRE Value 0.12075210 lit/ sq.m/sec

Average Permeabilty Value: 0.129486886 lit/ sq.m/sec

Soil Permeability test

TP03

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Constrution Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.9
Width	0.7
Depth	1.5

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
10.47	0	935	0.75145		4.26800	
10.54	7	1500	0.00000	0.75145	1.33000	0.63922

BRE Value 0.63921640 lit/ sq.m/sec

Average Permeabilty Value: 0.639216387 lit/ sq.m/sec

Soil Permeability test

TP04

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.4
Width	0.7
Depth	1.9

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
11.10	0	1135	0.74970		4.19300	
11.17	7	1900	0.00000	0.74970	0.98000	0.69012

BRE Value 0.69012180 lit/ sq.m/sec

Average Permeabilty Value: 0.690121786 lit/ sq.m/sec

Soil Permeability test

TP05

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	2.8
Width	0.65
Depth	2.2

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
11.22	0	1700	0.91000		5.27000	
11.29	7	1700	0.91000	0.00000	5.27000	0.00000
12.04	42	1700	0.91000	0.00000	5.27000	0.00000
12.23	61	1700	0.91000	0.00000	5.27000	0.00000
12.52	90	1700	0.91000	0.00000	5.27000	0.00000

ABANDONED DUE TO STATIONARY WATER LEVEL

Average Permeabilty Value: 0.000000000 lit/ sq.m/sec

Soil Permeability test

TP06

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.8
Width	0.8
Depth	2.2

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
12.13	0	1300	1.29600		6.12000	
12.17	4	1400	1.15200	0.14400	5.60000	0.10239
12.22	9	1460	1.06560	0.08640	5.28800	0.05290
12.40	27	1590	0.87840	0.18720	4.61200	0.03502
12.51	38	1630	0.82080	0.05760	4.40400	0.01936
13.28	75	1775	0.61200	0.20880	3.65000	0.02336
13.49	96	1860	0.48960	0.12240	3.20800	0.02833
13.59	106	1885	0.45360	0.03600	3.07800	0.01909
14.30	137	1960	0.34560	0.10800	2.68800	0.02014

BRE Value 0.02559990 lit/ sq.m/sec

Average Permeabilty Value: 0.037572965 lit/ sq.m/sec

Soil Permeability test

TP08

Site **Heaton Grange** **Date** 30.07.20

Client **Wharfedale Construction Ltd** **Job No.** E20/7738

Pit dimensions m

Length	1.3
Width	0.7
Depth	1.6

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
12.42	0	1050	0.50050		3.11000	
12.56	14	1070	0.48230	0.01820	3.03000	0.00706
13.20	38	1180	0.38220	0.10010	2.59000	0.02474
13.46	64	1185	0.37765	0.00455	2.57000	0.00113
14.30	108	1320	0.25480	0.12285	2.03000	0.02023

BRE Value 0.01292570 lit/ sq.m/sec

Average Permeabilty Value: 0.013289572 lit/ sq.m/sec

APPENDIX C

Chemical Analysis of Samples

Geotechnical Analysis of Samples

Certificate of Analysis

Certificate Number	20-14214
	10-Aug-20
Client	Haigh Huddleston & Associates Ltd Firth Buildings 99-101 Leeds Road Dewsbury WF12 7BU
Our Reference	20-14214
Client Reference	7738
Order No	(not supplied)
Contract Title	Heaton Grange
Description	8 Soil samples.
Date Received	04-Aug-20
Date Started	04-Aug-20
Date Completed	10-Aug-20
Test Procedures	Identified by prefix DETSn (details on request).
Notes	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 without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 20-14214
Client Ref 7738
Contract Title Heaton Grange

Sample ID	Depth	Lab No	Completed	Matrix Description
TP01	0.4	1707024	10/08/2020	Dark brown gravelly, sandy CLAY
TP02	0.7	1707025	10/08/2020	Dark brown gravelly, sandy CLAY
TP03	0.1	1707026	10/08/2020	Dark brown gravelly, very sandy CLAY including some rootlets
TP04	0.2	1707027	10/08/2020	Dark brown gravelly, very sandy CLAY
TP04	1	1707028	10/08/2020	Brown gravelly SAND
TP05	0.5	1707029	10/08/2020	Brown sandy CLAY
TP06	0.4	1707030	10/08/2020	Dark brown gravelly, very sandy CLAY (Possible made ground - brick)
TP08	0.1	1707031	10/08/2020	Dark brown gravelly, sandy CLAY

Summary of Chemical Analysis
Soil Samples

Our Ref 20-14214
Client Ref 7738
Contract Title Heaton Grange

			Lab No	1707024	1707025	1707026	1707027	1707028	1707029
			Sample ID	TP01	TP02	TP03	TP04	TP04	TP05
			Depth	0.40	0.70	0.10	0.20	1.00	0.50
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	7.0	13	16	24	7.3	7.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	2.2	0.2	0.3	0.1	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	12	18	14	20	12	13
Copper	DETSC 2301#	0.2	mg/kg	26	33	37	49	19	20
Lead	DETSC 2301#	0.3	mg/kg	23	57	41	56	15	14
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.07	0.11	0.20	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	17	23	19	20	20	21
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.7	0.8	1.0	< 0.5	0.6
Zinc	DETSC 2301#	1	mg/kg	75	100	98	140	52	64
Inorganics									
pH	DETSC 2008#		pH	8.2	7.0	5.8	5.7	6.9	6.2
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	1.5	1.4	< 0.6	1.6	1.8
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	0.03	0.06	0.08	0.02	0.04
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	0.2	0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	0.3	0.2	0.2	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.3	0.3	0.3	0.3	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.6	1.2	0.9	0.9	0.5	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	0.1	0.2	0.2	0.2	0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.7	1.3	1.1	1.1	0.5	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	0.7	1.5	0.9	1.4	0.6	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.7	0.9	0.8	0.8	0.4	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	2.4	0.9	1.8	0.8	0.6	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	0.5	0.5	0.6	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	0.3	0.2	0.2	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.4	0.7	0.8	0.7	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.3	0.5	1.4	0.6	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.1	0.2	0.2	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.4	0.8	< 0.1	1.2	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	8.0	9.8	9.7	9.4	2.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	0.5	0.7	0.6	< 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 20-14214
Client Ref 7738
Contract Title Heaton Grange

				Lab No	1707030	1707031
				Sample ID	TP06	TP08
				Depth	0.40	0.10
				Other ID		
				Sample Type	SOIL	SOIL
				Sampling Date	30/07/2020	30/07/2020
				Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Metals						
Arsenic	DETSC 2301#	0.2	mg/kg		16	31
Cadmium	DETSC 2301#	0.1	mg/kg		0.2	0.3
Chromium	DETSC 2301#	0.15	mg/kg		14	28
Copper	DETSC 2301#	0.2	mg/kg		40	91
Lead	DETSC 2301#	0.3	mg/kg		64	140
Mercury	DETSC 2325#	0.05	mg/kg		0.11	0.42
Nickel	DETSC 2301#	1	mg/kg		17	22
Selenium	DETSC 2301#	0.5	mg/kg		0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg		91	160
Inorganics						
pH	DETSC 2008#		pH		7.9	6.4
Thiocyanate	DETSC 2130#	0.6	mg/kg		6.0	2.3
Sulphide	DETSC 2024*	10	mg/kg		< 10	28
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.06	0.19
PAHs						
Naphthalene	DETSC 3301	0.1	mg/kg		< 0.1	0.2
Acenaphthylene	DETSC 3301	0.1	mg/kg		0.1	0.4
Acenaphthene	DETSC 3301	0.1	mg/kg		< 0.1	0.2
Fluorene	DETSC 3301	0.1	mg/kg		< 0.1	0.3
Phenanthrene	DETSC 3301	0.1	mg/kg		0.4	1.2
Anthracene	DETSC 3301	0.1	mg/kg		< 0.1	0.3
Fluoranthene	DETSC 3301	0.1	mg/kg		0.5	1.7
Pyrene	DETSC 3301	0.1	mg/kg		0.4	2.0
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg		< 0.1	1.1
Chrysene	DETSC 3301	0.1	mg/kg		< 0.1	1.2
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg		< 0.1	0.7
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg		< 0.1	0.4
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg		< 0.1	1.0
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg		< 0.1	0.8
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg		< 0.1	1.1
PAH Total	DETSC 3301	1.6	mg/kg		< 1.6	13
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		< 0.3	0.6

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

Summary of Asbestos Analysis
Soil Samples

Our Ref 20-14214
Client Ref 7738
Contract Title Heaton Grange

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1707024	TP01 0.40	SOIL	NAD	none	A Christodoulou
1707025	TP02 0.70	SOIL	Amosite	Amosite present in microscopic loose fibrous asbestos debris	A Christodoulou
1707026	TP03 0.10	SOIL	NAD	none	A Christodoulou
1707027	TP04 0.20	SOIL	NAD	none	A Christodoulou
1707028	TP04 1.00	SOIL	NAD	none	A Christodoulou
1707029	TP05 0.50	SOIL	NAD	none	A Christodoulou
1707030	TP06 0.40	SOIL	NAD	none	A Christodoulou
1707031	TP08 0.10	SOIL	NAD	none	A Christodoulou

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.

Information in Support of the Analytical Results

Our Ref 20-14214
Client Ref 7738
Contract Heaton Grange

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1707024	TP01 0.40 SOIL	30/07/20	GJ 250ml, PT 1L		
1707025	TP02 0.70 SOIL	30/07/20	GJ 250ml, PT 1L		
1707026	TP03 0.10 SOIL	30/07/20	GJ 250ml, PT 1L		
1707027	TP04 0.20 SOIL	30/07/20	GJ 250ml, PT 1L		
1707028	TP04 1.00 SOIL	30/07/20	GJ 250ml, PT 1L		
1707029	TP05 0.50 SOIL	30/07/20	GJ 250ml, PT 1L		
1707030	TP06 0.40 SOIL	30/07/20	GJ 250ml, PT 1L		
1707031	TP08 0.10 SOIL	30/07/20	GJ 250ml PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

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

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

End of Report

STRUCTURAL SOILS LTD

TEST REPORT

1774

Report No. 784588 r1

Date 19-August-2020 Contract Heaton Grange

Client Haigh Huddleston Associates
Address Firth Building
99-101 Leeds Road
Dewsbury
WF12 7BU

For the Attention of Martin Huddleston

Samples submitted by client	03/08/2020	Client Reference	
Testing Started	04/08/2020	Client Order No.	
Testing Completed	19/08/2020	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests Undertaken

Moisture Content (oven drying method) BS1377:Part 2:1990,clause 3.2 (superseded)**
Liquid Limit (definitive method) BS1377:Part 2:1990,clause 4.3
Plastic Limit BS1377:Part 2:1990,clause 5.3
Plasticity Index Derivation BS1377:Part 2:1990,clause 5.4

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977 552255. E-mail mark.athorne@soils.co.uk

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Description of Sample
TP05	1	D	1.50	13	35	19	16	84	Light brown slightly sandy sligfhtly gravelly CLAY
TP08	1	D	0.50	19	44	20	24	91	Light brown slightly sandy slightly gravelly CLAY

STRUCTURAL SOILS LTD

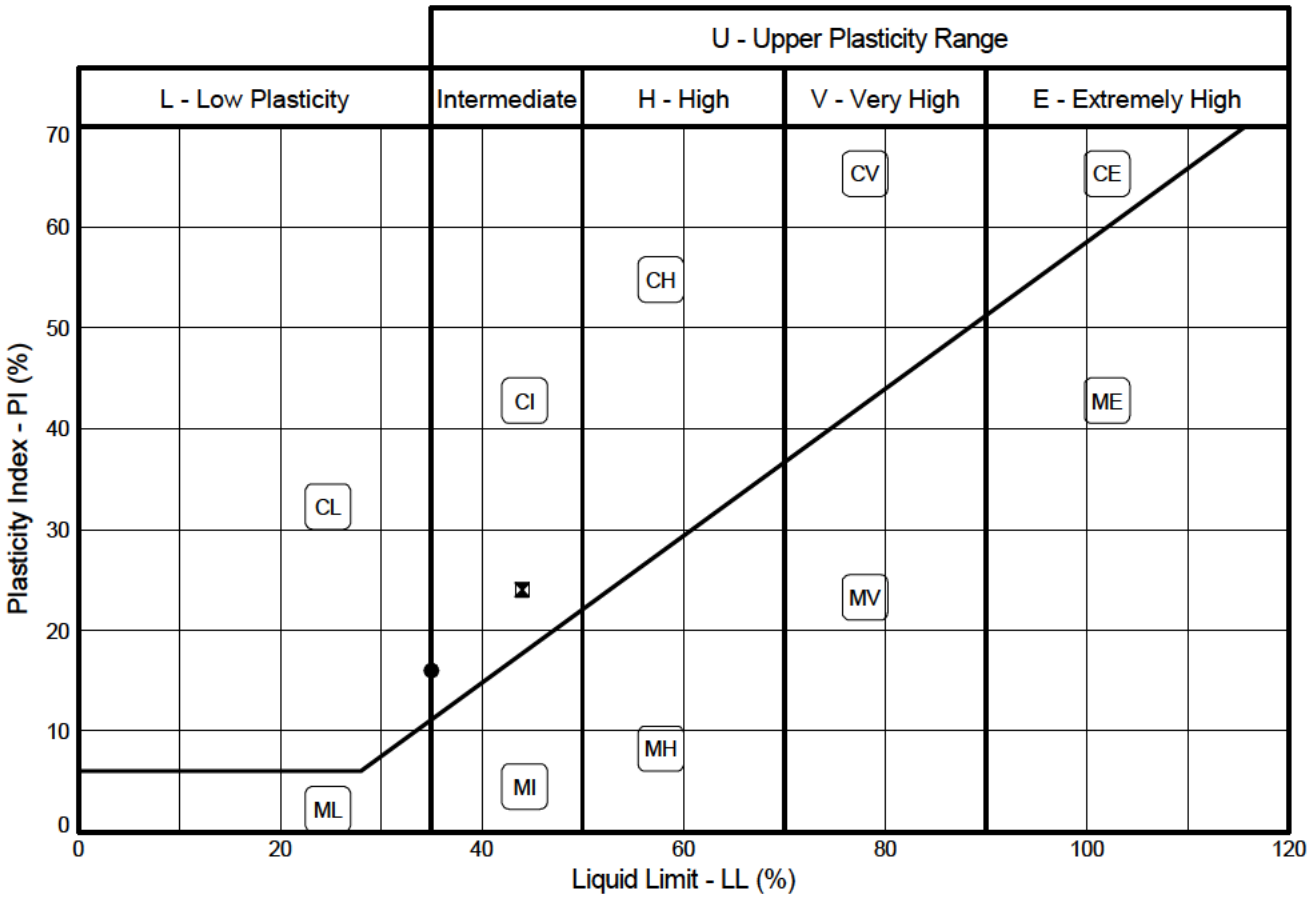
Contract: Heaton Grange

Contract Ref: 784588

AGS

PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425µm %	Lab location	Notes
	Exploratory Position ID	Sample	Dep h (m)									
●	TP05	1D	1.50	3.2/4.3/5.3/5.4	4.2.4	13	35	19	16	84	C	
⊠	TP08	1D	0.50	3.2/4.3/5.3/5.4	4.2.4	19	44	20	24	91	C	

Tested in accordance wi h the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Redacted

Compiled By: LORNA WHITWORTH

Date: 19/08/20

C

Heaton Grange

Contract Ref: 784588

AGS

TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **19/08/2020 14:57:03**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Luke Fisher (Materials Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

STRUCTURAL SOILS LTD	Contract: **Heaton Grange**	Job No: **784588**