

# New Children's Home, Pegswood

## Geo-Environmental Interpretative Report



**FAIRHURST**

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## CONTROL SHEET

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## **1.0 INTRODUCTION**

Fairhurst have been commissioned by Northumberland County Council to undertake a geo-environmental ground investigation for the proposed construction of a two storey children's home in Pegswood, Northumberland.

The aims of the ground investigation were to provide geotechnical and environmental assessment of the site to assist with foundation design and confirm the on-site chemical conditions. The ground investigation was also designed to specifically address the potential geotechnical and environmental constraints to the proposed development identified by the Desk Study.

This report presents details of the findings of the ground investigation undertaken on site, comments on the ground, groundwater and gassing conditions, and presents the results of a contamination qualitative risk assessment and conceptual site model. Based on these results, recommendations are made with regard to remedial works, mitigation measures, and foundation and substructure engineering design.

This geo-environmental interpretative report is to be utilised in support of a planning application for the proposed Pegswood Children's Home development and to assist in discharge of contamination related conditions.

## **2.0 LIMITATIONS**

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## **3.0 SOURCES OF INFORMATION**

The following information has been considered in the compilation of this report:

- Fairhurst, Geo-Environmental Desk Study, January 2020 (Ref. 1).
- Dunelm Geotechnical & Environmental Ltd, Draft Factual Report, March 2021 (Appendix 2).
- Dunelm Geotechnical & Environmental Ltd, Supplementary Gas and Groundwater Monitoring Data (Appendix 6).

## **4.0 DEVELOPMENT PROPOSALS**

The proposed development comprises the construction of a two storey children's home with associated car parking, hardstanding, garden space and perimeter fence. The development proposals are shown on Northumberland County Council Drawing Ref. PI191009-(L)02, Appendix 1.

The existing asphalt car park in the north of the site is to be retained and supplemented with additional spaces and several of the existing large perimeter trees are also to be retained.

Preliminary finished levels for the development are shown on Fairhurst Drawing No. 136018/2002, presented in Appendix 1. A finished floor level of 51.25mOD is proposed for the building. At the time



of reporting, it is understood that the proposed external levels are to remain relatively close to that of the proposed building.

## **5.0 SITE DESCRIPTION AND TOPOGRAPHY**

The proposed development site is located in Pegswood, Northumberland, at approximate National Grid Reference NZ 22782 87737. The site area is approximately 0.15 hectares. The site is currently vacant following demolition of a building associated with Pegswood First School, and comprises a mixture of relic hardstanding, rough ground, vegetation and mature trees in the south and central areas, and formal asphalt car parking in the north.

The site is bound to the north by open / playing fields, to the east by land undergoing development with residential properties, to the south by Longhirst Road with residential properties beyond, and to the west by the remainder of Pegswood First School with residential properties beyond.

The site boundary is shown in red on Northumberland County Council's drawings included in Appendix 1.

Landform Surveys' topographical survey of the site is included in Appendix 1. Site levels gently fall from southwest to northeast, with levels of approximately 51.30mOD shown within the south western corner of the site, falling to approximately 50.20mOD within the north eastern corner of the site.

## **6.0 SUMMARY OF POTENTIAL CONTAMINATION SOURCES AND GEOTECHNICAL CONSTRAINTS**

The following potential contamination sources and geotechnical constraints are presented within the Desk Study (Ref. 1), for which further information was required to enable assessment and design within the development area.

### **6.1 On Site Potential Contamination Sources**

- Potential presence of heterogeneous made ground and contamination associated with the historical development of Pegswood First School on site.
- Asbestos Contaminated Materials in the made ground associated with the former Pegswood First School buildings on site.
- Potential elevated soil / mine gas and vapour emissions associated with made ground and mine workings present beneath the site.

### **6.2 Off Site Potential Contamination Sources**

- Potential migration onsite of contaminated groundwaters and leachates associated with offsite historical developments including; a storage tank, depot, garage, electricity sub-station, industrial estate, landfill and infilled land.
- Potential migration and accumulation of elevated soil gas and vapour emissions associated with offsite made ground, infilled land and an historic landfill.
- Potential migration and accumulation of elevated mine gas emissions associated with offsite mine workings.



### **6.3 Potential Geotechnical Constraints**

- The potential for mineral instability associated with historic coal mining beneath the site, particularly the Bensham coal seam, but also in the Durham Low Main coal seam.
- The potential presence of variable thicknesses of made ground associated with historic development, with potentially poor engineering properties, low bearing capacity and high compressibility.
- The presence of relic foundations and / or basement structures beneath the site, including foundations associated with the now demolished school building.
- The potential for shallow perched discontinuous groundwater in the made ground, below ground structures and / or granular lenses in the Glacial Till, presenting the potential for a high groundwater table in excavations.
- The presence of existing services potentially requiring diversion, decommissioning or protection should they be retained.
- The potential presence of soils and groundwater containing elevated pH and sulphates with the potential for attack on buried concrete.
- The potential requirement to remove made ground and / or topsoil offsite, should it not be possible to re-incorporate deposits within the proposed development.
- The presence of trees and hedgerows which if retained or removed could induce shrinkage or heave of cohesive superficial deposits.
- The potential presence of invasive species within unmanaged vegetated areas.

### **6.4 Recommendations**

The following recommendations were provided within the Desk Study Report (Ref. 1):

- A site investigation to provide information for design of the proposed development and to specifically target the environmental and geotechnical issues identified within the Desk Study.
- An ecology survey to confirm the absence of sensitive ecology within and adjacent to the site.
- An arboricultural survey to inform the potential for impact of retained or removed trees on proposed foundations.
- A botanical survey to confirm the absence of invasive species within and adjacent to the site.
- Tracing of existing site services, if present, to confirm requirements with regard to decommissioning, diversion or protection.



## **7.0 DESIGN OF GROUND INVESTIGATION**

### **7.1 Investigation Objectives**

In order to address the recommendations presented in Section 6.4 a ground investigation was designed by Fairhurst. The objectives of the ground investigation were to provide geo-environmental information for the proposed development for planning purposes and to target the environmental and geotechnical issues listed in Section 6.0.

Specifically, there was a need to assess the current state of the site in relation to:

#### Environmental Considerations

- Confirmation of the nature, putrescible content and chemical characteristics of the topsoil, made ground, natural deposits and groundwaters.
- Confirmation of the potential for soil / mine gas and vapour emissions associated with made ground, natural deposits, historic offsite landfilled materials, historic offsite infilled land, contamination and shallow mine workings potentially underlying or migrating onto the site.

#### Geotechnical Consideration

- Confirmation of the extent, thickness and material properties of the topsoil, made ground, natural superficial deposits and underlying bedrock.
- Assess the bearing characteristics of superficial deposits and bedrock for foundation and hardstanding design.
- Determination of the pH and sulphate content of the soils and groundwaters for concrete design.
- Determination of the groundwater regime underlying the site.

#### Mineral Instability Consideration

- Assess the risk from shallow workings within the Bensham and Durham Low Main coal seams.

### **7.2 Ground Investigation Design**

The ground investigation was designed generally in accordance with BS5930:2015+A1:2020 Code of Practice for Site Investigations, BS10175:2011+A2:2017 Investigation of Potentially Contaminated Sites and Eurocode 7 (EN 1997-2:2007).

### **7.3 Ground Investigation Works Undertaken**

The ground investigation works were designed by Fairhurst and were undertaken by Dunelm Geotechnical & Environmental Ltd (Dunelm) between the 2<sup>nd</sup> February and 5<sup>th</sup> February 2021 and comprised the following:

- 3 No. rotary open boreholes (PR01 to PR03) to a maximum depth of 42.50mbgl;
- 3 No. window sample mini bores (PWS01 to PWS03) to a maximum depth of 2.10mbgl;
- In-situ testing within the window sample mini bores including standard penetration tests;



- A programme of chemical and geotechnical analysis; and
- A post site works programme of groundwater and ground gas monitoring on 12 No. occasions over a period of six months, of which seven monitoring visits have been completed at the time of reporting.

The exploratory hole locations are shown on Fairhurst Drawing No. 136018/9001 included in Appendix 1.

#### **7.4 Ground Investigation Constraints**

The following constraints were present in relation to the ground investigation works:

- Window sample mini-bores were scheduled instead of trial pits to minimise reinstatement requirements and disruption to the existing school grounds.
- Exploratory positions were located away from trees with likely root protection zones.

#### **7.5 Stratigraphic Descriptions**

Descriptions of the strata encountered during the ground investigation within each exploratory hole are presented in Appendix 2. Stratigraphic descriptions are to BS5930:2015 and BS EN ISO 14688:2018, as appropriate.

#### **7.6 In-situ Testing**

Standard penetration tests (SPTs) were carried out in the window sample mini bores to provide an indication on the relative density of the granular soils encountered, and the undrained shear strength of the cohesive soils. SPT tests were undertaken in accordance with BS EN ISO 22476-3 2005 + A1 2011.

#### **7.7 Chemical Laboratory Testing**

The following chemical analysis was undertaken on samples collected as part of the site investigation works to assess the chemical condition of the soils, and determine the lateral and vertical distribution of any contaminants.

- 5 No. soil samples (1 No. topsoil, 3 No. made ground and 1 No. natural superficial deposits) were analysed for total concentrations of a general suite of determinants including; heavy metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium (IV and total), copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, vanadium and zinc), inorganics (including; ammonia, cyanide (free, complex and total) and thiocyanate), speciated TPH, speciated PAH and phenols.
- 6 No. soil samples (1 No. topsoil, 3 No. made ground and 2 No. natural superficial deposits) were analysed for water soluble sulphate and pH.
- 4 No. soil samples (1 No. topsoil and 3 No. made ground) were screened for asbestos.
- 1 No. topsoil sample which tested positive for the presence of asbestos was subsequently subject to asbestos quantification.



- 2 No. soil samples (1 No. topsoil and 1 No. natural superficial deposits) were analysed for organic matter.
- 2 No. samples of the made ground were analysed for leachable concentrations of a general suite of determinants including; heavy metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium (IV and total), copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, vanadium and zinc), inorganics (including; ammonia, cyanide (free, complex and total) and thiocyanate), pH, sulphates, speciated TPH, speciated PAH and phenol.
- 1 No. groundwater sample taken after the site works was analysed for concentrations of a general suite of determinants including; heavy metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium (IV and total), copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, vanadium and zinc), inorganics (including; ammonia, cyanide (free, complex and total) and thiocyanate), water hardness, pH, sulphates, speciated TPH, speciated PAH and phenol.

## 7.8 Geotechnical Laboratory Testing

The following geotechnical testing was undertaken on samples taken as part of the site investigation works to determine the material properties of the soils and provide geotechnical design information for the proposed development.

- 8 No. samples of the natural superficial deposits were tested for moisture content.
- 6 No. samples of the natural superficial deposits were tested for Atterberg Limits.
- 1 No. sample of the natural superficial deposits was tested for Particle Size Distribution.

## 7.9 Monitoring Works Undertaken

Gas and groundwater monitoring standpipes were installed within each of the window sample boreholes during the ground investigation. Details of the monitoring response zones are summarised within Table 1.

**Table 1: Summary of monitoring response zones**

Borehole	Response Zone (mbgl)	Response Zone (mOD)	Strata
PWS01	0.50 to 1.50	50.06 to 49.06	Glacial Till
PWS02	0.50 to 1.00	50.66 to 50.16	Made Ground
PWS03	0.50 to 1.00	50.44 to 49.94	Glacial Till

At the time of reporting, the standpipes have been monitored on seven occasions post site works, between the 17<sup>th</sup> February and 20<sup>th</sup> May 2021. A further 5 No. monitoring visits are scheduled to be undertaken.

Gas monitoring has included the recording of methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide and volatile vapours together with gas flow rate and atmospheric pressure.

The results of the gas and groundwater monitoring undertaken to date are presented in Appendix 2 (Visits 1 – 3) and Appendix 6 (Visits 4 – 7).



All findings in relation to the groundwater regime and gas profile at the site are preliminary and subject to confirmation upon completion of the outstanding monitoring works.

## **8.0 QUALITY ASSURANCE AND QUALITY CONTROL**

### **8.1 General**

The quality assurance and control requirements for the ground investigation were prepared by Fairhurst.

### **8.2 Responsibilities**

Dunelm Geotechnical & Environmental Ltd were responsible for overall implementation and monitoring of the quality assurance during sampling, field investigations and laboratory analysis.

### **8.3 Laboratory Testing**

The geotechnical testing of soil samples was undertaken by a UKAS accredited laboratory and in accordance with BS1377:1990. The chemical testing was undertaken by an UKAS / MCERTS accredited laboratory.

## **9.0 GROUND CONDITIONS**

The results of the ground investigation indicate the following general sequence of strata beneath the site:

- Localised Topsoil in the western site area;
- Localised thin concrete hardstanding in the southern site area
- Thin granular made ground;
- Glacial Till and Glacial Sands;
- Bedrock of the Pennine Middle Coal Measures formation, comprising sandstone, mudstone and coal seams.

Details of each of the stratum encountered are discussed in more detail in the following sections.

### **9.1 Topsoil**

Topsoil was encountered within a single exploratory borehole (PWS02) within the west of the site from ground level (51.16mOD) to a depth of 0.60mbgl (50.56mOD). The topsoil was described as dark brown, slightly gravelly, sandy, clayey topsoil. Gravel of brick, sandstone and concrete was noted.

### **9.2 Concrete Hardstanding**

Concrete hardstanding was encountered within two exploratory boreholes (PWS03 and PR03) within the southern site area from ground level (51.04mOD and 50.94mOD) to a depth of 0.10mbgl (50.94mOD and 50.84mOD).



### 9.3 Made Ground

Granular made ground was encountered within all exploratory boreholes, either from ground level (50.64mOD to 50.56mOD), or underlying the localised topsoil (50.56mOD) or concrete hardstanding (50.94mOD to 50.84mOD). The granular made ground was proven to depths of between 0.20mbgl and 1.00mbgl (50.74mOD to 50.16mOD), with thicknesses of between 0.10m and 0.40m (average 0.35m).

The made ground is typically described as either a sandy slightly clayey gravel or a clayey gravelly sand. Gravel of sandstone, limestone, brick and concrete was noted.

### 9.4 Glacial Till

Glacial Till deposits comprising slightly sandy, slightly gravelly clays were recorded underlying made ground within each of the exploratory holes. The gravel was recorded to comprise sandstone and mudstone.

The Glacial Till was proven to depths of between 1.60mbgl and 2.00mbgl (49.34mOD to 48.6mOD) with proven thicknesses of between 0.60m and 1.50m (1.15m average).

The clays were typically described as either firm, becoming stiff with depth or stiff.

A localised sand layer was recorded at the top of the Glacial Till between 0.40mbgl and 1.00mbgl (50.24mOD to 49.64mOD) within PR01 in the northern site area.

### 9.5 Solid Geology

Solid geology comprising interbedded mudstone, sandstone and coal seams of the Pennine Middle Coal Measures Formation was recorded as being present underlying the Glacial Till deposits and proven to a maximum depth of 42.50mbgl (8.14mOD).

The Desk Study (Ref. 01) indicates that the site is underlain by two shallow coal seams which were either recorded to be worked or have the potential to have been worked. The coal seams comprise the Bensham, which was recorded as being worked, and the Durham Low Main coal seams which was not recorded as being worked but is of a thickness that could have been.

During the site investigation, coal seams and a void were recorded within the Pennine Middle Coal Measures geology, these are detailed within Table 2, below:

**Table 2: Summary of coal and workings encountered during the site investigation**

Borehole	Depth (mbgl)	Elevation (mOD)	Thickness (m)	Inferred Coal Seam	Thickness of Competent Bedrock above coal seam / void (m)
PR01	22.00 to 22.50	28.64 to 28.14	0.50 (Coal)	Bensham	20.40
PR02A	21.50 to 23.20	29.14 to 27.44	1.80 (Void)	Workings within the Bensham potentially including an element of roof collapse	19.90
PR03	21.00 to 22.00	30.04 to 29.04	1.00 (Coal)	Bensham	19.20



The void identified during the site investigation is inferred to be associated with workings recorded within the Bensham (Bottom Mauldin) coal seam, although workings were not recorded in the same seam in adjacent rotary holes.

The Durham Low Main, which is not recorded as being worked by the Coal Authority but was considered as part of the Desk Study (Ref. 01) assessment to be of a potential workable thickness (i.e. between 0.53m and 1.96m), was inferred to be present approximately 13m below the Bensham coal seam at a depth of approximately 36mbgl. The rotary holes were drilled to a maximum depth of 20m below the base of the Bensham and no evidence of this seam was recorded.

The workings encountered during the site investigation and the associated risk of mineral instability to the development is discussed within Section 17.9.

## 9.6 Visual / Olfactory Evidence of Contamination

No significant visual or olfactory evidence of contamination was observed during the ground investigation.

## 9.7 Relic Foundations

No relic structures or foundations were encountered during the intrusive ground investigation works; however, based upon historical site development, and that demolition works are known to have been undertaken relatively recently, relic structures are highly likely to be present beneath the site, particularly within the vicinity of the former school building.

## 10.0 UNEXPLODED ORDNANCE

The Desk Study (Ref. 1) indicates that the site is located within an area of low UXO risk.

## 11.0 GROUNDWATER CONDITIONS

The following groundwater strikes were recorded during the site works:

**Table 3: Summary of groundwater recorded during site works**

Ref	Level		Strata
	mbgl	mOD	
PWS01	0.10	50.46	Made Ground
PWS02	0.70	50.46	Made Ground

At the time of reporting the standpipes installed during the ground investigation have been monitored on three occasions post site works, between the 17<sup>th</sup> February and 20<sup>th</sup> May 2021. A further 5 No. monitoring visits are scheduled to be undertaken. The monitoring undertaken to date is summarised in Table 4.

**Table 4: Summary of groundwater recorded during monitoring**

Ref	Level		Response Zone
	mbgl	mOD	
PWS01	Dry to 0.52	Dry to 50.04	Glacial Till



Ref	Level		Response Zone
	mbgl	mOD	
PWS02	0.85 to 0.92	50.31 to 50.24	Made Ground
PWS03	Dry to 1.06	Dry o 49.88	Glacial Till

The groundwater monitoring results are presented in Appendix 2 (Visits 1 – 3) and Appendix 6 (Visits 4 - 7).

Based on observations during the site works and groundwater monitoring undertaken to date, the following preliminary groundwater regime is anticipated;

- Isolated discontinuous groundwater within made ground perched on top of more cohesive Glacial Till deposits, and in granular lenses within the Glacial Till deposits;
- A main groundwater table at depth within the bedrock aquifer. The bedrock aquifer was not recorded to be encountered during the site works by the Contractor; however, due to the water flush utilised within the rotary boreholes, it is not possible to discern this with any certainty.

All assertions as to the groundwater regime should be confirmed following completion of the monitoring programme.

The Desk Study (Ref. 1) indicates the superficial deposits across the site classify as a Secondary Aquifer – Undifferentiated. The underlying bedrock of the Pennine Middle Coal Measures Formation classifies as a Secondary A Aquifer. Based on the ground stratigraphy which identified continuous low permeability cohesive deposits across the site, the potential for hydraulic continuity between groundwater in the made ground and the superficial deposits, and the bedrock aquifer, is considered to be low.



## 12.0 SOIL GAS AND VAPOURS

The results of the ground investigation indicate the ground conditions to typically comprise granular made ground to depths between 0.20mbgl and 1.00mbgl, locally recorded as being overlain by topsoil deposits or concrete hardstanding. The made ground is underlain by thin cohesive glacial deposits across the entirety of the site.

There was no evidence of putrescible materials within the strata encountered.

The site is considered to present a moderate risk in terms of a “gas generation potential of source” in accordance with CIRIA C665 (Ref. 2) due to the potential for soil and mine gas emissions. On this basis, and in view of the high sensitivity of the development (residential), 12 No. gas monitoring visits are scheduled to be undertaken over a minimum period of six months to meet guidance given in CIRIA C665 (Ref. 2).

A total of 3 No. gas and groundwater monitoring standpipes were installed within the exploratory holes, with response zones in the natural superficial deposits (PWS01 and PWS03) and made ground (PWS02). The standpipes have been monitored on seven occasions post site works to date, between the 17<sup>th</sup> February and 20<sup>th</sup> May 2021. The results of the gas monitoring are presented in Appendix 2 (Visits 1 – 3) and Appendix 6 (Visits 4 – 7). The results are summarised below:

- A maximum carbon dioxide concentration of 2.6% was recorded.
- Methane was not detected. Therefore, a worst case methane concentration of 0.1% v/v has been adopted for design based upon the limit of detection for the gas monitor.
- Oxygen levels of between 16.5% and 20.3% were recorded.
- No volatile vapours, hydrogen sulphide or carbon monoxide concentrations were recorded.
- A worst case flow rate of 0.6l/hr was recorded.

In accordance with CIRIA C665 (Ref. 2) and based upon a maximum flow rate of 0.6l/hr, these readings give a Gas Screening Values of 0.0156 for carbon dioxide and 0.0006 for methane and the site is indicated as a Gas Characteristic Situation 1 (Very Low Risk) in accordance with CIRIA C665 (Ref. 2) and BS8485 (Ref. 3). Subject to confirmation following the completion of the post site works monitoring and Environmental Health agreement, gas protection measures may not be required within the proposed development. Due to the presence of known workings beneath and around the development site, however, the Client may wish to consider adopting some form of basic gas protection within the building.

The Desk Study (Ref. 1) indicates the site to be within a lower probability radon area (i.e. less than 1% of homes are at or above the action level); as such radon gas protection measures are not a statutory requirement within new buildings or extensions on site. The omission of specific radon protection measures should, however, be agreed with Environmental Health.



## **13.0 GEOTECHNICAL PROPERTIES**

In situ and laboratory geotechnical testing was undertaken as part of the ground investigation. The geotechnical soil properties for each of the stratum encountered are detailed in the following section.

### **13.1 Topsoil**

Topsoil was encountered within a single exploratory borehole (PWS02) within the west of the site from ground level to a depth of 0.60mbgl. The topsoil is described as dark brown, slightly gravelly, sandy, clayey topsoil. Gravel of brick, sandstone and concrete is noted.

#### Organic Matter

The result of a single organic matter test undertaken on the topsoil gave an organic matter content of 13%. On the basis of this result, the topsoil is classified as medium organic in accordance with BS EN ISO 14688-2:2018 (Ref. 4).

#### pH and Sulphate

The results of a single water soluble sulphate and pH test undertaken on the topsoil gave a water soluble sulphate content of 70mg/l and a pH value of 8.9.

### **13.2 Made Ground**

Granular made ground was encountered within all exploratory boreholes, either from ground level or underlying the localised topsoil or concrete hardstanding. The granular made ground was proven to depths of between 0.20mbgl and 1.0mbgl.

The made ground is typically described as either a sandy slightly clayey gravel or a clayey gravelly sand. Gravel of sandstone, limestone, brick and concrete is noted.

#### pH and Sulphate

The results of 3 No. water soluble sulphate and pH tests undertaken on the granular made ground gave water soluble sulphate contents of between <10mg/l and 330mg/l (mean 129mg/l) with pH values of between 10.9 and 12.3 (mean 11.7).

### **13.3 Glacial Till**

Glacial Till deposits comprising slightly sandy, slightly gravelly clays are recorded underlying the made ground. The gravel is recorded to comprise sandstone and mudstone.

The Glacial Till is proven to depths of between 1.60mbgl and 2.00mbgl with proven thicknesses of between 0.60m and 1.50m.

The clays are typically described as either firm, becoming stiff with depth or stiff.

A localised sand layer was recorded at the top of the Glacial Till between 0.40mbgl and 1.00mbgl in the north of the site.

#### Natural Moisture Content

The results of 8 No. moisture content tests undertaken on the Glacial Till gave moisture contents of between 18% and 28% (mean 24%).



### Atterberg Limits

The results of 6 No. Atterberg Limits tests undertaken on the Glacial Till gave plastic limits of between 17% and 20% (mean 19%), liquid limits of between 28% and 46% (mean 37%) and plasticity indices of between 10% and 26% (mean 19%).

On the basis of these results the Glacial Till would be classified as a clay of low to intermediate plasticity.

### Particle Size Distribution

The results of a single particle size distribution test undertaken on the Glacial Till indicates the material to comprise the following particle composition:

Particle Size		Percentage Composition
Boulders & Cobbles	>60mm	0%
Gravel	60mm to 2mm	8.3%
Sand	2mm to 0.06mm	46.1%
Silts	0.06mm to 0.002mm	42.6%
Clays	<0.002mm	3.0%

Based upon the above grading, the Glacial Till tested is assessed to comprise a slightly clayey, slightly gravelly, sandy silt, which does not generally correspond to the engineering descriptions provided on the drilling logs which typically recorded the material to comprise a slightly sandy, gravelly clay.

### Undrained Shear Strength

The results of 5 No. hand shear vane tests undertaken at depths of between 0.50mbgl and 1.00mbgl gave undrained shear strengths ( $c_u$ ) of between 46kN/m<sup>2</sup> and 83kN/m<sup>2</sup> (mean 67kN/m<sup>2</sup>) indicating medium to high strengths and firm to stiff consistencies.

The results of 3 No. Standard Penetration Tests undertaken in the Glacial Till at depths of 1.20mbgl determined N values of between 18 and 19 (mean 18).

Based upon the correlation between SPT N values, plasticity index and undrained shear strength ( $c_u$ ), and using a moderately conservative F1 value of 4.7 (Ref. 5) based upon the highest plasticity index recorded for this material, undrained shear strengths ( $c_u$ ) of between 85kN/m<sup>2</sup> and 89kN/m<sup>2</sup> (mean 86kN/m<sup>2</sup>) can be derived for the Glacial Till. These results indicate high strengths and stiff consistencies.

Based on consideration of the above, and the visual description of the material, the following moderately conservative undrained shear strengths are considered appropriate for use as design values for the Glacial Till:

- 50kN/m<sup>2</sup> to a depth of 1.2mbgl and;
- 75kN/m<sup>2</sup> below 1.2mbgl.

The undrained shear strengths are plotted against depth and elevation on Figures 1 and 2 respectively included within Appendix 5.



### Coefficient of Volume Compressibility

Based upon empirical correlation between plasticity index, the coefficient of compressibility and the SPT (N) value, and using a moderately conservative F2 value of 0.48 (Ref. 5) based upon the highest plasticity index recorded for this material,  $m_v$  values of between 0.110m<sup>2</sup>/MN and 0.116m<sup>2</sup>/MN (mean 0.114m<sup>2</sup>/MN) can be derived for the Glacial Till.

Based upon consideration of the above results, a moderately conservative  $m_v$  value of 0.12m<sup>2</sup>/MN is considered appropriate for design purposes for the Glacial Till deposits.

### Organic Matter

The results of a single organic matter test undertaken on the Glacial Till gave an organic matter content of 4.7%. On the basis of this result the Glacial Till is classified as low organic in accordance with BS EN ISO 14688-2:2018 (Ref. 4).

### pH and Sulphate

The results of 2 No. water soluble sulphate and pH tests undertaken on the Glacial Till gave water soluble sulphate contents of 25mg/l and 39mg/l with pH values of 7.9 and 8.7.

## **13.4 Sandstone Bedrock**

Solid geology comprising interbedded mudstone, sandstone and coal seams of the Pennine Middle Coal Measures Formation was recorded as being present underlying the Glacial Till deposits and proven to a maximum depth of 42.50mbgl.

### Standard Penetration Tests

The results of 3 No. SPTs undertaken on the upper surface of the sandstone bedrock at depths of between 1.60mbgl and 2.00mbgl determined N values of 50 for 15mm of penetration.

### Angle of Shearing Resistance

Based on a design SPT N value of 50 for the upper surface of the sandstone bedrock and correlation between SPT N values and effective angle of shearing resistance ( $\phi'$ ) (Ref. 5), an angle of shearing resistance value of 40° is considered appropriate for design purposes for the upper surface of the sandstone bedrock.



## **14.0 CHEMICAL PROPERTIES**

### **14.1 Soils – Visual / Olfactory Evidence of Contamination**

No significant visual or olfactory evidence of contamination was observed during the ground investigation.

### **14.2 Chemical Analysis and Assessment Criteria**

The programme of chemical testing undertaken included the analysis of soil samples for specific determinands which could potentially indicate contamination risks. A preliminary screen of the chemical test results has been undertaken, as presented in Appendix 3, in order to identify contamination hazards using site specific assessment criteria derived for a 'residential with home grown produce' end use. The Assessment Criteria are presented in Appendix 4. Detailed assessment of the potential hazards presented by the elevated concentrations recorded, with regards to specific receptors, is presented below.

No significant difference in material chemistry was noted in the made ground attributable to specific contamination sources. As such, for the purpose of this assessment it has been assumed that the made ground comprises a single source.

### **14.3 Chemical Analysis of Topsoil**

A single sample of the topsoil (PWS02, 0.40mbgl) within the western landscaped area was analysed for the range of determinands given in Section 7.7 and the results have been compared to site specific assessment criteria for receptors including human health, the built development and landscaping. The results of these tests are summarised below.

#### Human Health

- Asbestos, in the form of bundles of Chrysotile fibres, was recorded in the topsoil sample. Asbestos quantification subsequently determined the Chrysotile fibre to comprise <0.001% of the sample.

#### Built Development

- No elevated concentrations of contaminants were recorded within the topsoil sample above the assessment criteria for the built development.

#### Landscaping

- No elevated concentrations of contaminants were recorded within the topsoil sample above the assessment criteria for landscaping.

### **14.4 Chemical Analysis of Made Ground**

Three samples of the made ground were analysed for the range of determinands given in Section 7.7 and the results have been compared to site specific assessment criteria for receptors including human health, the built development and landscaping. The results of these tests are summarised below.



### Human Health

- A single marginally elevated concentration of beryllium was recorded within the made ground above the assessment criteria for human health.
- Two marginally elevated concentrations of dibenzo(ah)anthracene (0.30mg/kg), were recorded within the made ground above the assessment criteria for human health.

### Built Development

- Three elevated concentrations of total sulphate (4,950mg/kg) were recorded within the made ground above the assessment criteria for the built development.

### Landscaping

- No elevated concentrations of contaminants were recorded within the made ground above the assessment criteria for landscaping.

## **14.5 Chemical Analysis of Natural Superficial Deposits**

A single sample of the natural superficial deposits was analysed for the range of determinands given in Section 7.7 and the results have been compared to site specific assessment criteria for receptors including human health, the built development and landscaping. An additional sample of the natural superficial deposits was also tested for pH and water soluble sulphates.

No elevated concentrations of contaminants were recorded within the natural superficial deposits above the assessment criteria for human health, built development or landscaping.

## **14.6 Leachate Analysis of Made Ground**

Two leachate samples taken from the made ground were analysed for the range of determinands given in Section 7.7 and have been compared to assessment criteria derived for controlled waters. The results of these tests are summarised below.

### Controlled Waters – Surface Waters (Fresh)

- Elevated leachable concentrations of copper (12.0ug/l), mercury (3.5ug/l), benzo(a)anthracene (0.10ug/l), benzo(a) pyrene (0.11ug/l), the sum of benzo(b)fluoranthene and benzo(k)fluoranthene (0.18ug/l), the sum of benzo(ghi)perylene and indeno(123-cd)pyrene (0.18ug/l) and fluoranthene (0.22ug/l) were recorded above the assessment criteria for fresh surface waters.
- The made ground was slightly alkaline in nature with an elevated pH result of 9.3 being recorded.

### Controlled Waters – Ground Waters

- Elevated leachable concentrations of iron (300ug/l), mercury (3.5ug/l), benzo(a)pyrene (0.11ug/l) and the sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(123-cd)pyrene (0.36ug/l) were recorded above the assessment criteria for groundwaters.
- The made ground was slightly alkaline in nature with an elevated pH result of 9.3 being recorded.



## 14.7 Groundwater Analysis

A single groundwater sample was analysed for the range of determinands given in Section 7.7 and the results have been compared to assessment criteria derived for controlled waters. The results of these tests are summarised below.

### Controlled Waters – Surface Waters (Fresh)

- Elevated concentrations of trivalent chromium (6.9ug/l), copper (71ug/l), mercury (11ug/l), vanadium (25ug/l), TPH aromatic EC>12-16 (30ug/l), TPH aromatic EC>16-21 (71ug/l), TPH aromatic EC>21-35 (230ug/l), TPH aromatic EC>35-44 (63ug/l), anthracene (0.20ug/l), benzo(a)anthracene (0.48ug/l), benzo(a)pyrene (0.36ug/l), the sum of benzo(b)fluoranthene and benzo(k)fluoranthene (0.68ug/l), the sum of benzo(ghi)perylene and indeno(123-cd)pyrene (0.49ug/l), dibenzo(ah)anthracene (0.07ug/l) and fluoranthene (0.88ug/l) were recorded above the assessment criteria for fresh surface waters.
- The groundwater was slightly alkaline in nature with an elevated pH result of 10.8 being recorded.

### Controlled Waters – Ground Waters

- Elevated concentrations of mercury (11ug/l), TPH aromatic EC>21-35 (230ug/l), benzo(a)pyrene (0.36ug/l) and the sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(123-cd)pyrene (1.17ug/l) were recorded above the assessment criteria for groundwaters.
- The groundwater was slightly alkaline in nature with an elevated pH result of 10.8 being recorded.

## 14.8 Detection Limits

### Human Health, Built Development and Landscaping

The detection limits for all total soil tests were below assessment criteria for human health, built development and landscaping receptors.

### Surface Water (Fresh) Assessment Criteria

Total and leachable concentrations of Chromium (VI) (<7ug/l), cyanide free (<20ug/l) and phenol (<100ug/l) were recorded at levels below the testing laboratories limit of detection, however these detection limits are above current fresh surface water assessment criteria.

### Ground Water Assessment Criteria

The detection limits for all leachate and water tests were below the current ground water assessment criteria.

## 14.9 Waste Analysis

Waste disposal classification of onsite materials which may be generated as part of the works, and require offsite disposal, is outside the scope of this report and should be confirmed by the receiving landfill / treatment facility following excavation, as per the landfill or treatment facility's requirements.



The total chemical concentrations recorded, and contained within Appendix 2, should be considered as part of this exercise.



## 15.0 ENVIRONMENTAL ASSESSMENT

### 15.1 Approach to Contamination Risk Assessment

The Environmental Protection Act 1990, Part II A Contaminated Land (Section 57 of the Environment Act 1995) and the Contaminated Land Regulations 2006 (and 2012 amendments) provide a basis on which to determine the risks and liabilities presented by a contaminated site. Contaminated Land is defined within Section 78A(2) of the Environmental Protection Act 1990, Part II A Contaminated Land (by commencement of Section 86 of The Water Act 2003 [Commencement Order No. 11] Order 2012) as:

*“Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that-*

- (a) *Significant harm is being caused or there is significant possibility of such harm being caused; or*
- (b) *Significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.”*

Section 57 of the Environment Act 1995 requires that any site identified as being “contaminated” by the Local Authority will be registered by them and remediation will be required to render the site fit for use.

The presence of contamination is not the sole factor for deciding whether a site is contaminated. Relevant parties should identify site-specific risks and provide objective, cost-effective methods to manage the contamination in a manner which satisfies the proposed end-use.

A risk-based approach, which takes both technical and non-technical aspects into consideration when making decisions on contamination resulting from past, present or future human activities, is advocated. The assessment of environmental risks generally relies on the identification of three principal elements forming a ‘pollutant or contaminant linkage’:

**Source:** the contaminant

**Pathway:** the route through which the contaminant can migrate, and

**Receptor:** all human, animal, plant, controlled water or property that may be adversely affected (harmed) by the contaminant

In the absence of one of these elements, on a given site, there is no risk. Where all three elements are present, risk assessment is required to determine the significance of the harm or pollution that is being or may be caused. As outlined above, the terms of the Contaminated Land regime specify that remediation need only be implemented where a site is causing, or there is a significant possibility that it will cause, significant harm, or that pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.

Development of contaminated land is usually addressed through the application of planning and development legislation and guidance (i.e. NPPF). The suitable for use approach is seen as the most appropriate basis to deal with contaminated land, taking account of environmental, social and economic objectives. The assessment is made in the context of the proposed land use.



## 15.2 Conceptual Site Model

A conceptual site model is formed by presenting all identified and suspected sources, pathways and receptors. For this site, a conceptual site model has been developed based on the results of the site investigation and with consideration of a residential end use with home grown produce.

The significance of the presence of these elements is considered by carrying out a risk assessment of all potential pollutant or contaminant linkages, as presented in the following sections.

## 15.3 Source Characterisation

The following sources of contamination have been identified in relation to the site as determined by the ground investigation:

### Topsoil

- Asbestos was recorded within the topsoil in the form of bundles of Chrysotile fibres with a mass of <0.001%.

### Made Ground

- Marginally elevated concentrations of beryllium, dibenzo(ah)anthracene and total sulphates.
- Elevated leachable concentrations of copper, iron, mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(123-cd)pyrene and fluoranthene.
- Slightly alkaline characteristics.

### Groundwaters

- Slightly elevated concentrations of trivalent chromium, copper, mercury, vanadium, TPH aromatic EC>12-16, TPH aromatic EC>16-21, TPH aromatic EC>21-35, TPH aromatic EC>35-44, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(123-cd)pyrene, dibenzo(ah)anthracene and fluoranthene.

## 15.4 Pathway Characterisation

The potential pathways by which receptors might be exposed to contaminants (sources) at the site can vary depending on the proposed land use.

For humans, the possible route of exposure to contaminants is:

- Inhalation of dusts, fibres and accumulated ground gas and vapours;
- Ingestion of soil and groundwater either by hand-to-mouth activity or by eating plants grown in contaminated soils/ waters; and
- Dermal (skin) contact with contaminated soils and waters and transfer of contaminants through the skin to the body.

Buildings and service conduits can also be affected by contaminants in the following ways:

- Ground gas and vapours accumulating in voids within or beneath structures;



- By direct contact of building fabric with contaminated soils;
- Service trenches acting as preferential migration pathways; and
- Ingress of contaminants into conduits, contaminating drinking water supplies.

For the local water environment the following pathways may be present:

- Leaching of contaminants from the soil to on-site groundwater;
- Run-off from the site surface entering surface water courses near the site; and
- Migration of contaminated on-site groundwater to off-site surface waters or groundwater.

For plants and soft landscaping the main pathway for exposure involves either direct contact with contaminated soils or groundwater or uptake of contaminants into the plant leading to adverse impact.

### **15.5 Receptor Characterisation**

The receptors are the elements in the pollutant linkage that can potentially be harmed by the contaminants. These are as follows:

#### **Part IIA Receptors:**

Human Health:	Site end users and adjacent site users
Property:	Buildings and services
The Water Environment:	Secondary Undifferentiated Aquifer – Superficial Deposits Secondary A Aquifer – Pennine Middle Coal Measures Surface Waters – Unnamed drainage ditch (~120m north), Bothal Burn (480m east)
Vegetation:	Soft landscaping and gardens

#### **Non-Part IIA Receptors:**

Human Health:	Construction and maintenance workers.
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### **15.6 Hazard Assessment**

A screen of the chemical and gas monitoring data has been undertaken using Assessment Criteria developed for site specific receptors and the proposed end uses, to identify contamination hazards.

Where hazards have been identified these are summarised in Table 5:



**Table 5 - Contaminants of Concern (Receptor Specific Assessment Criteria)**

Source	Human Health			Built Development (Buildings / Services)	Ecology	Pollution to Controlled Waters	
	Commercial End Users	Adjacent Users	Construction/ Maintenance Workers		Landscaping	Groundwaters	Surface Waters (Fresh)
Topsoil	Asbestos (<0.001% Chrysotile fibre bundles)	Asbestos (<0.001% Chrysotile fibre bundles)	Asbestos (<0.001% Chrysotile fibre bundles)	-	-	-	-
Made Ground	Beryllium 2.10mg/kg (1.70mg/kg) Dibenzo(ah)anthracene 0.30mg/kg (0.24mg/kg)	Beryllium 2.10mg/kg (1.70mg/kg) Dibenzo(ah)anthracene 0.30mg/kg (0.24mg/kg)	Beryllium 2.10mg/kg (1.70mg/kg) Dibenzo(ah)anthracene 0.30mg/kg (0.24)	Total sulphate 4,950mg/kg (2,400mg/kg)	-	Iron 300ug/l (200ug/l) Mercury 3.5ug/l (0.05ug/l) Benzo(a)pyrene 0.11ug/l (0.01ug/l) Sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene & indeno(123-cd)pyrene 0.36ug/l (0.10ug/l) pH 9.3 (6.5-8.5)	Copper 12ug/l (10ug/l) Mercury 3.5ug/l (0.05ug/l) Benzo(a)anthracene 0.10ug/l (0.05ug/l) Benzo(a)pyrene 0.11ug/l (0.05ug/l) Sum of benzo(b)fluoranthene & benzo(k)fluoranthene 0.18ug/l (0.03ug/l) Sum of benzo(ghi)perylene & indeno(123-cd)pyrene 0.18ug/l (0.002ug/l) Floranthene 0.22ug/l (0.10ug/l) pH 9.3 (6.0-9.0)
Natural Superficial Deposits	-	-	-	-	-	-	-
Groundwaters	-	-	-	-	-	Mercury 11ug/l (1.0ug/l) TPH aromatic EC>21-35 230ug/l (90ug/l) Benzo(a)pyrene 0.36ug/l (0.01ug/l) Sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene & indeno(123-cd)pyrene 1.17ug/l (0.10ug/l) pH 10.8 (6.5-8.5)	Trivalent chromium 6.9ug/l (4.7ug/l) Copper 71ug/l (10ug/l) Mercury 11ug/l (0.05ug/l) Vanadium 25ug/l (20ug/l) TPH aromatic EC>12-16 30ug/l (20ug/l) TPH aromatic EC>16-21 71ug/l (20ug/l) TPH aromatic EC>21-35 230ug/l (20ug/l) TPH aromatic EC>35-44 63ug/l (20ug/l) Anthracene



Source	Human Health			Built Development (Buildings / Services)	Ecology	Pollution to Controlled Waters	
	Commercial End Users	Adjacent Users	Construction/ Maintenance Workers		Landscaping	Groundwaters	Surface Waters (Fresh)
							0.20ug/l (0.10ug/l) Benzo(a)anthracene 0.48ug/l (0.05ug/l) Benzo(a)pyrene 0.36ug/l (0.05ug/l) The sum of benzo(b)fluoranthene & benzo(k)fluoranthene 0.68ug/l (0.03ug/l) The sum of benzo(ghi)perylene & indeno(123- cd)pyrene 0.49ug/l (0.002ug/l) Dibenzo(ah)anthracene 0.07ug/l (0.05ug/l) Fluoranthene 0.88ug/l (0.10ug/l) pH 10.8 (6.0-9.0)
Soil Gas	-	-	-	-	-	-	-

Values shown are the maximum concentrations recorded as part of the site investigation works.  
 Values shown in brackets for the soils are based upon a conservative 1% organic matter and relate to the Assessment Criteria Limit, previously detailed.



### **15.7 Contaminant Linkages and Qualitative Risk Assessment**

The significance of potential contaminant linkages at the site have been qualitatively assessed by considering the magnitude of the hazard and the possibility of the linkages occurring as shown in Table 6.

As part of future redevelopment of the site it is assumed that the adoption of appropriate health and safety measures (i.e. PPE, RPE, monitoring, decontamination etc.) based upon a risk assessment of site conditions by future contractors would adequately mitigate the risk posed to construction and maintenance workers from the identified sources of contamination. As such, no contaminant linkage exists and construction / maintenance workers are not considered further in this risk assessment.



**Table 6 - Qualitative Risk Assessment for Identified Sources of Contamination**

Source	Contaminants of Concern	Potential Pathway (s)	Potential Receptor (s)	Assessment	Potential Severity	Potential Probability	Risk Class	Remediation / Mitigation
Contamination in on site soils	<p><b>Topsoil</b> Asbestos - Chrysotile fibre bundles &lt;0.001%</p> <p><b>Made Ground</b> Soils – Beryllium, PAHs and sulphates</p> <p>Leachates – Heavy metals, PAHs and pH</p> <p><b>Natural Superficial Deposits</b> None</p>	Ingestion, inhalation & dermal contact	Human Health End Users	<p>The proposed development comprises a children's home building with associated hardstanding, soft landscaping and gardens.</p> <p>Chemical testing has identified the presence of asbestos in the form of chrysotile bundles in the topsoil which presents a risk to human health. Quantification results indicate the chrysotile fibre bundles are present at &lt;0.001% mass. In addition, slightly elevated concentrations of beryllium and dibenzo(ah)anthracene were recorded in the made ground which presents a risk to human health.</p> <p>The made ground is unlikely to form a suitable rooting medium for landscaping, and a clean topsoil and subsoil rooting layer will need to be placed above the made ground across proposed landscaping areas and the garden. This layer will remove the pathway for potential harm to human health from the made ground.</p> <p>Due to the presence of asbestos fibres within the existing topsoil, this material should not form part of the clean topsoil and subsoil rooting layer for the scheme. The impacted topsoil would either need to be excavated, disposed of and replaced with the clean topsoil and subsoil layer or a clean topsoil and soil layer will need to be placed above these materials in the landscaped areas, levels permitting. Either of these options should remove the pathway for potential harm to human health from the asbestos impacted topsoil.</p>	High	Moderate	Moderate	Yes
		Inhalation	Human Health Adjacent Users	<p>There is the temporary potential for the inhalation of wind-blown dust and asbestos fibres during earthworks and construction works. However, if appropriate suppression and monitoring is undertaken during construction operations then no pathway or linkage would exist.</p> <p>Post development, soils which could be mobilised in landscaped areas will comprise clean topsoil and be bound by planting.</p>	High	Low	Moderate	Yes - During Construction
		Direct contact	Property; built fabric & services	<p>Elevated concentrations of total sulphates identified within the soils and groundwaters present a risk to in ground concrete.</p> <p>Marginally elevated total concentrations of beryllium and dibenzo(a,h)anthracene were identified in the made ground soils above the assessment criteria for human health, along with leachable concentrations of PAHs and heavy metals, which could present a risk of harm to end users by penetrating drinking water pipes and tainting onsite drinking water supplies.</p> <p>Following confirmation of the proposed route of potable drinking water supplies, the Local Water Authority is to confirm the requirements for protected water supply pipework (if any) in accordance with guidance from the UK Water Industry Research (UKWIR) for the environmental conditions identified at the site.</p>	Moderate	Moderate	Moderate	Yes
			<p>High</p> <p>Low</p> <p>Moderate</p>	Yes – Subject to confirmation by the Local Water Authority				



Source	Contaminants of Concern	Potential Pathway (s)	Potential Receptor (s)	Assessment	Potential Severity	Potential Probability	Risk Class	Remediation / Mitigation
		Leaching, migration	Controlled Waters (Groundwaters) – Undifferentiated Aquifer in glacial deposits	<p>The superficial aquifer beneath the site is classified by the Environment Agency as being Secondary Undifferentiated. The aquifer has previously classified as both a minor and non-aquifer due to the variable characteristics of the strata.</p> <p>No significant sources of contamination have been identified within the soils and only minor potentially leachable contaminants (heavy metals and PAHs) were identified during the site investigation.</p> <p>The proposed site development, including construction of hardstanding / built development with formal surface water drainage, will also significantly reduce the current potential for infiltration and present a net betterment to existing site conditions.</p> <p>On this basis it is considered that the proposed development presents a negligible risk to the underlying superficial aquifer and remediation is not required.</p>	Low	Low	Low	No
			– Secondary A Aquifer in Pennine Middle Coal Measures Formation	<p>The bedrock aquifer beneath the site is classified by the Environment Agency as being a Secondary A Aquifer which comprises permeable layers capable of supporting water supplies at a local rather than strategic scale.</p> <p>Whilst in some cases, Secondary A Aquifers from an important source of base flow to rivers, the Pennine Middle Coal Measures have been subject to significant historic mining activity and the quality of the groundwater is likely to be low. The recorded superficial ground conditions above the bedrock, which comprise low permeability cohesive Glacial deposits (up to 1.50m thick), are also likely act as an aquitard, restricting the migration of contaminants identified in the soil and overlying perched groundwater.</p> <p>The proposed site development, including construction of hardstanding / built development with a formal surface water drainage system, is also likely to present a net betterment to existing site conditions.</p> <p>On this basis, it is considered that the proposed development presents a negligible risk to the underlying bedrock aquifer and remediation is not required.</p>	Low / Moderate	Low	Low	No
			Surface Waters – Unnamed Drainage Ditch (~120m North), Bothal Burn (~480m east)	<p>In view of the surrounding ground conditions and significant distances of between approximately 120m and 480m from the site to the nearest minor and significant controlled surface water features (i.e. an unnamed drainage ditch and the Bothal Burn respectively), the pollution risk to controlled surface waters as a result of surface water runoff or migration through base flow is considered to be negligible.</p>	Moderate	Low	Low	No
		Direct contact and uptake of contaminants	Landscaped Areas	<p>No elevated concentrations of contaminants were recorded within the topsoil, made ground or natural superficial deposits which could present a risk to proposed gardens and landscaped areas.</p>	Low	Low	Low	No
Groundwater	<b>Natural Superficial Groundwaters</b> Heavy Metals, TPHs & PAHs, pH	Ingestion, inhalation & dermal contact	Human Health (End Users)	<p>Given the nature of the proposed development, which comprises of site levels either remaining close to existing or being raised, there is limited opportunity for end users to come into contact with the elevations recorded in the groundwaters.</p> <p>Elevated heavy metals, pH, TPHs and PAHs could present a risk of harm to end users by penetrating drinking water pipes and tainting onsite drinking water supplies. Following confirmation of the proposed route of potable drinking water supplies, the Local Water Authority is to be supplied with the site investigation factual report and asked to confirm the requirements for protected water supply pipework (if any) to address the environmental conditions identified at the site.</p>	Moderate	Low	Low	Yes – Subject to confirmation by the Local Water Authority



Source	Contaminants of Concern	Potential Pathway (s)	Potential Receptor (s)	Assessment	Potential Severity	Potential Probability	Risk Class	Remediation / Mitigation
		Migration	Controlled Waters (Groundwaters) – Undifferentiated Aquifer in glacial deposits – Secondary A Aquifer in Pennine Middle Coal Measures Formation	<p>Elevated concentrations of heavy metals, pH, TPHs and PAHs were recorded within the superficial groundwaters.</p> <p>The superficial aquifer beneath the site is classified by the Environment Agency as being secondary undifferentiated. The aquifer comprises drift deposits with negligible significance for water supply or river base flow due to the variable characteristics of the strata. Furthermore, The Pennine Middle Coal Measures Secondary A Aquifer has been subject to significant historic mining activity and the quality of the groundwater is anticipated to be low.</p> <p>Therefore, given specific sources of contamination were not identified, the made ground identified onsite was thin, the minor nature of elevated total and leachable contaminants identified within the made ground, and the presence of low permeability cohesive deposits, it is considered that the elevated determinand concentrations present within the superficial groundwaters are unlikely to be associated with the development site and could be representative of the local groundwater quality.</p> <p>An increased risk to the underlying aquifers from the proposed development has not been identified.</p>	Moderate	Low	Low	No
			Surface Waters – Unnamed Drainage Ditch (~120m North), Bothal Burn (~480m east)	In view of the surrounding ground conditions and significant distances of approximately 120m and 480m from the site to the nearest minor and significant controlled surface water features (i.e. an unnamed drainage ditch and the Bothal Burn respectively), the pollution risk to controlled surface waters as a result of surface water runoff or migration through base flow is considered to be negligible.	Moderate	Low	Low	No
Gas & vapours	Carbon dioxide, methane and depleted oxygen	Accumulation in confined spaces and inhalation resulting in asphyxiation	Human Health End Users	<p>The following gassing conditions have been identified to date:</p> <ul style="list-style-type: none"> <li>• Maximum carbon dioxide concentration - 2.6%,</li> <li>• Maximum methane concentration - &lt;0.1%</li> <li>• Maximum flow rate - 0.6l/hr</li> <li>• Minimum oxygen concentration - 16.5%</li> </ul> <p>These concentrations do not currently present a risk to human health however, a further 5 No. monitoring visits are required.</p>	High	Low	Low	No Subject to confirmation following completion of monitoring programme.
		Accumulation in confined spaces and ignition	Built development	Elevated concentrations of methane or volatile vapours have not been recorded during the post site works monitoring to date; however at the time of reporting, a further 5 No. monitoring visits are required.	High	Low	Low	No Subject to confirmation following completion of monitoring programme.



## **16.0 RECOMMENDATIONS ON REMEDIAL/MITIGATION MEASURES**

Based on review of the site investigation information and the potential contaminant linkages identified in the previous sections, the minor contamination sources identified on site would not preclude site development. The following preparatory works and mitigation measures should however be adopted.

### **16.1 Preparatory Works**

As part of the preparatory works to facilitate redevelopment, the following surveys should be completed and measures adopted:

- An ecology survey to confirm the absence of sensitive ecology within and adjacent to the site.
- A botanical survey to discount the presence of invasive species within the development area.
- An arboriculture survey to confirm the types, heights and associated water demand of the mature trees, shrubs and vegetation which are to be removed / retained as part of the proposed development. This report will inform detailed sub-structure design and dictate potential requirements for heave / swell protection, if any, relating to the proposed floor slab and foundation solutions.
- Decommissioning of all installed boreholes following completion of the monitoring programme in accordance with current Environment Agency guidance to prevent them acting as a pathway for migration of ground gas contamination.
- An intrusive utilities survey to trace and map all existing site services.
- Diversion, decommissioning or upgraded to existing services, as required, to accommodate for the proposed development.

### **16.2 Mitigation Measures during Enabling Works and Construction**

The following measures are required during the enabling works / construction phase of development:

#### **16.2.1 General Measures**

- Implementation of health, safety, welfare, hygiene and monitoring practices appropriate to the contamination risks identified by the site investigation.
- Monitoring for soil gas/vapours in excavations, buried chambers and confined spaces during construction, where man access is required.
- Control of surface water runoff.
- Implementation of dust and fibre control measures and monitoring during periods of dry weather and/or high winds, particularly during the earthworks. The specific measures required will be informed by a construction phase asbestos risk assessment.
- Preparation and approval of a Materials Management Plan (MMP) and Earthworks Specification to facilitate the reuse of site won made ground materials and the importation of engineered fill and topsoil. A Remediation Strategy would also need to be produced to facilitate the approval of the Materials Management Plan.



### **16.2.2 Measures Relating to Potential Asbestos Contamination**

- Excavation of asbestos impacted topsoil in the west of the site, and replacement with a clean topsoil and subsoil layer or placement of a clean topsoil and soil layer above the impacted materials in landscaped areas, levels permitting, to remove the pathway for potential harm to human health.
- Excavation of asbestos impacted topsoil in the west of the site and replacement with the proposed construction makeups where these deposits underlie proposed hardstanding and building areas, to remove the pathway for potential harm to human health.
- Asbestos impacted topsoil is only suitable for reuse on the scheme in landscaping and garden areas if it is located beneath an approved clean cover layer and following hand picking of any visible Asbestos Containing Materials (ACM) and a programme of confirmatory asbestos testing to ensure the soils do not have a fibre content above the hazardous waste threshold of 0.1%. These works would also need to be undertaken under an approved Materials Management Plan (MMP). These requirements are further discussed in Section 16.3.1 below.
- Provision of health and safety procedures and monitoring and adoption of respiratory protective equipment (RPE) and decontamination facilities, as required, subject to asbestos risk assessment by a qualified specialist in accordance with best practice, including:
  - CIRIA Report C733 Asbestos in Soils and Made Ground (Ref. 10)
  - JIWG CAR SOIL Guidance 2016 (Ref. 11)
  - The Licensed Contractors Guide, HSG247

### **16.3 Mitigation Measures within the Built Development**

It is recommended that the following mitigation measures are incorporated into the built development:

#### **16.3.1 Clean Covers within Landscaped Areas and Gardens**

##### *Topsoil – Western Site Area*

Asbestos in the form of bundles of Chrysotile fibres with a mass of <0.001% was recorded in the topsoil present in the west of the site during the site investigation works.

Due to the identified presence of asbestos, these topsoil deposits are not considered fit for re-use within the topsoil and subsoil clean landscaping rooting layer. Where encountered in proposed areas of soft landscaping in the western site area, the existing topsoil should be overlain by, or excavated to facilitate placement of, a suitable clean topsoil and subsoil rooting layer.

Where encountered in proposed areas of hardstanding or buildings in the western site area, the existing topsoil should be fully excavated and removed.

Asbestos impacted topsoil materials are only suitable for reuse within proposed landscaped areas and gardens and beneath a suitable clean topsoil and subsoil rooting layer. Hand picking of any visible Asbestos Containing Materials (ACM) and a programme of confirmatory asbestos testing will also be required to ensure the soils do not have a fibre content above the hazardous waste threshold of 0.1%.

Handpicked ACMs and soils containing >0.1% asbestos fibres will require disposal off site as a



hazardous waste, with the remaining suitable topsoil placed at depth beneath an appropriate cover layer in landscaped and garden areas. If soils containing concentrations of either ACMs or asbestos fibres above the hazardous waste threshold are reused on site, they could attract retrospective landfill tax by the HMRC.

Topsoil materials would only be suitable for reuse within the scheme under an approved Materials Management Plan.

The required clean cover thickness and landscape make-up is to be confirmed by the Regulators as part of the planning process and agreed by the Landscape Architect.

#### Topsoil – Other Site Areas

Topsoil was not recorded within other site areas during the investigation but based on the site walkover is likely to be present.

Should topsoil be encountered during the site works within proposed hardstanding or building areas out with the western site area, these materials should undergo confirmatory environmental testing to establish their suitability for reuse within proposed landscaped and garden areas. Topsoil materials are to be fully removed below proposed hardstanding or building areas.

Should topsoil be encountered during the site works within proposed landscaping areas out with the western site area, these materials should undergo confirmatory environmental testing to establish their suitability to be left in-situ, for reuse and/or the requirement for a clean topsoil and subsoil rooting layer to be placed above the materials.

Topsoil materials are only suitable for reuse within the scheme under an approved Materials Management Plan.

The required clean cover thickness and landscape make-up is to be confirmed by the Regulators as part of the planning process and agreed by the Landscape Architect.

#### Made Ground

Chemical testing of the Made Ground has determined marginally elevated concentrations of beryllium and dibenzo(ah)anthracene which presents a risk to human health. Subject to review by a Landscape Architect, the visual descriptions of the Made Ground also indicate that the deposits are unlikely to be suitable to act as a rooting medium.

Where encountered in proposed areas of soft landscaping, made ground should be overlain by, or excavated to facilitate placement of, a suitable clean topsoil and subsoil rooting layer.

The required clean cover thickness and landscape make-up is to be confirmed by the Regulators as part of the planning process and agreed by the Landscape Architect.

Made ground materials are only suitable for reuse within the scheme under an approved Materials Management Plan and Earthworks Specification.

#### Natural Superficial Deposits

Elevated concentrations of contaminants above the assessment criteria for human health or soft landscaping were not recorded within the natural superficial deposits during the site investigation works. Subject to review of their suitability by the Landscape Architect, natural superficial deposits are considered fit for re-use within the subsoil landscaping rooting layer.



### **16.3.2 Gas Protection Measures**

At the time of reporting the gas monitoring programme is incomplete. The assessment of the requirement for gas protection measures presented below is preliminary and is subject to confirmation following completion of the gas monitoring.

The gas monitoring undertaken to date has identified the gassing regime on site as a Gas Characteristic Situation 1 in accordance with CIRIA C665 (Ref. 2) and BS 8485 (Ref. 3).

On the basis of the monitoring undertaken to date, gas protection measures may not be required subject to Local Authority agreement. Due to the presence of known workings beneath and around the development site, however, the Client may wish to consider adopting some form of basic gas protection within the building.

The site is within a lower probability radon area (i.e. less than 1% of homes are at or above the action level); as such radon gas protection measures are not a statutory requirement within new buildings or extensions on site. The omission of specific radon protection measures should, however, be agreed with the Local Authority.

### **16.3.3 In Ground Concrete**

Buried concrete should be designed to Design Sulphate Class DS-2, ACEC Class AC-2 in accordance with BRE Special Digest 1:2005, Concrete in Aggressive Ground (Ref. 6).

### **16.3.4 In Ground Services**

At the time of reporting, the proposed route of potable water is unknown. In view of the chemical conditions prevailing at the site special precautions may be required in relation to potable water pipes. It is recommended that upon confirmation of their proposed route, the factual site investigation results are provided to the Local Water Authority for consideration, and their requirements confirmed with regards to further testing along the line of supply pipelines or use of chemically resistant pipework, in accordance with guidance from the UK Water Industry Research (UKWIR).

Upon confirmation, potable drinking water supplies shall be designed and installed in full accordance with UKWIR guidance and the Local Water Authority's requirements.

## **16.4 Unrecorded Contamination**

The above assessment is based on the intrusive investigations results to date. The risk of unrecorded contamination, including but not limited to asbestos and hydrocarbons, being identified within areas of the site which have not previously been investigated cannot be fully discounted. Such occurrences should immediately be notified to the Engineer for consideration.



## **17.0 ENGINEERING ASSESSMENT**

### **17.1 Design Elements and Requirements**

The proposed development comprises the construction of a two storey children's home with associated car parking, hardstanding, soft landscaping and garden space. The development proposals are shown on Northumberland County Council Drawing Ref. PI191009-(L)02 included in Appendix 1.

### **17.2 Geotechnical Constraints**

Based on current site conditions and the findings of the ground investigation the following geotechnical constraints to the proposed development have been identified.

- The presence of mature trees and hedgerows, on site and adjacent to it, which if retained or removed could induce shrinkage or heave of cohesive superficial deposits. An arboricultural survey is required to provide further details on these and inform detailed sub-structure design.
- The presence of made ground with variable thickness, strength and compressibility which is an unsuitable founding strata.
- Made ground materials generated will require either reuse as part of the development under an approved Materials Management Plan, Environmental Exemption or Environmental Permit, or offsite disposal.
- Although not encountered during the site investigation, relic structures and drainage (or similar) should be expected to be present associated with historic development of the site and in particular the recently demolished school building.
- The potential presence of existing services requiring diversion, decommissioning or protection, should they be retained.
- The requirement to import suitable materials to form a clean rooting layer in soft landscaped areas and gardens (i.e. subsoil and topsoil)
- The potential for shallow perched groundwaters to be encountered in excavations in the made ground and natural superficial deposits requiring the control measures described in Section 17.3.
- Elevated sulphates associated with existing ground conditions, with the potential attack on buried structures and requiring the design precautions detailed in Section 16.3.3.

### **17.3 Temporary Works**

The following temporary works are anticipated as part of the proposed development:

- Excavation within the topsoil, made ground and the natural superficial deposits should give minimal difficulty to traditional plant.
- Removal of hardstanding, relic structures and bedrock will require use of a breaker.
- Groundwater encountered within excavations should be adequately controlled by pumping from sumps.



- Due to the identified material properties of the localised granular superficial deposits, and the shallow groundwater conditions identified, adequate lateral trench support will be required for deeper excavations, to prevent trench wall collapse or over excavation, as well as to create a safe working environment. Excavations on this site should also remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time.

#### **17.4 Earthworks**

At the time of reporting detailed cut and fill calculations have not been undertaken. However, it is understood that proposed development levels are to be raised by up to 0.65m above existing.

Earthwork operations are likely to comprise:

- A site strip removing existing vegetation, hardstanding, asbestos impacted surface topsoil within the western area (where necessary) and topsoil within the other site areas (if any).
- Re-grading of site levels to form development formation levels
- Importation and placement of suitable upfill materials to achieve formation levels (as required) and construction make-ups.
- Excavations for utilities, drainage and foundations.
- Replacement of site won soils, where possible.
- Importation and placement of clean rooting medium in soft landscaping and garden areas (i.e. topsoil and subsoil)

The materials generated from these operations will predominately comprise a volume of asbestos impacted topsoil, potentially some non-asbestos impacted topsoil, granular made ground and natural superficial deposits. As these materials have been confirmed to be generally environmentally suitable for reuse across the site, beneath either hardstanding or a clean cover layer, it is not envisaged that significant site won materials would require offsite disposal. This is, however, subject to detailed volumetric analysis and confirmation that the quantities of topsoil and made ground likely to be generated can be accommodated on site beneath the clean cover.

#### **17.5 Foundation Design Requirements**

The structural design requirements for the proposed development have not yet been finalised.

For the purposes of this preliminary assessment the following design requirements have been assumed:

- Maximum un-factored column loads of 230kN with a ground bearing slab or 430kN with a suspended slab.
- A finished ground floor level of 51.25mOD.
- A permissible tolerance of 25mm for Total Settlement.
- A permissible tolerance of 1 in 500 for Differential Settlement.

Preliminary calculations indicate that either strip foundations 0.90m in width or pad foundations 1.4m square (1.90m square for suspended slab) could be used as the foundation solution on site, placed at



a minimum of 0.50m into the competent firm to stiff or stiff natural glacial clays. This would require foundations to extend to typical depths of between 1.20m and 1.50m below existing ground levels. Foundations at this depth should be designed to a maximum allowable bearing capacity of 125kN/m<sup>2</sup>. At these load intensities settlements will be restricted to less than 25mm.

Foundations are to be placed within the same material type and are not to be placed within different strata to minimise differential settlements. Should glacial sands be encountered at formation level then the Engineer should be contacted and the depths of the foundations may need to be adjusted.

In accordance with Chapters 4.2 of the NHBC Standards (Ref. 7) the minimum depth of foundations and special heave requirements associated with the heave and shrinkage risk from existing and proposed trees would also need to be assessed following confirmation of the landscaping proposals and the arboricultural survey. As such, during detailed design the foundation depths which are provided in the sections above, to achieve the required allowable bearing pressures and settlement requirements, may need to be deepened and/or heave and shrinkage mitigation measures adopted to mitigate against the risk from existing and proposed trees / shrubs.

### **17.6 Floor Slab**

On the basis of the proposed site levels being raised by up to 0.65m, the increased loads associated with these upfill materials, the presence of made ground up to 1.00m thick which presents a differential settlement risk, and the potential risks associated with existing mature trees (subject to survey), a ground bearing floor slab is unlikely to be a viable solution.

At this preliminary stage a suspended floor slab is recommended based upon the identified site conditions, development proposals and swell/ heave risks.

### **17.7 Pavement Design**

It is understood that the existing car park in the north of the site is to be retained and supplemented with additional spaces.

On the basis of the proposed site levels and an indicative construction thickness of 0.45m, formation levels within the additional car parking spaces and paved areas would either be within the upfill earthwork materials or the granular made ground deposits.

Based upon consideration of the guidance provided in Interim Advice Note 73/06 2009 (Ref. 8) and the nature of the made ground, the following preliminary CBR design values are recommended following adequate re-compaction of the subgrade:

- 5.0% CBR for the granular made ground; and
- The CBR performance of upfill earthwork materials comprising the subgrade could be specified by the Earthworks Specification for the site. Higher CBR performances for re-engineered made ground and natural clays than those detailed above could be achieved.

It is recommended that confirmatory CBR testing of the subgrade following proof rolling is undertaken during construction.



## 17.8 Infiltration and SuD Drainage

In view of the ground conditions identified comprising of low permeability natural cohesive superficial deposits, infiltration drainage in the superficial deposits would not form an appropriate drainage solution for the site.

## 17.9 Mining Risk Assessment

### Identified Ground Conditions

Solid geology comprising mudstone, sandstone and coal seams of the Pennine Middle Coal Measures Formation was recorded during the site investigation as being present underlying the Glacial Till deposits and proven to a maximum depth of 42.50mbgl.

The Desk Study (Ref. 01) indicates that the site is underlain by two shallow coal seams which were either recorded to be worked or have the potential to have been worked. These coal seams comprise the Bensham, which was recorded as being worked, and the Durham Low Main coal seams which was not recorded as being worked but is of sufficient thickness that it could have been.

During the site investigation, a number of coal seams and a single void were recorded within the Pennine Middle Coal Measures geology, these are detailed within Table 7, below:

**Table 7: Summary of workings encountered during the site investigation**

Borehole	Depth (mbgl)	Elevation (mOD)	Thickness (m)	Bedrock above Void / Coal Seam (m)	Rock Cover Ratio	Inferred Coal Seam
PR01	22.00 to 22.50	28.64 to 28.14	0.50 (Coal)	20.40	40.8	Bensham
PR02A	21.50 to 23.20	29.14 to 27.44	1.80 (Void)	19.90	11.1	Workings with the Bensham potentially including an element of roof collapse
PR03	21.00 to 22.00	30.04 to 29.04	1.00 (Coal)	19.20	19.2	Bensham

The single void identified during the site investigation is inferred to be associated with workings recorded within the Bensham (Bottom Maudlin) coal seam.

The underlying Durham Low Main, which is not recorded as being worked by the Coal Authority but was considered as part of the Desk Study assessment to be of a potential workable thickness (i.e. between 0.53m and 1.96m), is inferred to be present approximately 13m below the Bensham coal seam at a depth of approximately 36mbgl. The rotary holes were drilled to a maximum depth of 20m below the base of the Bensham and no evidence of this seam was recorded.

### Coal Seams and Historic Mining

The Fairhurst Desk Study (Ref. 1) recommended that both the shallow Bensham and the underlying Durham Low Main were investigated to confirm mineral instability risks, if any, to the proposed development. The coal seams present beneath these seams were not recommended for investigation due to sufficient rock cover ratios being inferred.



### *Bensham (Bottom Maudlin) Coal Seam*

The Coal Authority records indicate that this coal seam was historically worked beneath the site.

A single void, inferred to be associated with historic workings, was recorded within the inferred Bensham (Bottom Maudlin) coal seam during the site investigation. The Coal authority records the Bensham coal seam as being worked beneath the property at a depth of 20mbgl, which coincides with the recorded workings. The Coal Authority records an extraction thickness of 0.70m for the Bensham coal seam.

### *Durham Low Main (Top Brass Thill) Coal Seam*

The Coal Authority does not hold records of historic workings within this coal seam beneath the site.

Rotary holes were drilled to a maximum depth of 42.50mbgl during the site investigation, which was 20m below the base of the Bensham coal seam, and no evidence of the Durham Low Main Coal Seam or associated workings were recorded.

### *Old Pit Shafts and Mine Entries*

There are no recorded mine entries within a 100m radius of the site, however, the presence of unrecorded mine shafts within the site area, whilst considered to be a low risk, cannot be fully discounted.

No further remedial works are currently deemed necessary associated with unrecorded mine shafts. However, if abnormal ground conditions such as localised deep made ground or relic structures (i.e. potential shaft caps) are identified during future construction works then the Engineer shall be notified.

### *Underground Mine Workings Risk Assessment*

In accordance with the current industry guidance presented in CIRIA C758D (2019) - Abandoned Mine Workings Manual (Ref. 09), mineral instability at ground surface from the collapse of old coal mine workings is considered to present a risk where the thickness of rock cover between rock head and the worked seam is less than 10 times the worked seam thickness, i.e. a competent rock cover thickness to seam thickness ratio <10 for room and pillar extraction techniques.

### *Bensham (Bottom Maudlin) Coal Seam*

Although a single borehole encountered voids associated with extraction in the Bensham coal seam, the corresponding rock / cover ratio is greater than 10 (i.e. 11.1) when assessed against the voided thickness of 1.80m. A greater rock cover ratio of 29.1 can be inferred based upon the coal seam extraction thickness of 0.70m which was provided in the Coal Authority Report, and a ratio of 16.0 based upon the maximum recorded thickness of 1.27m provided on the BGS records. On this basis, workings within the Bensham coal seam are considered to present a low mineral instability risk to the development.

### *Durham Low Main (Top Brass Thill) Coal Seam*

2 No. rotary boreholes, denoted PR01 and PR02, extended below the Bensham coal seam to depths of up to 42.50mbgl which is up to 20.0m below the base of the Bensham coal seam. These rotary holes did not encounter the Durham Low Main or evidence of associated workings.

Based on rock cover thickness of up to 20m above the Durham Low Main coal seam to the base of the Bensham coal seam, and the maximum extraction thickness of 1.96m provided on the BGS records, void migration associated with unrecorded workings in this coal seam, if present, is unlikely



to migrate to the overlying shallower Bensham coal seam. On this basis, unrecorded workings within the Durham Low Main coal seam are considered to present a low mineral instability risk to the development.

No further remedial works are therefore deemed to be warranted in relation to either the Bensham or the Durham Low Main coal seams.



## 18.0 REFERENCES

1. Fairhurst, Geo-Environmental Desk Study, Document Ref. D/I/D/136018/02, January 2020.
2. CIRIA Publication 665, Assessing Risks Posed By Hazardous Ground Gases to Buildings, 2007.
3. BS 8485:2015+A1:2019, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
4. BSI Standards Publication, Geotechnical investigation and testing – Identification and Classification of Soil, Part 2: Principles for a classification. Document Ref. BS EN ISO 14688-2:2018, February 2018.
5. Foundation Design and Construction, 7th Edition, MJ Tomlinson, 2001.
6. BRE Special Digest No. 1:2005 (3<sup>rd</sup> Edition), Concrete in Aggressive Ground.
7. NHBC Standards, HB2894 01/1, 2017.
8. Interim Advice Note 73/06 Revision 1, Design Guidance for Road Pavement Foundations (Draft HD25), 2009.
9. Abandoned Mine Workings Manual. CIRIA C758D, 2019.
10. CIRIA C733, Asbestos in soil and made ground: a guide to understanding and managing risks, 2017.
11. CL:AIRE, CAR-SOIL, Control of Asbestos Regulations 2012, Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials, Industry Guidance, JIWG, 2016.
12. UK Radon Online Viewer - <http://www.ukradon.org> viewed on the 27<sup>th</sup> March 2021.

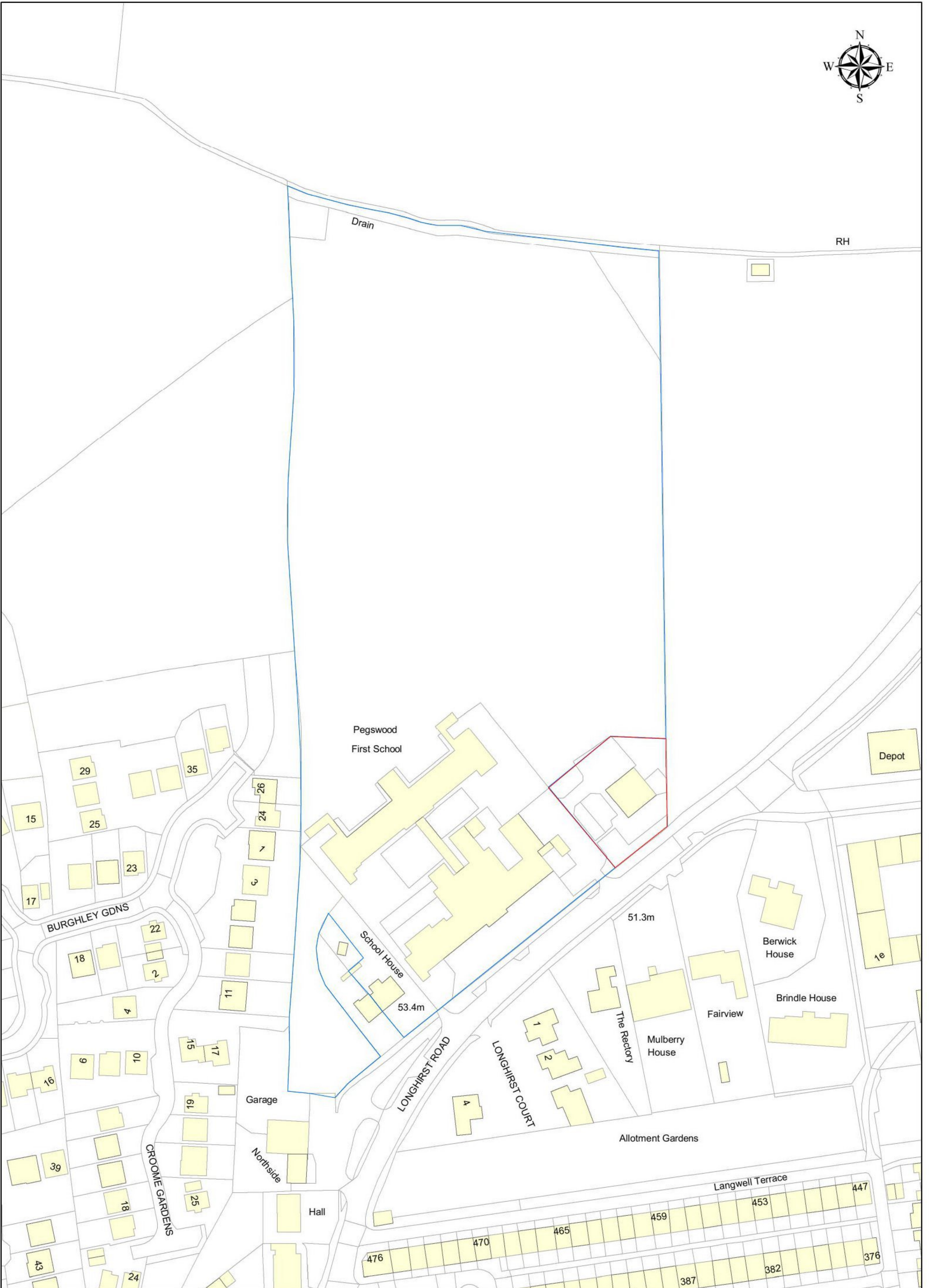


## Appendix 1

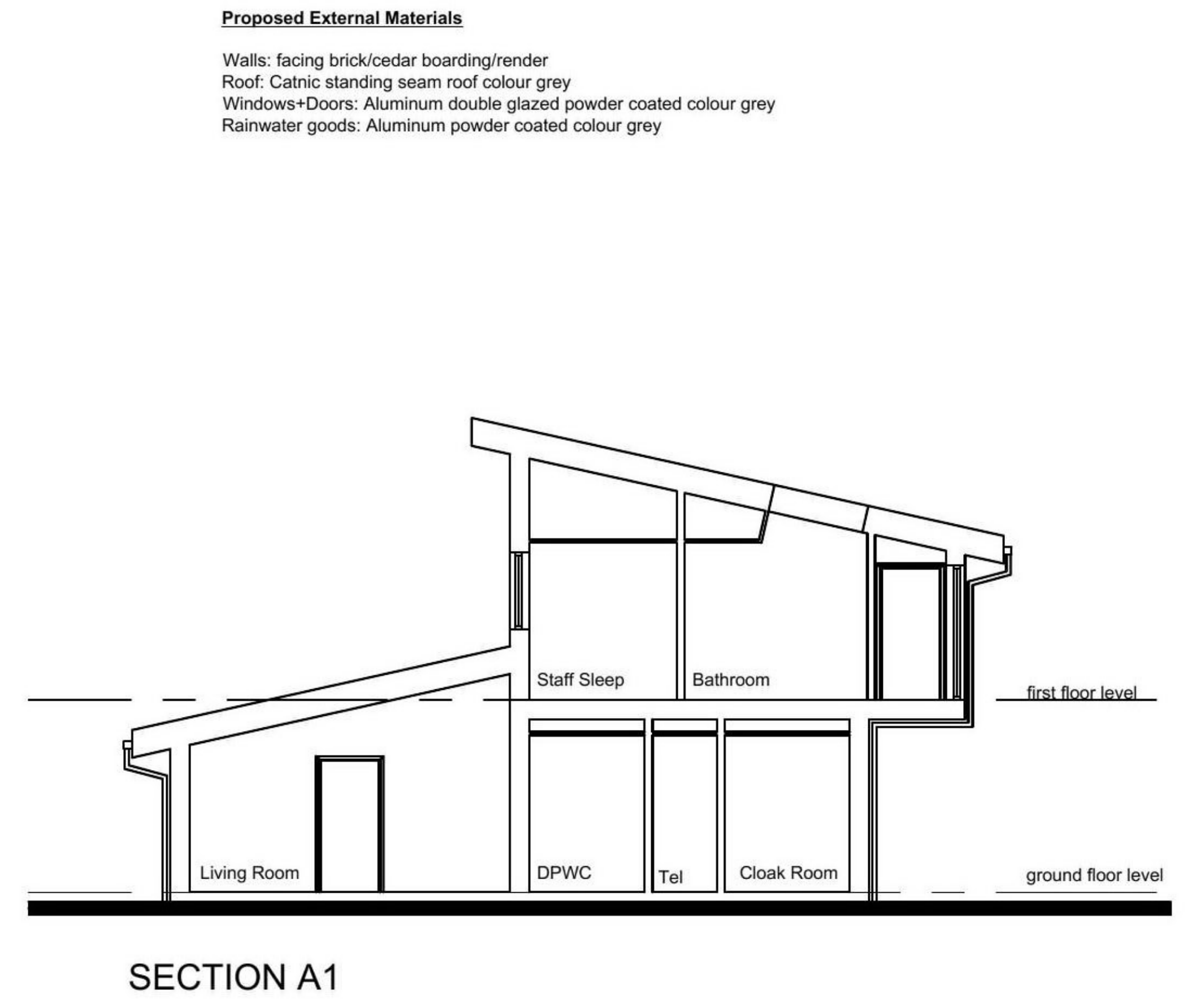
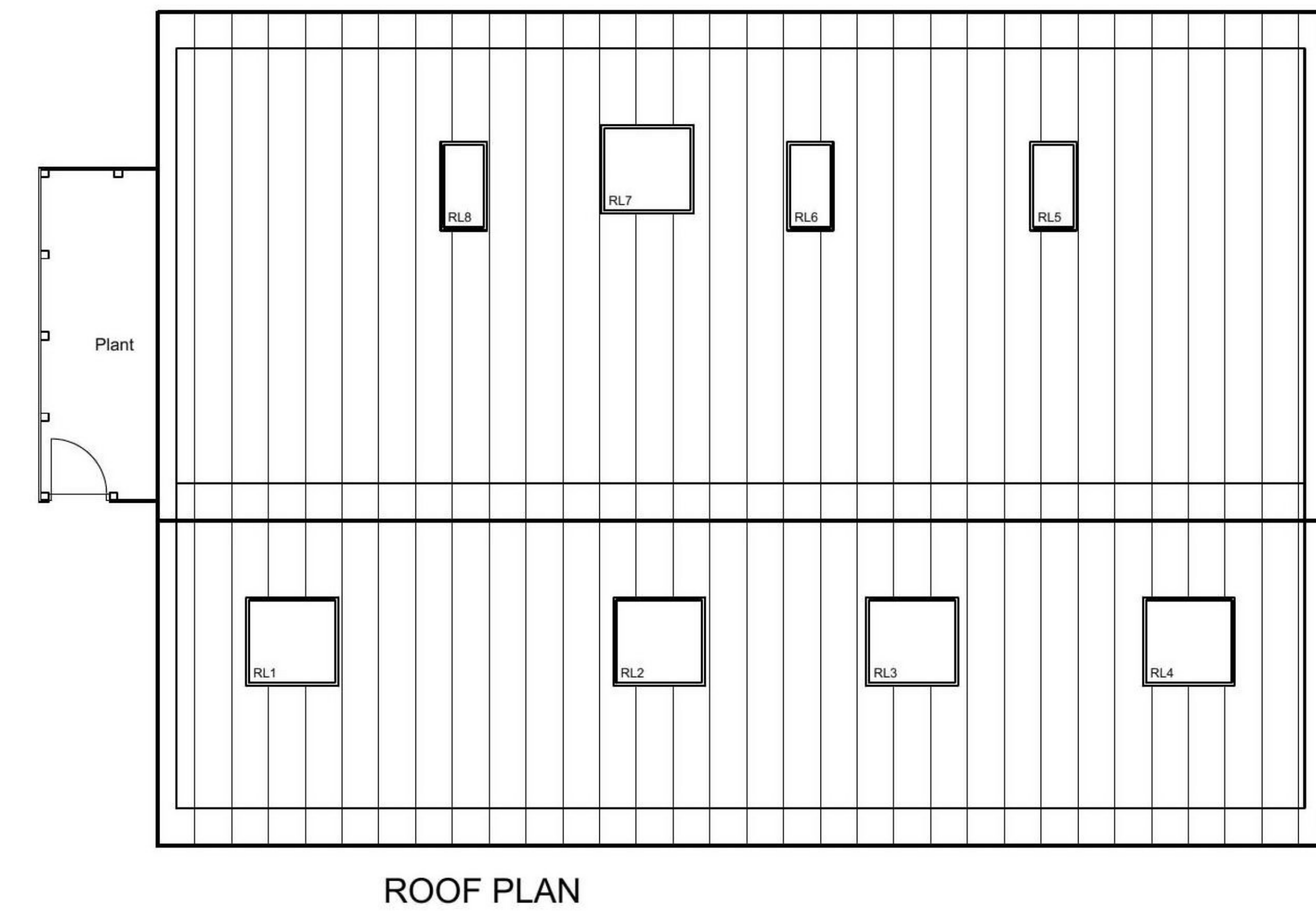
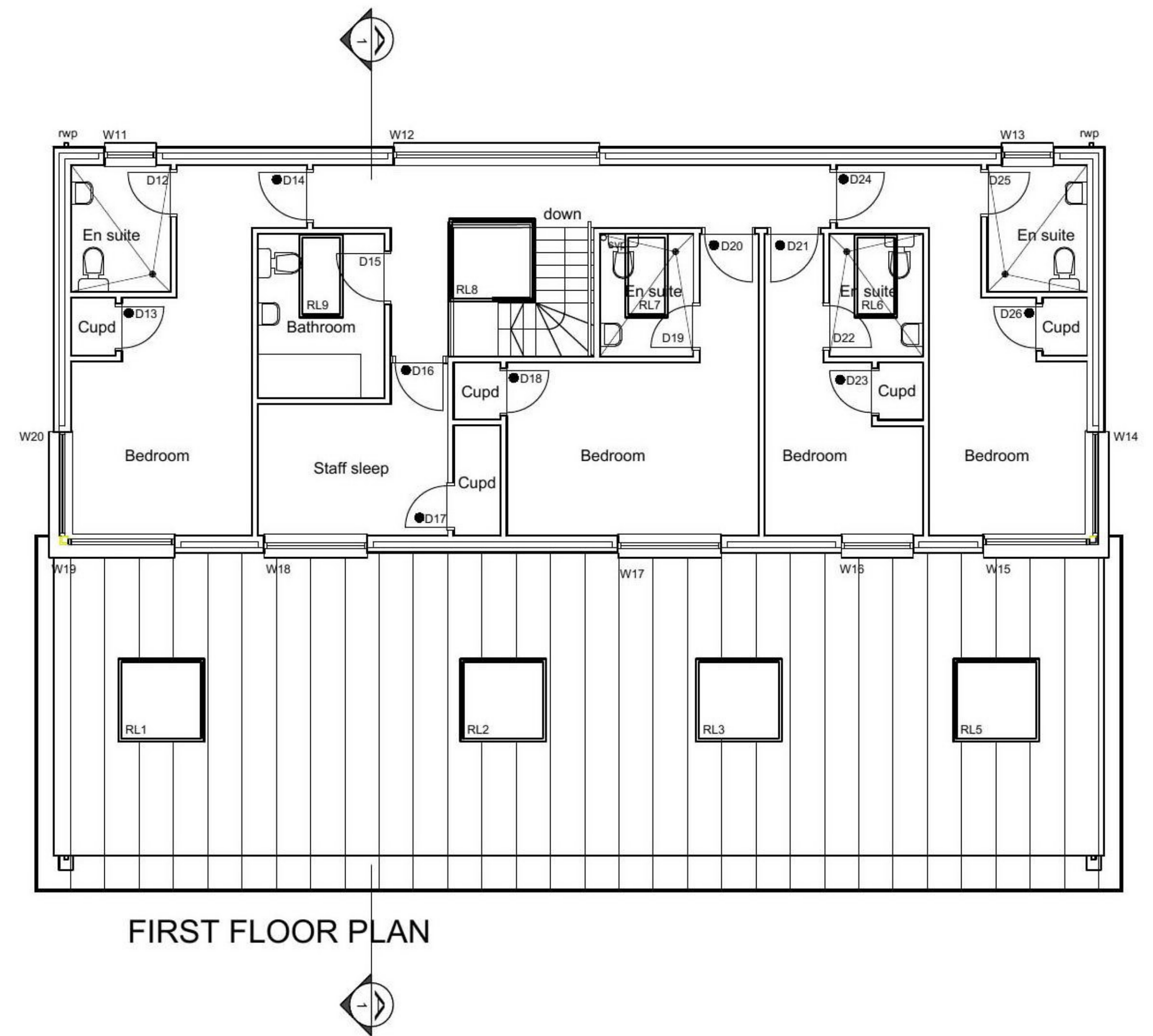
### Drawings

Drawing Ref.	Revision	Originator	Title
-	-	Northumberland County Council	Pegswood First School
PI191009	(0)01	Northumberland County Council	Plans / Elevations
PI191009	(L)02	Northumberland County Council	Proposed Site Plan
F027b	-	Landform Surveys	Topographical Survey
136018/2002	-	Fairhurst	Proposed Drainage and Levels
136018/9002	-	Fairhurst	As Built Exploratory Hole Location Plan

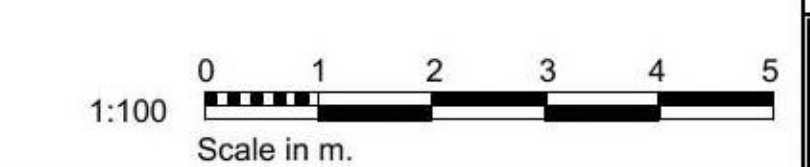
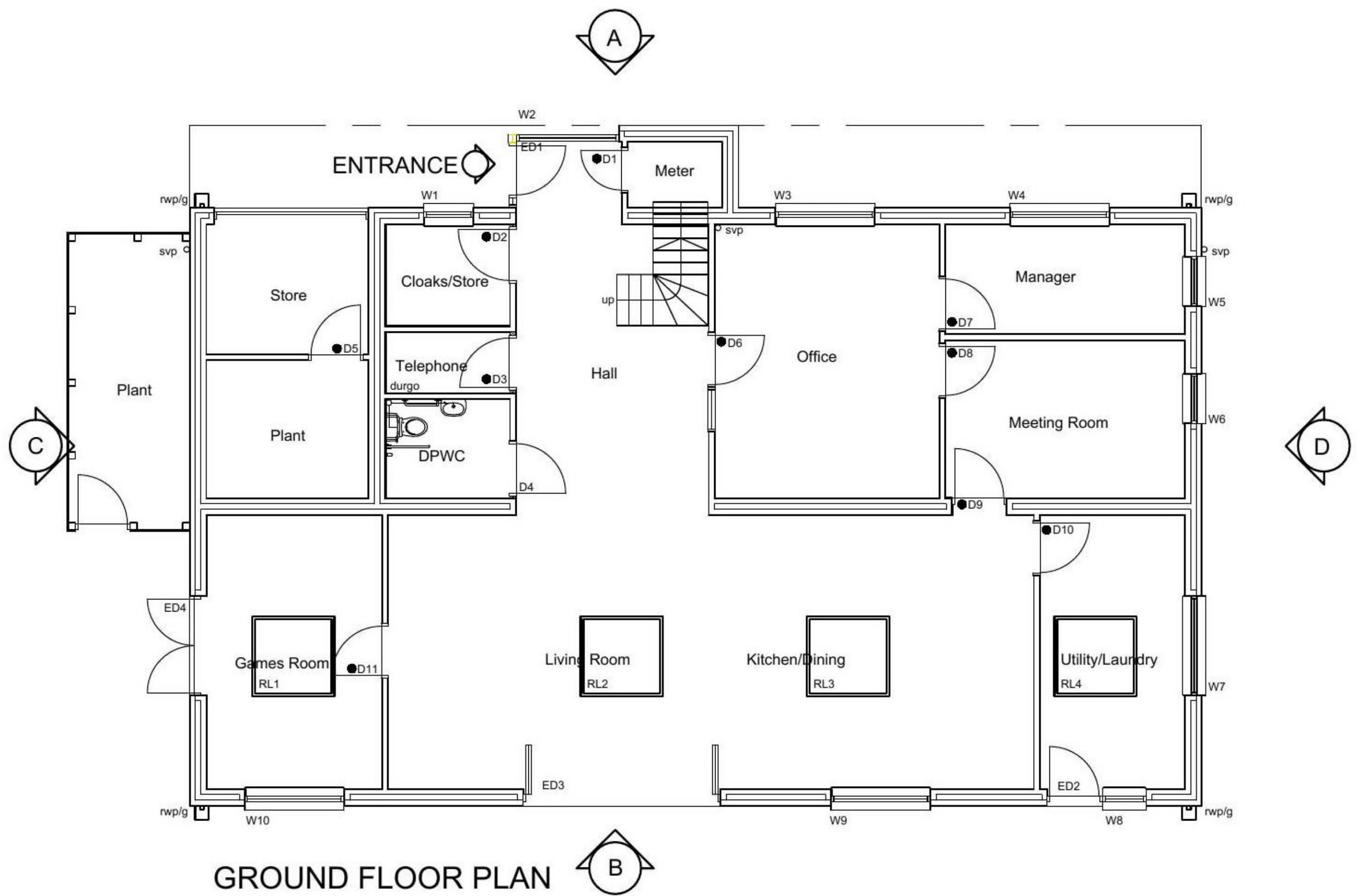








**Proposed External Materials**  
Walls: facing brick/cedar boarding/render  
Roof: Calmic standing seam roof colour grey  
Windows-Doors: Aluminum double glazed powder coated colour grey  
Rainwater goods: Aluminum powder coated colour grey



REV A 00/00/00 ADD NOTES

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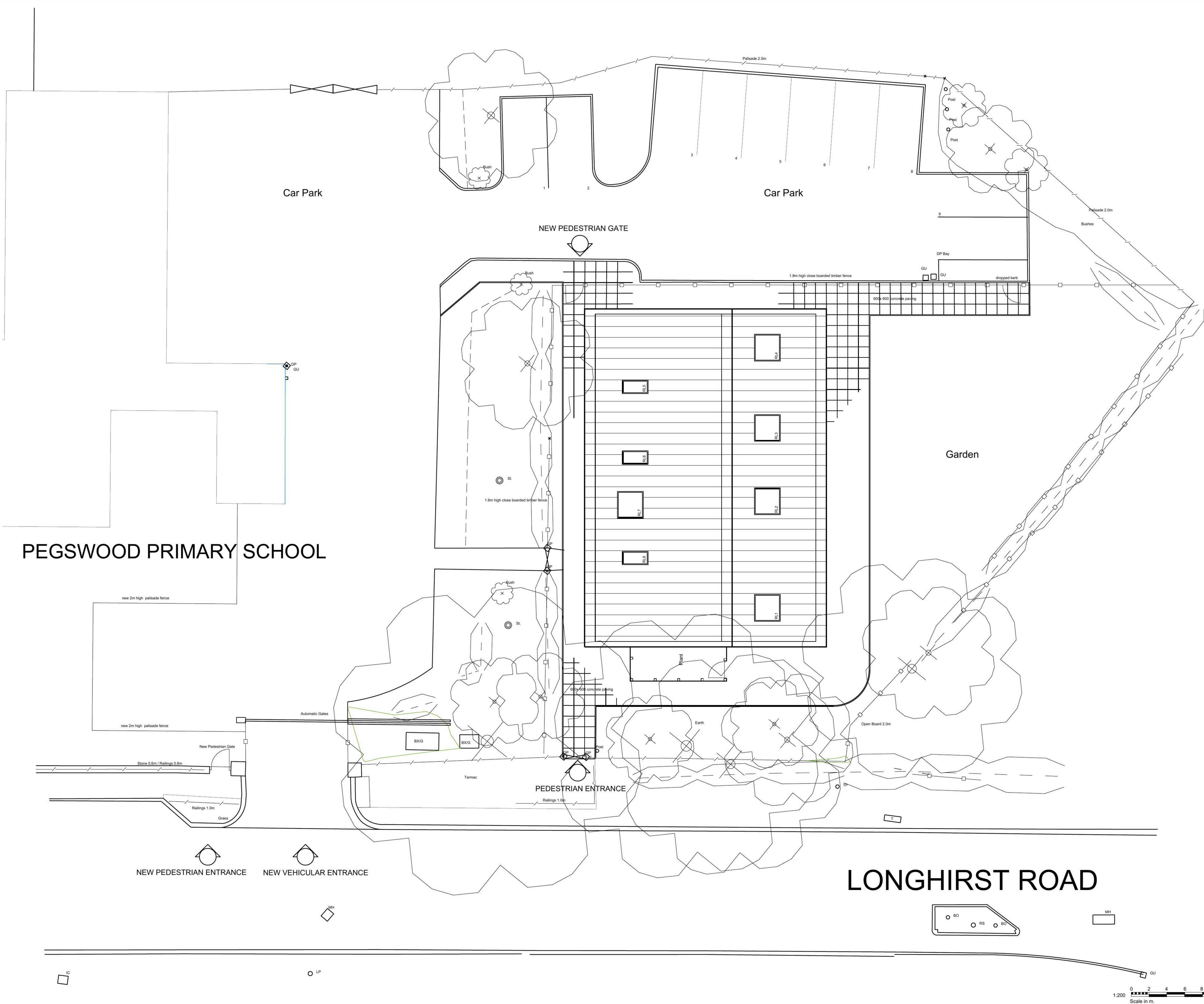
**Childrens Homes - Pegswood Site**

**Plans/Elevations**

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P191009 (0)01





PEGSWOOD PRIMARY SCHOOL

LONGHIRST ROAD

REV A 00/00/00 ADD NOTES



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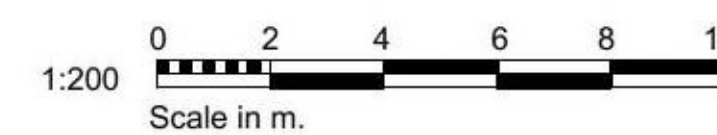
**Childrens Homes - Pegswood Site**

**Proposed Site Plan**

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**PI191009 (L)02**





587775N

422725E

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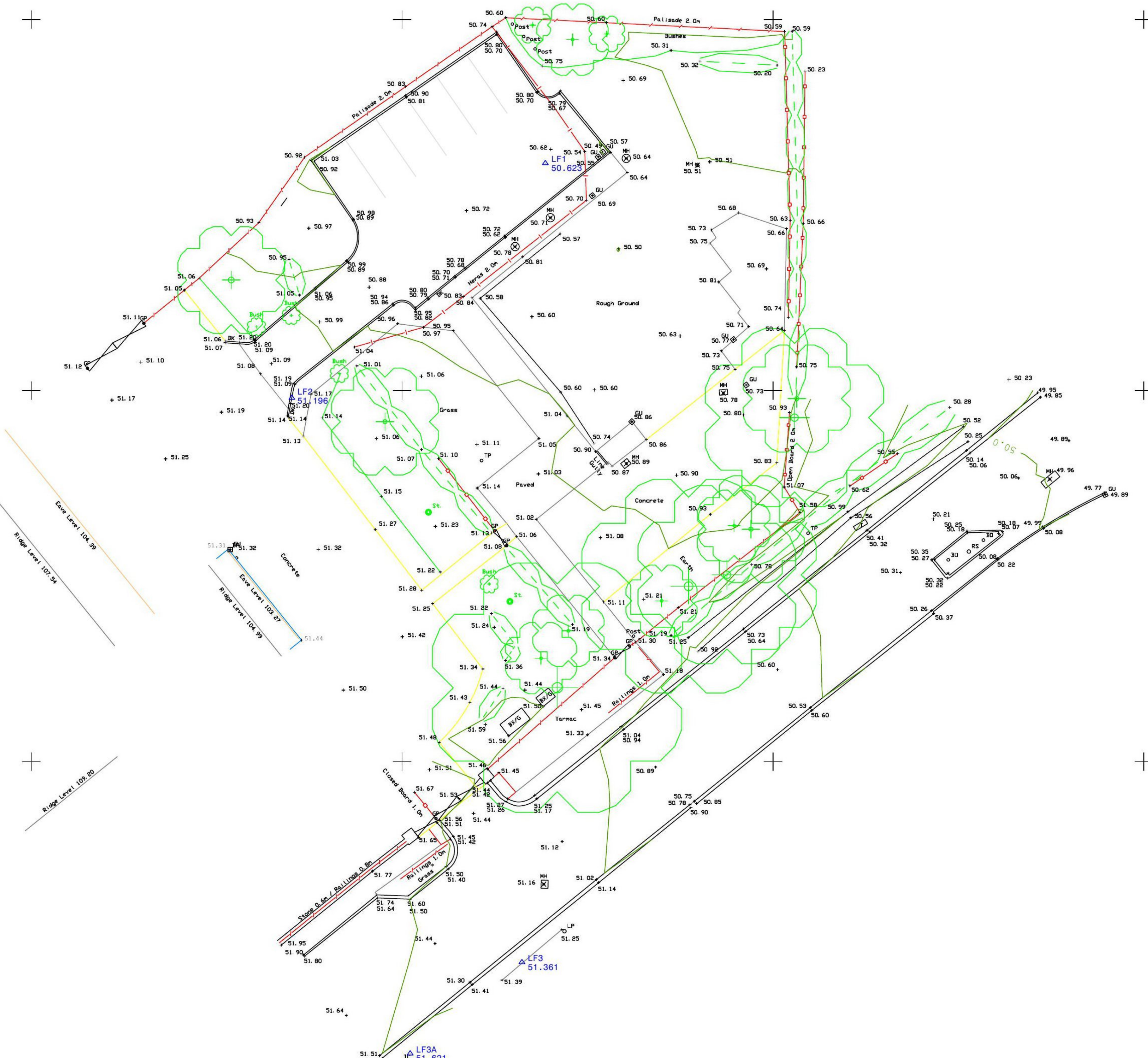
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LF2	422767.571	587724.509	51.196
LF3	422783.078	587686.480	51.361
LF3A	422775.543	587680.329	51.621



Legend

Boundary Type and Description

C/B	Close Board
C/L	Chain Link
EE	Misc.
K/R	Knee Rail
O/B	Open Board
Pal	Palisade
M/R	Metal Railings
Pick	Picket
P/R	Post & Rail
P/W	Post & Wire
W/M	Wire Mesh
Brick	Brick Wall
Brick Ret.	Brick Retaining Wall
Stone	Stone Wall
Stone Ret.	Stone Retaining Wall
Block	Block Wall
Misc	Misc. Wall
Gate	Gate

Vegetation

Hedge	Hedge
Edge of Hedge	Edge of Hedge
Edge of Canopy	Edge of Canopy
Tree and Trunk	Tree and Trunk
Stump	Stump
Bush	Bush
Verge	Verge

General Utility Lifestyles

CD	Drainage Combined
FD	Drainage Foul
SD	Drainage Surface
UD	Drainage Unidentified
O/C	O/Head Combined
O/E	O/Head Electric
O/T	O/Head Telecom

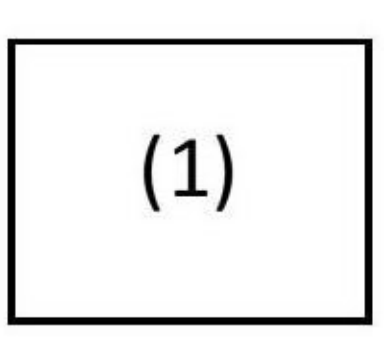
General Survey Abbreviations

AV	Air Valve	GV	Gas Valve
BH	Borehole Collar	HP	Hand Pit
BX	Box (General)	IBO	Illuminated Bollard
BX/E	Box (Elec)	IC	Inspection Cover
BX/G	Box (Gas)	IL	Invert Level
BX/T	Box (Telecom)	KO	Kerb Outlet
BX/W	Box (Water)	LP	Lampost
BM	Benchmark	LT	Light
BO	Bollard	MH	Manhole
BS	Bus Stop	MR	Marker
Bin	Bin	POST	Post (General)
BT	Telecom Cover	PB	Post Box
CCTV	Air Valve	RE	Rodding Eye
CL	Cover Level	RS	Road Sign
DK	Dropkerb	SV	Stay
DP	Downpipe	SV	Stop Valve
DP/G	Downpipe/Gully	TL	Traffic Light
EC	Electric Cover	TFR	Taken From Records
EOR	End of Records	TP	Telecom Pole
EOS	End of Survey	TV	Cable TV
EOT	End of Trace	UTGA	Unable to Gain Access
EP	Electric Pole	UTL	Unable to Lift
ER	Earth Rod	UTS	Unable to Survey
FH	Fire Hydrant	UTT	Unable to Trace
FL	Floor Level	WL	Water Level
FP	Flag Pole	WS	Window Sample
GP	Gate Post		
G	Gully		

Measured Survey Abbreviations

AC	Air Conditioning	SCH	Structural Ceiling Height
AH	Access Hatch	SKY	Sky Light
AP	Access Panel	W	Window Height
BH	Beam Height		
C	Cil Height		
DH	Door Height		
FCH	False Ceiling Height		
FL	Floor Level		
HT	Height (General)		
RD	Radiator		

Layout Key



CO-ORDINATES AND ELEVATIONS ARE SET BY GNSS AT STATION LF1.  
 CO-ORDINATES ARE TO OS NATIONAL GRID USING OSTN15 TRANSFORMATION  
 LEVELS ARE TO ORDNANCE DATUM USING OSGM15 GEOID MODEL.  
 THE REMAINDER OF THE SURVEY IS TO SCALE FACTOR 1 PLANE GRID.

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rev	by	date	notes	check

**Landform Surveys**  
 professional surveying solutions  
 Suite 18, YBN, Delta Bank Road, Gateshead, NE11 9DJ  
 Tel: 0191 2765636  
 e: office@landform-surveys.co.uk www.landform-surveys.co.uk

CLIENT  
**Fairhurst**  
 Land at Pegswood First School

TITLE  
**Topographic Survey**

drawn	MM	date	22-01-20	drawing no	
checked	MR	date	22-01-20	scale	
client ref				F027b	1/200@A1



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION:

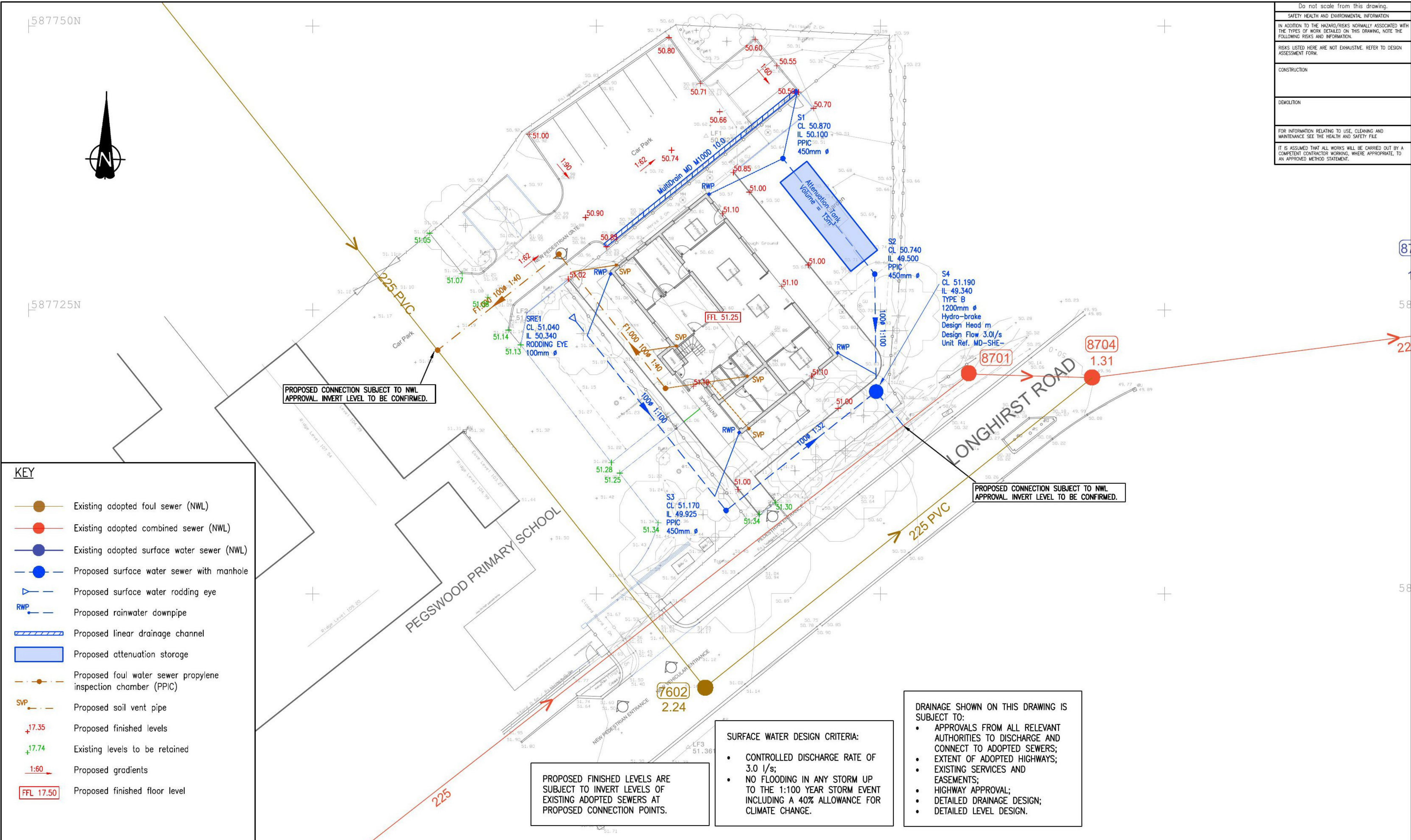
RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.



**KEY**

- Existing adopted foul sewer (NWL)
- Existing adopted combined sewer (NWL)
- Existing adopted surface water sewer (NWL)
- Proposed surface water sewer with manhole
- ▶ Proposed surface water rodding eye
- RWP Proposed rainwater downpipe
- ▬▬▬ Proposed linear drainage channel
- Proposed attenuation storage
- Proposed foul water sewer propylene inspection chamber (PPIC)
- SVP Proposed soil vent pipe
- +17.35 Proposed finished levels
- +17.74 Existing levels to be retained
- 1:60 Proposed gradients
- FFL 17.50 Proposed finished floor level

PROPOSED CONNECTION SUBJECT TO NWL APPROVAL. INVERT LEVEL TO BE CONFIRMED.

PROPOSED CONNECTION SUBJECT TO NWL APPROVAL. INVERT LEVEL TO BE CONFIRMED.

PROPOSED FINISHED LEVELS ARE SUBJECT TO INVERT LEVELS OF EXISTING ADOPTED SEWERS AT PROPOSED CONNECTION POINTS.

**SURFACE WATER DESIGN CRITERIA:**

- CONTROLLED DISCHARGE RATE OF 3.0 l/s;
- NO FLOODING IN ANY STORM UP TO THE 1:100 YEAR STORM EVENT INCLUDING A 40% ALLOWANCE FOR CLIMATE CHANGE.

DRAINAGE SHOWN ON THIS DRAWING IS SUBJECT TO:

- APPROVALS FROM ALL RELEVANT AUTHORITIES TO DISCHARGE AND CONNECT TO ADOPTED SEWERS;
- EXTENT OF ADOPTED HIGHWAYS;
- EXISTING SERVICES AND EASEMENTS;
- HIGHWAY APPROVAL;
- DETAILED DRAINAGE DESIGN;
- DETAILED LEVEL DESIGN.

Rev.	Date	Description	Drawn	Checked	Approved

**NOTES**

- This drawing is based on the following received information:  
NORTHUMBERLAND COUNTY COUNCIL Drawing PI191009 (L)02 - Site Plan as Proposed.  
LANDFORM SURVEYS Topographic Survey F027b.  
Existing NWL services information,
- All road levels and car parking levels at kerb lines are channel levels unless stated otherwise.

Client:  
**NORTHUMBERLAND COUNTY COUNCIL**

Project Title:  
**CHILDREN HOMES NORTHUMBERLAND COUNTY COUNCIL PEGSWOOD**

Drawing Title:  
**PROPOSED DRAINAGE AND LEVELS**

**FAIRHURST**

1 Amgrove Court, Barrack Road,  
Newcastle-upon-Tyne, NE4 5DB  
Tel: 0191 221 0205 Fax: 0984 381 4412

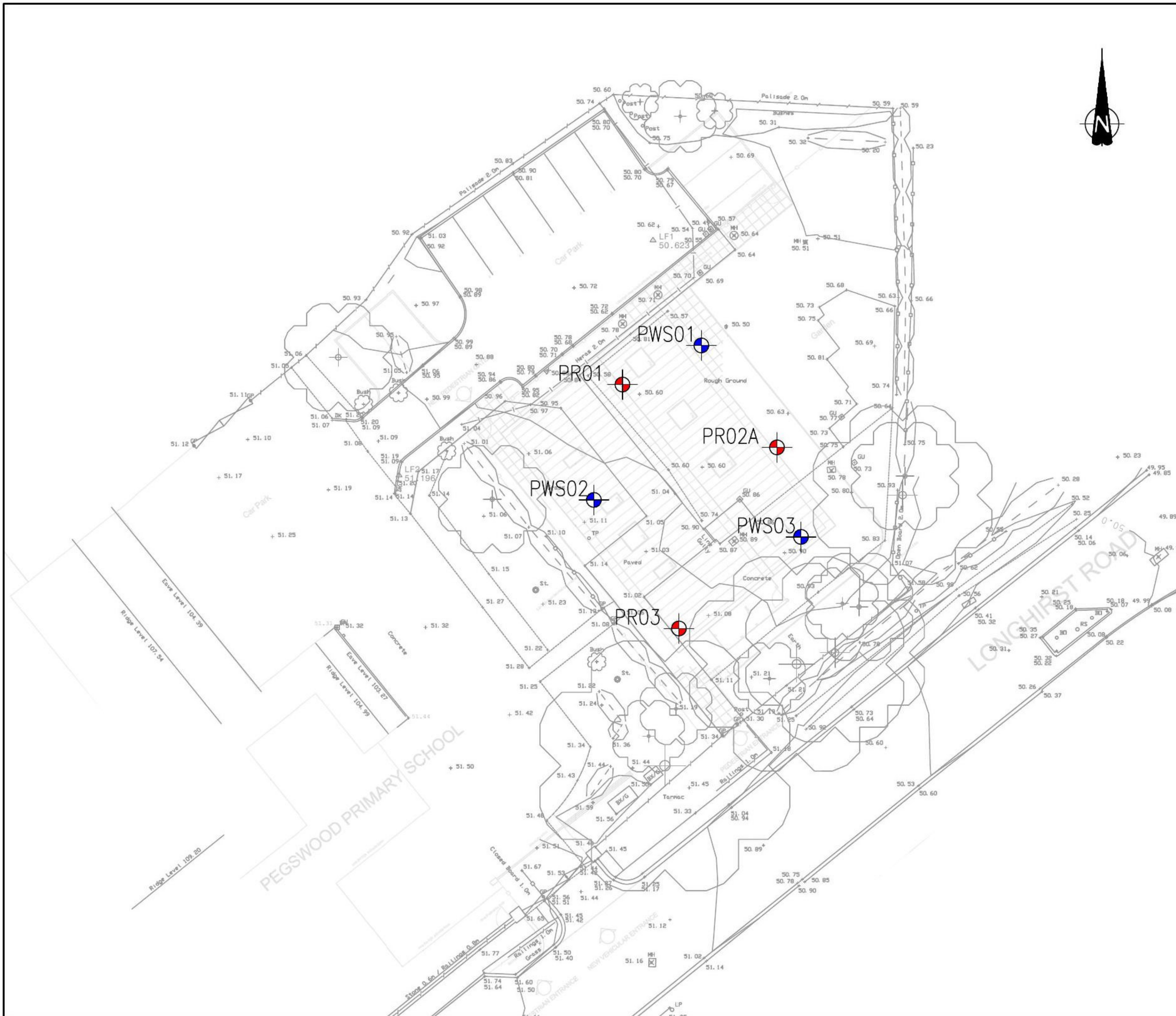
Scale of A2:  
1:250

Status:  
For Information

Drawn: JF	Checked:	Approved:
Date: 02/06/20	Date:	Date:

Drawing No.: 136018/2002





Do not scale from this drawing.

**SAFETY HEALTH AND ENVIRONMENTAL INFORMATION**

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO. D/I/D/136018/05.

- CONSTRUCTION**  
 The following Key Significant Hazards to the drilling operations were identified:
- Risk of harm associated with below ground services.
  - Risk of contamination (including asbestos) within soils and groundwater.
  - Risk of interface with members of the public and site users during operations.
  - Risk of harm associated with soil / mine gas.
  - Risk of harm associated with mineral instability
- Further information relating to these hazards are detailed within Fairhurst Design Risk Assessment Form D/I/D/136018/05.

**DEMOLITION**  
 FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

- Key**
- Rotary Open Hole Borehole
  - Window Sample

Rev.	Date	Description	Drawn	Chkd	Appd.

**FAIRHURST**

1 Amgrove Court  
 Barrack Road,  
 Newcastle-upon-Tyne  
 NE4 6DB  
 Tel: 0191 221 0505  
 Fax: 0844 381 4412

**NORTHUMBERLAND**  
 Northumberland County Council

Project Title:  
**CHILDREN HOMES  
 NORTHUMBERLAND COUNTY COUNCIL  
 PEGSWOOD**

Drawing Title:  
**AS BUILT EXPLORATORY HOLE  
 LOCATION PLAN**

Scale at A3: 1:250	Status: 'AS BUILT'	
Drawn: CMC	Checked: SPP	Approved: NB
Date: 26/03/21	Date: 26/03/21	Date: 26/03/21

Drawing No.: **136018/9002**      Revision: **-**



## Appendix 2

**Dunelm Geotechnical & Environmental Ltd  
Ground Investigation Factual Report (Draft)**







**CONTRACT NO: D10015-2**

**FACTUAL REPORT ON SITE INVESTIGATION FOR  
PI191009 PEGSWOOD NEW BUILD CHILDREN'S HOME**

**PREPARED FOR:**

**NORTHUMBERLAND COUNTY COUNCIL**



● FOUNDATION HOUSE ● ST. JOHN'S ROAD ● MEADOWFIELD ● DURHAM ● DH7 8TZ  
● TEL: 0191 378 3151 ● FAX: 0191 378 3157





<b>Contract No.</b>	D10015-2
<b>Job Name</b>	PI191009 Pegswood New Build Children's Home

## REPORT REVISIONS

Revision No.	Issue Date	Details
D10015-2/00	22.03.2021	Draft report for approval.
D10015-2/01	30.03.2021	Draft report following Fairhurst comments on Factual Report Rev00.

## VERIFICATION

Revision No.	Issue Date		Written By	Checked By	Verified By
D10015-2/00	22.03.2021	<b>Initials</b>	SH	BL	JH
		<b>Signature</b>	[REDACTED]		

Revision No.	Issue Date		Written By	Checked By	Verified By
D10015-2/01	30.03.2021	<b>Initials</b>	SH	BL	JH
		<b>Signature</b>	[REDACTED]		



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<b>APPENDIX B</b>	<b>EXPLORATORY HOLE RECORDS</b>
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# 1 INTRODUCTION

## 1.1 SCOPE OF WORKS

Dunelm Geotechnical and Environmental Ltd (Dunelm) were commissioned by Northumberland County Council (NCC) to carry out a site investigation of Pegswood New Build Children's Home with Fairhurst acting as geotechnical consulting engineers.

The objectives of the investigation were as follows:

- To determine the typical nature, thickness and engineering parameters of the made ground and natural strata.
- To determine the nature and extent of potential contamination within the site.
- To recover samples of made ground and natural strata for chemical and geotechnical laboratory testing.
- To recover samples of groundwater from the boreholes for laboratory testing.
- To record gas concentrations and gas flows within the boreholes.

Fieldwork was undertaken generally as specified in the contract documents provided by Fairhurst. The fieldwork was carried out between 3<sup>rd</sup> and 5<sup>th</sup> February 2021.

Following the completion of the fieldwork selected soil samples were submitted for a range of geotechnical and chemical testing.

This report presents the factual information obtained during the investigation; interpretation of this data was outside the remit of this report. The factual data is reported separately in AGS format Version 4.

One other phase of work was carried out along-side this project. Information relating to the factual data can be found in Dunelm Report No D10015-1.

## 1.2 GENERAL

Guidance contained in the following Standards has been followed during the investigation work as appropriate: BS5930:2015+A1:2020, BS10175:2011+A2:2017; BS1377:2016; BS EN ISO 14688-2:2018 and BS EN ISO 14689:2018.

The information contained in this report is as indicated on the site plan shown in Appendix A, and the areas accessible during the ground investigation.

This report is for the exclusive use of NCC and their agents. No third party may rely upon, or reproduce, the contents of this report without the written approval of Dunelm.

This report is based on the data obtained from the exploratory holes and from the subsequent tests carried out. There is always a possibility of variation in the ground conditions between boreholes. Responsibility cannot be accepted for conditions not revealed by the investigation. Any diagram or opinion of the possible configuration of the findings is conjectural and given for guidance only, and confirmation of intermediate ground conditions should be considered if deemed necessary. Dunelm's Notes on Limitations are included in Appendix F.

# 2 SITE LOCATION & FEATURES

The site is located 0.5km north east of Pegswood town centre. The approximate centre of the site is at National Grid Reference 425192, 599950.

A site location plan is presented as Drawing No. D10015-2/01 in Appendix A to this report.



The site comprises an area of approximately 40m x 35m in extent and was formerly occupied by the Pegswood Children's Centre building which has now been demolished.

The site currently comprises a disused brownfield space delineated by Herras fencing. The site is overlain by a mix of grassed and hardcore, paved and tarmacked hardstanding. The site is bound by Longhirst Road to the south, Pegswood First School buildings to the west and open agricultural land to the north and east.

### 3 FIELDWORK

#### 3.1 INTRODUCTION

The fieldwork comprised the following:

Number	Exploratory Hole Label	Method
3	PR01, PR02A, PR03	Rotary Open Hole Drilling
3	PWS01, PWS02, PWS03	Windowless Sampling

Termination reasons are listed in the table below:

Number	Exploratory Hole Label	Termination Reasons
1	PR02	Was not undertaken as per client's decision.
3	PWS01, PWS02, PWS03	Due to hard strata

On completion all exploratory positions were backfilled immediately in accordance with instructions from Fairhurst.

#### 3.2 EXPLORATORY HOLE LOCATIONS

The locations of each of the above exploratory holes were recorded by survey following the completion of the works. The locations are shown on Drawing No. D10015-2/02 in Appendix A.

The ground elevations and co-ordinates of each of the exploratory holes determined from the survey are shown on the exploratory hole records.

#### 3.3 STRATA DESCRIPTIONS

Descriptions of the strata encountered in each of the exploratory holes are presented on the exploratory hole record sheets in Appendix B to this report. Strata descriptions are based on an examination of the strata, together with consideration of the in-situ testing results and laboratory test data.

Strata descriptions have been completed in accordance with BS5930:2015+A1:2020, BS EN ISO 14688-2:2018 and BS EN ISO 14689:2018 as appropriate.

#### 3.4 SAMPLING

Samples were recovered during the investigation works in general accordance with the contract specification.



Samples of soil for chemical analysis were placed into suitable sample containers as specified by the chemical testing laboratory. Samples of soil for geotechnical testing were recovered in accordance with the principles of BS1377-1:2016.

### 3.5 IN-SITU TESTING

In-situ Standard Penetration Tests (SPTs) were carried out in the rotary and mini-rig boreholes at a frequency in general accordance with the contract specification.

SPT tests were carried out in accordance with BS EN ISO 22476-3 2005 + A1:2011 in order to determine the relative density of the granular soils and an indication of the undrained shear strength of cohesive soils. The results of these tests are shown as 'N' values on the exploratory hole records, with the blow counts for each increment shown in brackets.

In situ hand shear vane tests were carried out in the hand dug pit of each mini-rig hole. The results are presented at the relevant depth of the borehole logs included in Appendix B.

### 3.6 MONITORING WELLS

On completion of drilling, monitoring wells were installed in selected boreholes to enable subsequent gas and groundwater monitoring. The construction of the wells was as specified during the works by Fairhurst. Details of the installations are shown on the exploratory hole records and summarised in Table B1 in Appendix B.

Each well consisted of a lower slotted section of 50mm diameter HDPE standpipe surrounded by single size non-calcareous gravel, with an upper section of plain HDPE pipe surrounded by a bentonite cement seal.

Each of the wells was fitted with a suitable bung and gas tap to allow for gas and groundwater monitoring, and a protective steel cover to prevent damage to the installation.

Boreholes not fitted with a monitoring installation were backfilled in general accordance with the specification or subsequent instruction from Fairhurst.

## 4 LABORATORY TESTING

### 4.1 GEOTECHNICAL

Geotechnical laboratory testing, as scheduled by Fairhurst, was carried out on selected samples in accordance with techniques in BS 1377:1990 and BRE SD1 : 2005. The testing was undertaken by a UKAS accredited laboratory and the results are presented in Appendix C.

### 4.2 CHEMICAL

Samples as scheduled by Fairhurst were tested for a range of contaminants by an MCERTS accredited laboratory. The results of these tests are presented in Appendix D.



## 5 GAS & GROUNDWATER MEASUREMENTS

### 5.1 INTRODUCTION

Measurements of gas concentrations in the vicinity of the drilling rig were made by a Dunelm engineer during the rotary drilling investigation. These measurements were carried out at intervals as the drilling progressed and involved recording the concentrations of carbon monoxide, carbon dioxide, methane and oxygen using a hand-held instrument. The monitoring results are presented in the remarks section of the borehole logs.

Following the completion of the investigation work on site, a Dunelm technician made a series of visits to the site in order to carry out measurements of gas and groundwater within the monitoring wells described above. The number and frequency of these visits were specified by Fairhurst.

The site has been monitored on three occasions at the time of issuing this report. The monitoring results are presented in Appendix E.

### 5.2 GAS MONITORING PROCEDURE

Each of the gas monitoring wells was monitored to record the concentration of methane, carbon dioxide, carbon monoxide, oxygen and hydrogen sulphide using an infra-red gas analyser. The borehole flow rate, atmospheric and differential pressure was also measured using a suitable instrument.

Gas monitoring was undertaken in accordance with current guidance.

### 5.3 GROUNDWATER MONITORING PROCEDURE

Measurements of groundwater level (in metres below ground level) were recorded in each borehole using a standard dipmeter.

### 5.4 GROUNDWATER SAMPLING PROCEDURE

Prior to groundwater sampling being commenced, each monitoring well was developed by purging. This work was completed on 17<sup>th</sup> February 2021.

Samples of groundwater were recovered on 17<sup>th</sup> February 2021 using a bailer.

Measurements were taken on each water sample of redox potential, dissolved oxygen, temperature, pH and conductivity prior to despatch to the laboratory. The results obtained are included in a table in Appendix E.

Samples were then despatched to an appropriate laboratory for testing. The results of these tests are presented in Appendix D.

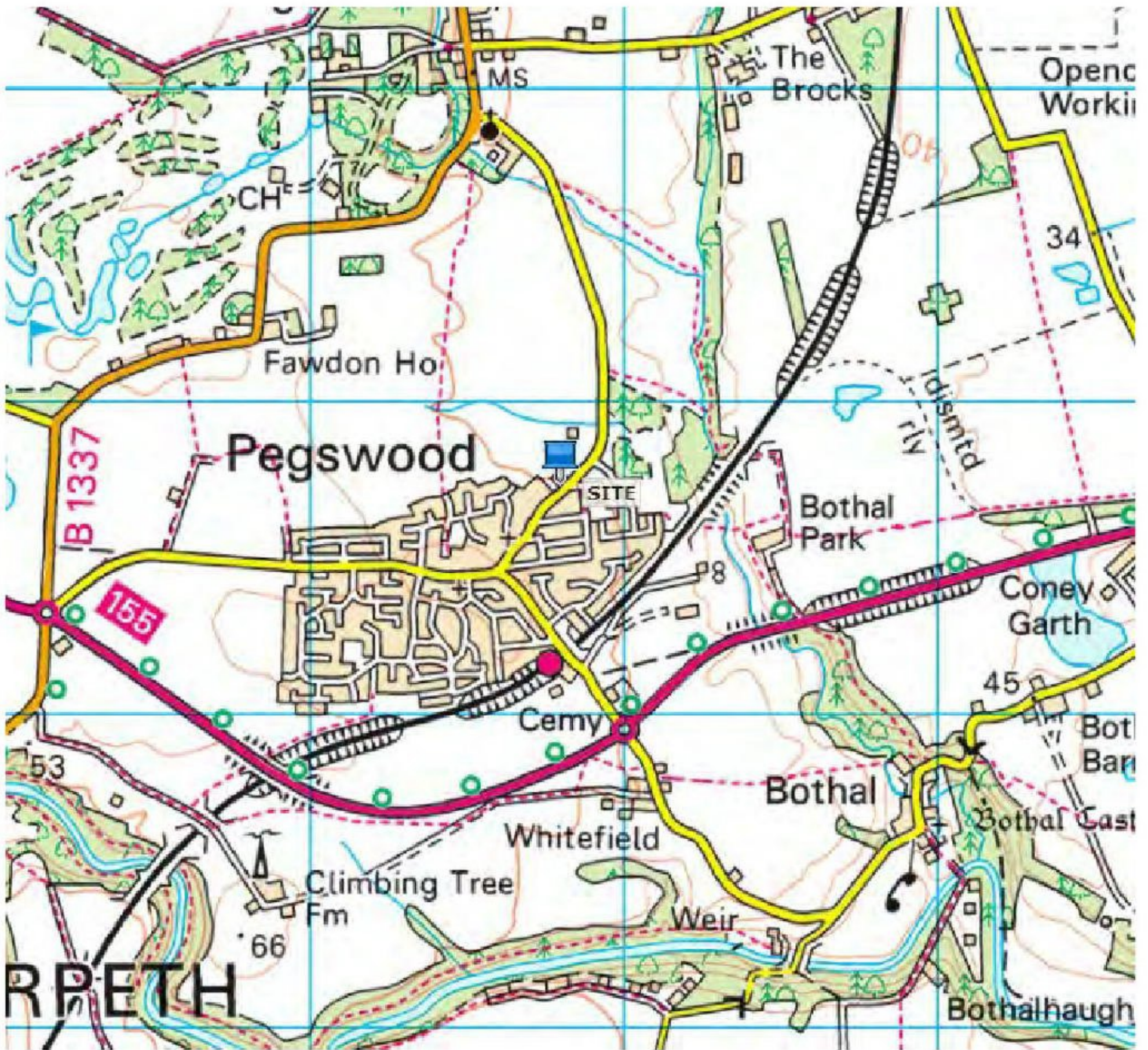


# APPENDIX A


## Drawings







Ordnance Survey © Crown copyright 2012 All rights reserved. Licence number 100048410.

	Contract: PI191009 Pegswood New Build Children's Home		Contract No: D10015-2	
	Client: Northumberland County Council			
TEL: 0191 378 3151	Drawing Title: Site Location Plan			
Drawing & Revision No: D10015-2/01 - 00	Date: February 2021	Scale: NTS	Status: Final	Drawn by: SH




Project Id: D10015-2  
Project Title: P1191009 Pegswood New Build Children's Home  
Client: Northumberland County Council

Title: Exploratory Hole Location Plan  
Scale: 1:1000  
Drawing No: D10015-2/02



Legend Key

-  Rotary Open Hole Drilling
-  Windowless Sampling





## **APPENDIX B**

### **Exploratory Hole Records**





**INFORMATION GENERALLY RELATING TO ALL EXPLORATORY HOLE RECORDS****GENERAL****Borehole/Trial Pit No**

The exploratory hole identity number used throughout the report.

**Site**

The ground investigation project name.

**Client**

Client's name responsible for funding the ground investigation project.

**Ground Level and Location**

The precise ground level in meters above Ordnance Datum at the exploratory hole location from which the reduced level for each stratigraphic boundary is calculated. The exploratory hole position is given as either national grid-coordinates or local grid as specified.

**ABBREVIATIONS****Samples**

- B** Bulk disturbed sample generally representative of the soil type for cohesive and fine granular soils.
- BRE** Sample taken for electrochemical testing
- C** Core soil samples
- D** Small disturbed tub sample normally taken at intermediate depth between other sampling or testing operations. The sample is stored in an airtight container.
- ES** Sample of potentially contaminated materials.
- P** Piston Sample
- PF** An attempted but failed piston sample
- U** 100mm diameter undisturbed thick-walled sample (OS-TK/W)
- UT** 100mm diameter undisturbed thin walled sample (OS-T/W)
- UF/UTF** An attempted but failed 100mm undisturbed sample.
- W** Water sample.
- EW** Water sample for contamination testing

**In-situ Testing**

- CBR** California Bearing Ratio mould sample or test.
- SPT** Standard Penetration Test (SPT) using the split barrel sampler (shoe). The corresponding 'N' value is given in the test result column.
- SWPen** Self-Weight Penetration
- PID** On Site Volatile Headspace Testing by Photo Ionisation Detector
- HVP** Hand Shear Vane test

**Rock Quality and Core Recovery**

- TCR** Total core recovery - The length of the recovered core expressed as a percentage of the length of core run.
- SCR** Solid Core Recovery - The sum length of all core pieces (measured along the centre of the core), expressed as a percentage of the length core run.
- RQD** Rock Quality Designation- The sum length of all core pieces that are 100mm or longer (measured along the centre of the core), expressed as a percentage of the length of core run.
- FI** Fracture Index- The number of fractures per 1000mm length of solid core.
- NI** Non-intact- The material recovered in a non-intact state.
- NR** No recovery from the core run.
- AZCL** Assessed Zone of Core Loss.

**Cobble Content**

Low <10%, medium 10 – 20%, high >20%

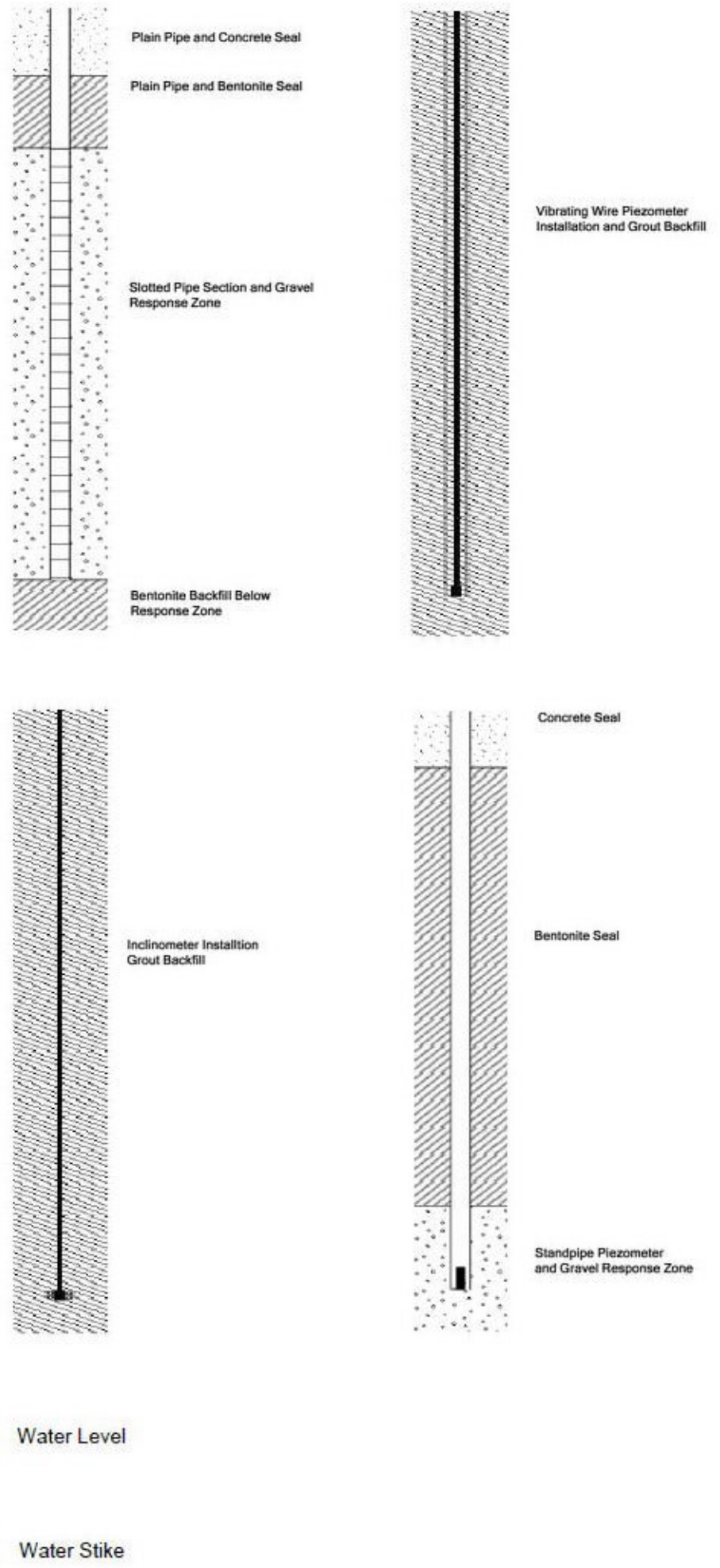


## Exploratory Hole Log Legend

### BOREHOLE LEGEND:

TOPSOIL	
MADE GROUND	
SILT	
CLAY	
SAND	
GRAVEL	
PEAT	
MUDSTONE	
SILTSTONE	
SANDSTONE	
LIMESTONE	
COAL	
CHALK	
BENTONITE	
GROUT	
ARISINGS	

## Monitoring Installation Legend:



NB Where strata consists of material of more than one soil or rock type the legends are appropriately combined.



Dunelm Geotechnical & Environmental Ltd  
 Foundation House, St John's Road, Meadowfield  
 Durham, DH78TZ  
 Tel: 0191 378 3151  
 Fax: 0191 378 3157  
 e-mail: admin@dunelm.co.uk  
 web: www.dunelm.co.uk



# SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005



SPT Hammer Ref: CD1  
 Test Date: 04/12/2020  
 Report Date: 04/12/2020  
 File Name: CD1.spt  
 Test Operator: SP

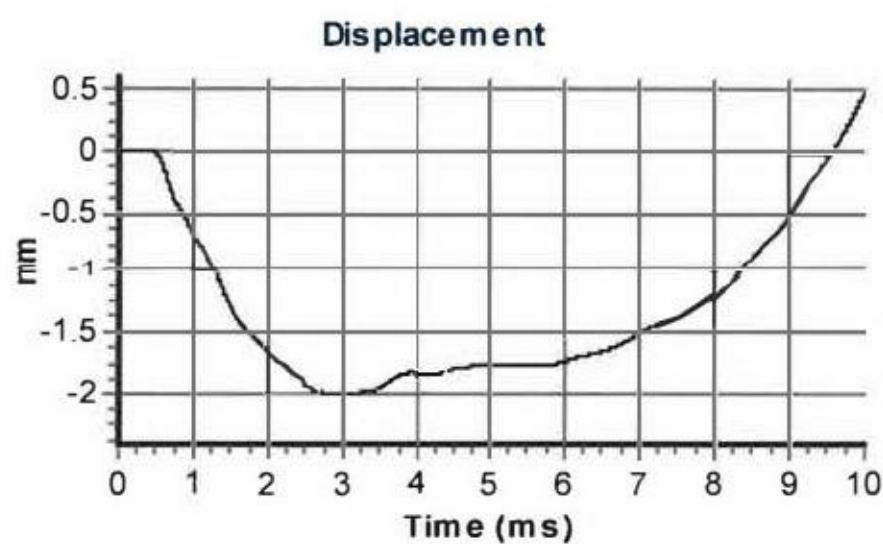
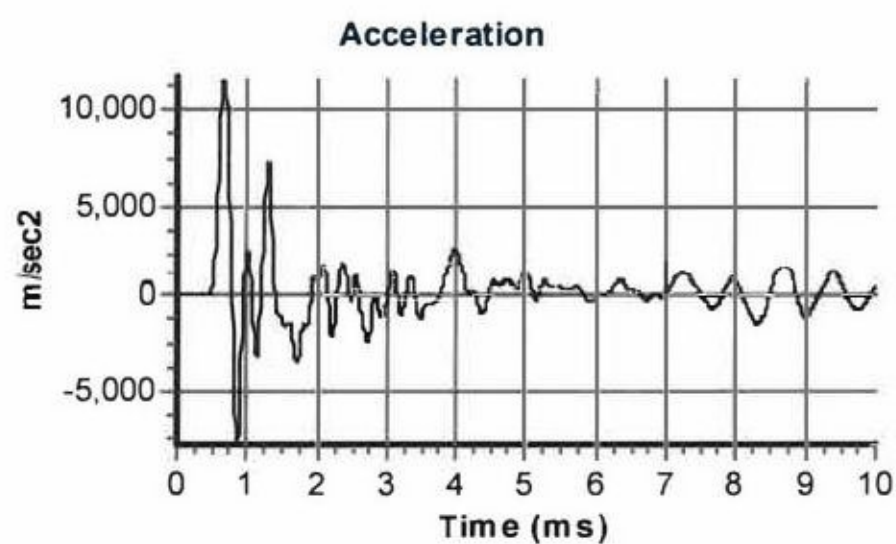
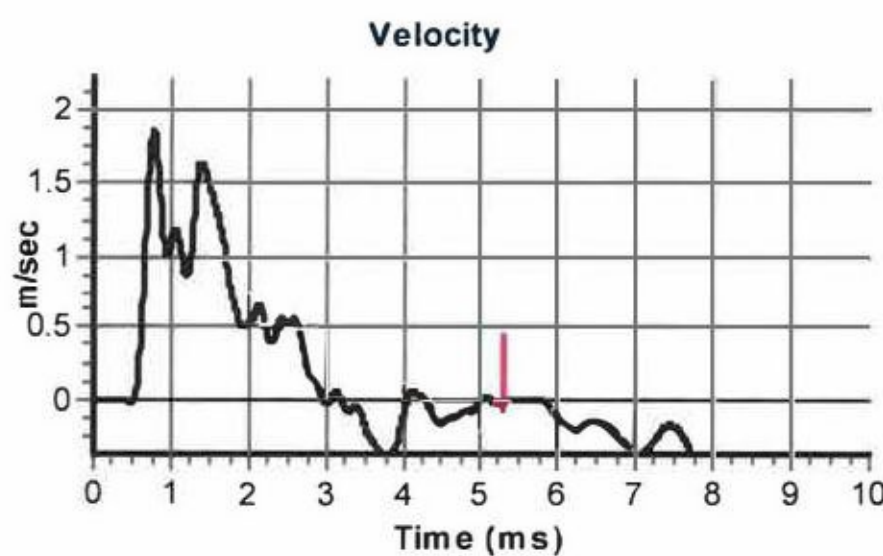
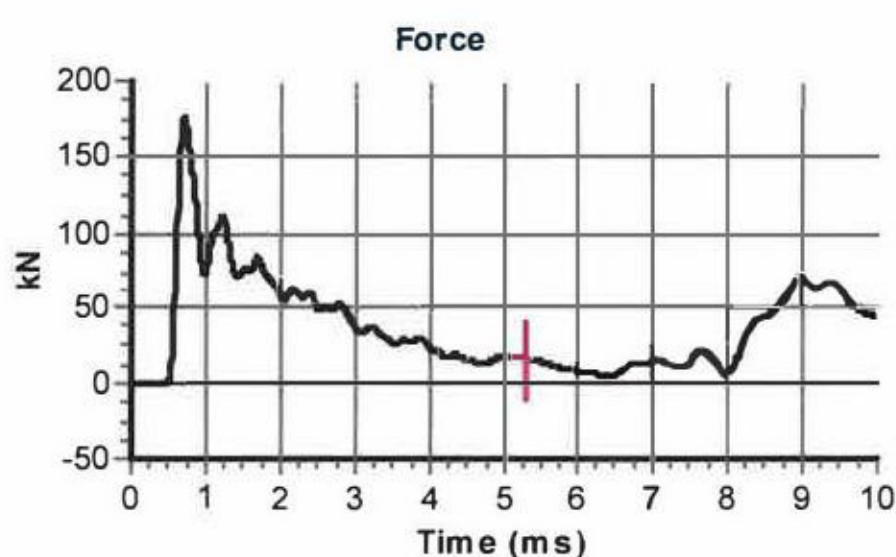
### Instrumented Rod Data

Diameter  $d_r$  (mm): 54  
 Wall Thickness  $t_r$  (mm): 6.5  
 Rod Length  $l_r$  (m): 1.0  
 Assumed Modulus  $E_a$  (GPa): 208  
 Accelerometer No.1: 6178  
 Accelerometer No.2: 5843

### SPT Hammer Information

Hammer Mass  $m$  (kg): 63.5  
 Falling Height  $h$  (mm): 760  
 SPT String Length  $L$  (m): 14.0

### Comments / Location



### Calculations

Area of Rod A (mm<sup>2</sup>): 970  
 Theoretical Energy  $E_{theor}$  (J): 473  
 Measured Energy  $E_{meas}$  (J): 282

**Energy Ratio  $E_r$  (%):** 60



Signed: Scott Pincher  
 Title: Director



# SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

SPT Hammer Ref: DART.R15  
 Test Date: 23/04/2020  
 Report Date: 23/04/2020  
 File Name: DART.R15.spt  
 Test Operator: MB

### Instrumented Rod Data

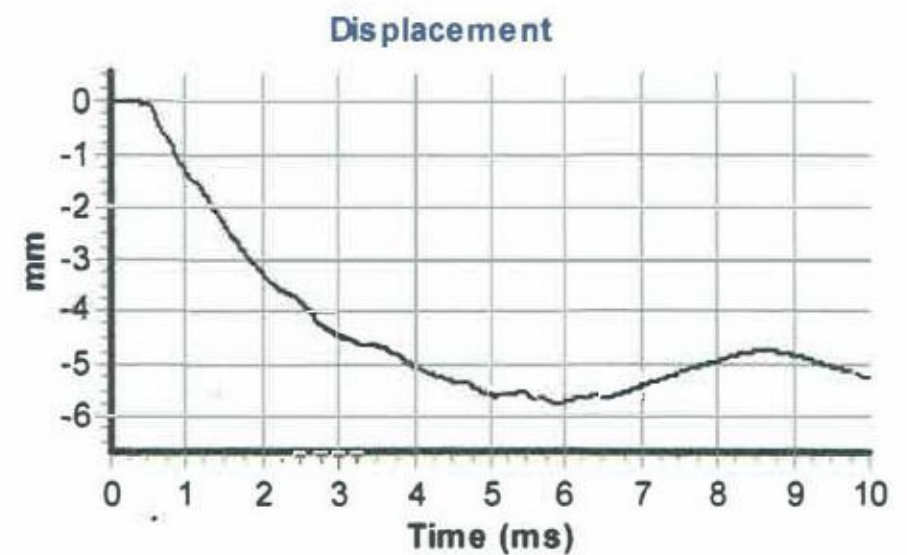
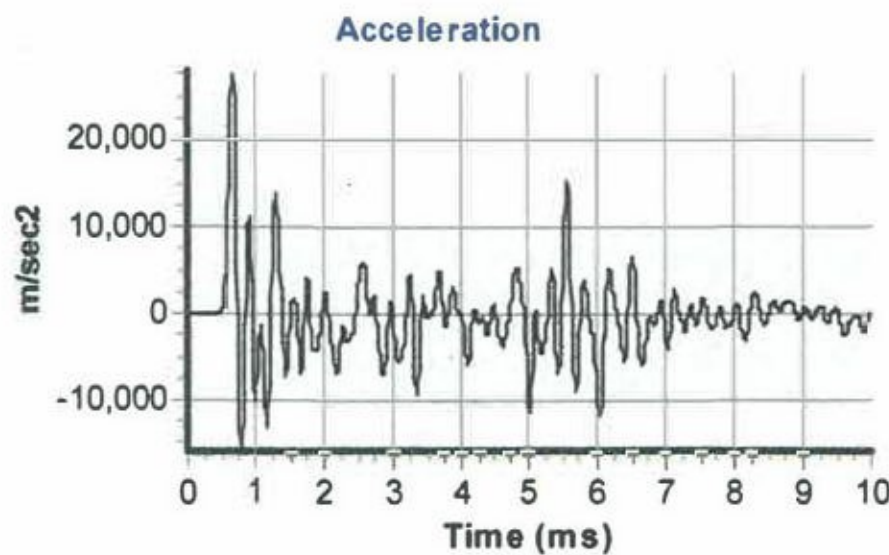
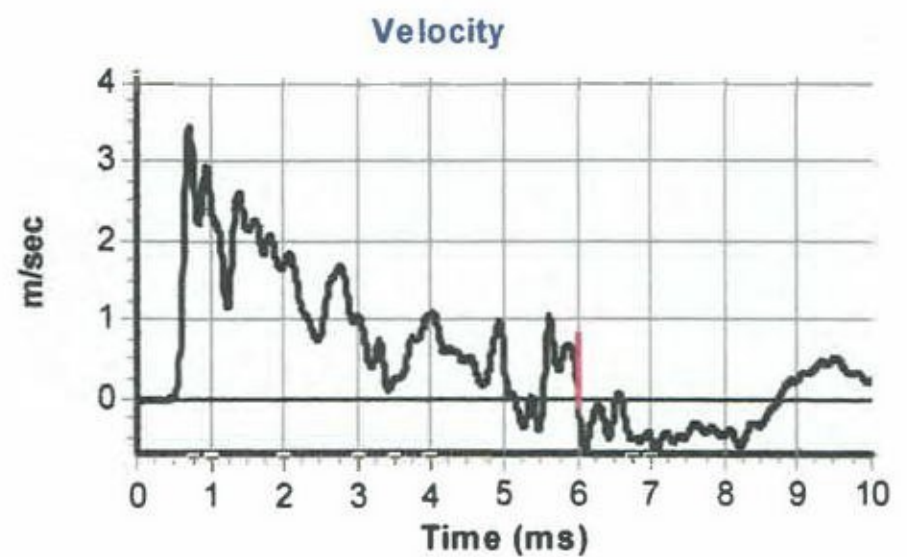
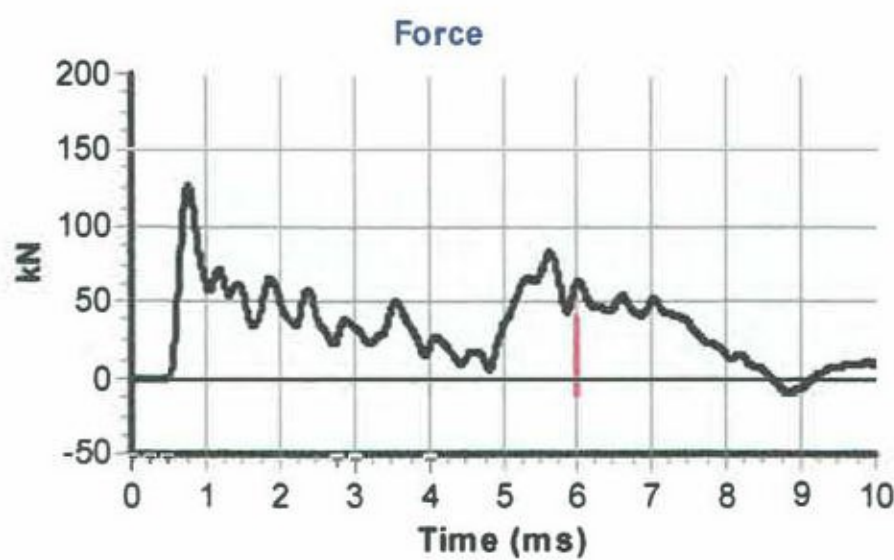
Diameter  $d_r$  (mm): 54  
 Wall Thickness  $t_r$  (mm): 6.0  
 Assumed Modulus  $E_a$  (GPa): 200  
 Accelerometer No.1: 7080  
 Accelerometer No.2: 11609

### SPT Hammer Information

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

### Comments / Location

DUNELM/70449



### Calculations

Area of Rod A ( $mm^2$ ): 905  
 Theoretical Energy  $E_{theor}$  (J): 473  
 Measured Energy  $E_{meas}$  (J): 304

**Energy Ratio  $E_r$  (%):** **64**



Signed: M.BELL  
 Title: SUPERVISOR

The recommended calibration interval is 12 months





<b>Contract:</b>	PI191009 Pegswood New Build Children's Home	<b>Contract No:</b>	D10015-2
<b>Client:</b>	Northumberland County Council		
<b>Drawing:</b>	Instrumentation Summary		
<b>Table No.</b>	B1	<b>Date:</b>	26/02/2021
		<b>Status:</b>	Final

BH No.	Instrument Type	Instrument Dia. (mm)	Response Zone		Surface Protection
			Top (m)	Base (m)	
PWS01	SP	50	0.50	1.50	Flush Cover.
PWS02	SP	50	0.50	1.00	Flush Cover.
PWS03	SP	50	0.50	1.00	Flush Cover.

	<b>Contract:</b> PI191009 Pegswood New Build Children's Home		<b>Contract No:</b> D10015-2	
	<b>Client:</b> Northumberland County Council			
TEL: 0191 378 3151	<b>Table Title:</b> Installation Summary Sheet			
<b>Table &amp; Revision No:</b> B1 - 0	<b>Date:</b> February 2021	<b>Scale:</b> NA	<b>Status:</b> Final	<b>Drawn by:</b> SH









# BOREHOLE RECORD

## Borehole PR01

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422782.60      Northing: 587730.62

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 2 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021

SAMPLE DETAILS							Casing (Groundwater)	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							10	Yellow SANDSTONE. (Drillers Description).	19.40			
							11					
							12					
							13					
							14					
							15					
							16					
							17					
							18					
							19					
							20					
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							26					
							27					
							28					
							29					
							30					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	1.20	139 92	1.20 42.50	





# BOREHOLE RECORD

## Borehole PR01

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422782.60      Northing: 587730.62

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 3 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021

SAMPLE DETAILS							Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							20	Yellow SANDSTONE. (Drillers Description).				
							21	Grey MUDSTONE. (Drillers Description).	21.00	29.64		
							22	22.00 - 42.50 80 % Water COAL. (Drillers Description).	22.00	28.64		
							23	Grey MUDSTONE. (Drillers Description).	22.50	28.14		
							24					
							25					
							26					
							27					
							28					
							29					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	1.20	139 92	1.20 42.50	





# BOREHOLE RECORD

## Borehole PR01

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422782.60      Northing: 587730.62

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 4 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							30	Grey MUDSTONE. (Drillers Description).	(20.00)			
							31					
							32					
							33					
							34					
							35					
							36					
							37					
							38					
							39					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	1.20	139 92	1.20 42.50	





# BOREHOLE RECORD

## Borehole PR01

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422782.60      Northing: 587730.62

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 5 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021

SAMPLE DETAILS							Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill	
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI							
							40	Grey MUDSTONE. (Drillers Description).           04/02/2021 1700 (1.20) Dry  End of Borehole at 42.50 m	42.50	8.14			
							41						
							42						
							43						
							44						
							45						
							46						
							47						
							48						
							49						

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	1.20	139 92	1.20 42.50	





# BOREHOLE RECORD

## Borehole PR02A

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422793.00      Northing: 587726.39

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 1 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 02/02/2021 - 03/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
								MADE GROUND (Drillers Description).	(0.40)			
								Stiff brown CLAY. (Drillers Description).	0.40	50.24		
							1		(0.80)			
							02/02/2021 1500 (0.00) Dry	CLAY. (Drillers Description).	1.20	49.44		
							03/02/2021 0800 (0.00) Dry		(0.40)			
							1.60 - 21.50 80 % Water	Yellow SANDSTONE. (Drillers Description).	1.60	49.04		
							2					
							3					
							4					
							5					
							6					
							7					
							8					
							9					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139	2.00	1. Hand dug inspection pit to 1.20m. 2. Gas readings start and end of shift: O <sub>2</sub> - 20.8%, CO <sub>2</sub> - 0%, CH <sub>4</sub> - 0%, H <sub>2</sub> S - 0ppm. Readings remained the same throughout the shift.
										92	40.00	





# BOREHOLE RECORD

## Borehole PR02A

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422793.00      Northing: 587726.39

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 2 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 02/02/2021 - 03/02/2021

SAMPLE DETAILS							Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI				
							10			
							11			
							12	(19.90)		
							13			
							14			
							15			
							16			
							17			
							18			
							19			

STRATA RECORD Description

Yellow SANDSTONE. (Drillers Description).

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139 92	2.00 40.00	





# BOREHOLE RECORD

## Borehole PR02A

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422793.00      Northing: 587726.39

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 3 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 02/02/2021 - 03/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							20	Yellow SANDSTONE. (Drillers Description).				
							21					
							21.50 - 40.00 0 % Water	VOID. (Drillers Description).	21.50	29.14		
							22		(1.70)			
							23	No flush returns, driller noted competent rock. (Drillers Description).	23.20	27.44		
							24					
							25					
							26					
							27					
							28					
							29					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139	2.00	1. Hand dug inspection pit to 1.20m. 2. Gas readings start and end of shift: O <sub>2</sub> - 20.8%, CO <sub>2</sub> - 0%, CH <sub>4</sub> - 0%, H <sub>2</sub> S - 0ppm. Readings remained the same throughout the shift.
										92	40.00	





# BOREHOLE RECORD

## Borehole PR02A

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422793.00      Northing: 587726.39

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 4 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 02/02/2021 - 03/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							30	No flush returns, driller noted competent rock. (Drillers Description).				
							31					
							32					
							33					
							34					
							35					
							36					
							37					
							38					
							39					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139	2.00	1. Hand dug inspection pit to 1.20m. 2. Gas readings start and end of shift: O <sub>2</sub> - 20.8%, CO <sub>2</sub> - 0%, CH <sub>4</sub> - 0%, H <sub>2</sub> S - 0ppm. Readings remained the same throughout the shift.
										92	40.00	





# BOREHOLE RECORD

## Borehole PR02A

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.64      Scale 1:50  
 Easting: 422793.00      Northing: 587726.39

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 5 of 5

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 02/02/2021 - 03/02/2021

SAMPLE DETAILS							Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							4003/02/2021 1730 (2.00) Dry  41  42  43  44  45  46  47  48  49	No flush returns, driller noted competent rock. (Drillers Description).  End of Borehole at 40.00 m	40.00	10.64		

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139 92	2.00 40.00	





# BOREHOLE RECORD

## Borehole PR03

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 51.04      Scale 1:50  
 Easting: 422786.40      Northing: 587714.21

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 1 of 3

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021 - 05/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
								MADE GROUND: Concrete. (Drillers Description). MADE GROUND. (Drillers Description).	(0.10) 0.10 (0.40)	50.94		
								Firm brown CLAY. (Drillers Description).	0.50 (0.70)	50.54		
							1 04/02/2021 1630 (0.00) Dry 05/02/2021 0800 (0.00) Dry	CLAY (Drillers Description).	1.20 (0.60)	49.84		
							2 1.80 - 21.00 100 % Water	Yellow SANDSTONE. (Drillers Description).	1.80	49.24		
							3					
							4					
							5					
							6					
							7					
							8					
							9					

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139 92	2.00 25.00	1. Hand dug inspection pit to 1.20m. 2. Gas readings start and end of shift: O <sub>2</sub> - 20.6%, CO <sub>2</sub> - 0%, CH <sub>4</sub> - 0%, H <sub>2</sub> S - 0ppm. Readings remained the same throughout the shift.





# BOREHOLE RECORD

## Borehole PR03

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 51.04      Scale 1:50  
 Easting: 422786.40      Northing: 587714.21

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 2 of 3

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021 - 05/02/2021

SAMPLE DETAILS							Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill	
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI							
							10	Yellow SANDSTONE. (Drillers Description).					
							11		(18.60)				
							12						
							13						
							14						
							15						
							16						
							17						
							18						
							19						

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139 92	2.00 25.00	





# BOREHOLE RECORD

## Borehole PR03

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 51.04      Scale 1:50  
 Easting: 422786.40      Northing: 587714.21

**Client:** Northumberland County Council

Driller: LP

Logged By: LP

Sheet 3 of 3

**Method:** Rotary Open Hole Drilling

Checked By: BL

Dates: 04/02/2021 - 05/02/2021

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
							20	Yellow SANDSTONE. (Drillers Description).				
							20.40	Grey MUDSTONE. (Drillers Description).	30.64	(0.60)		
							21	21.00 - 25.00 90 % Water COAL (Drillers Description).	30.04	(1.00)		
							22	Grey MUDSTONE. (Drillers Description).	29.04	(3.00)		
							23					
							24					
							25	End of Borehole at 25.00 m	26.04			
							26					
							27					
							28					
							29					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								139	2.00	139 92	2.00 25.00	





# BOREHOLE RECORD

## Borehole PWS01

**Contract No:** D10015-2

**Site:** PI191009 Pegswood New Build Children's Home

GL (m AOD) 50.56      Scale 1:50  
 Easting: 422787.91      Northing: 587733.25

**Client:** Northumberland County Council

Driller: SF

Logged By: AB

Sheet 1 of 1

**Method:** Windowless Sampling

Checked By: BL

Dates: 03/02/2021

SAMPLE DETAILS			(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	In situ Testing						
D	0.20			MADE GROUND: Light brown, sandy slightly clayey gravel. Gravel is angular to subangular, fine to coarse of limestone, sandstone, brick and concrete.	(0.40)			
ES	0.20			<i>At 0.10m: Seepage noted.</i>	0.40	50.16		
B	0.40 - 1.00			Firm dark greyish brown, slightly sandy, slightly gravelly CLAY of low plasticity. Gravel of subangular to subrounded, fine to coarse of sandstone and mudstone.	(1.20)			
D	0.50	HVP=46 kPa						
ES	0.50							
D	1.00	HVP=69 kPa	1					
D	1.00							
SPT (S)	1.20 - 1.65	N=18 (2,3/4,4,5,5)	0.01	<i>1.20-1.60m: Becoming stiff.</i>				
D	1.50			<i>1.50m: Clay of intermediate plasticity.</i>	1.60	48.96		
D	1.60				(0.10)	48.86		
SPT (S)	1.60 - 1.62	N=50+ (25 for 5mm/50 for 15mm)	0.01	Weak, yellowish brown SANDSTONE. Recovered as sand and gravel sized fragments. (Possible weathered rockhead).	1.70			
			03/02/2021 1700 (0.00) Dry	End of Borehole at 1.70 m				
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
										87	1.70	1. Hand dug inspection pit to 1.20m. 2. Borehole terminated at 1.70m on encountering hard strata.

Log last updated 30/03/2021











## **APPENDIX C**

### **Geotechnical Laboratory Results**





# Laboratory Report Front Sheet

Site name

Pegswood

Job number

D10015-2

Solmek  
12-16 Yarm Road,  
Stockton on Tees,  
TS18 3NA  
01642 607083  
lab@solmek.com



## Client details:

Reference: D10015-2  
Name: Dunelm  
Address: Foundation House,  
St John's Road,  
Meadowfield,  
County Durham,  
DH7 8TZ  
  
Telephone: 0191 3783151  
Email: blaycock@dunelm.co.uk  
  
FAO: B Laycock


Date commenced: 10/02/2021

Date reported: 24/02/2021

### Observations and interpretations are outside of 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 in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the all samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
	<input checked="" type="checkbox"/> K Watkin (Lab Manager) <input type="checkbox"/> U Mazhar (Assistant Lab Manager) <input type="checkbox"/>







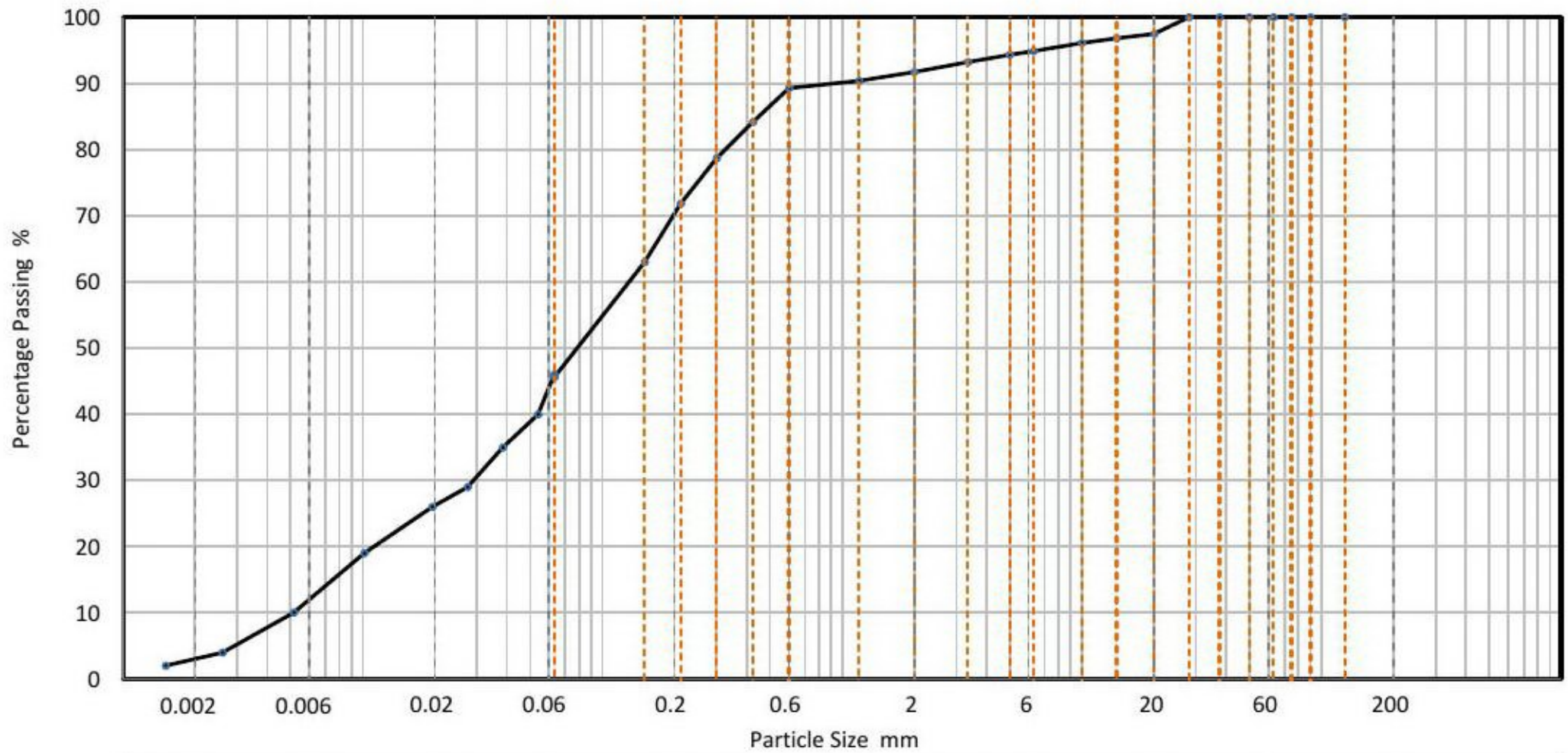
# PARTICLE SIZE DISTRIBUTION

Solmek  
12-16 Yarm Road,  
Stockton on Tees,  
TS18 3NA  
01642 607083  
lab@solmek.com



Site name	Job number
Pegswood	D10015-2

Hole	PWS03	Lab sample ID	SLMK2021021012
Depth (Top)	m 0.50	Test Method	BS 1377 - 2 : 1990 Clauses 9.2 and 9.5
Depth (Base)	m	Soil Description	Brown, slightly clayey, slightly gravelly, Very Silty SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	46
90	100	0.0538	40
75	100	0.0384	35
63	100	0.0274	29
50	100	0.0195	26
37.5	100	0.0102	19
28	100	0.0052	10
20	98	0.0026	4
14	97	0.0015	2
10	96		
6.3	95		
5	94		
3.35	93		
2	92		
1.18	90		
0.6	89	Particle density (assumed)	
0.425	84	2.65 Mg/m3	
0.3	79		
0.212	72		
0.15	63		
0.063	46		

Dry Mass of sample, g 1355

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	8.3
Sand	46.1
Silt	42.6
Clay	3.0

Grading Analysis	
D100	mm
D60	mm 0.129
D30	mm 0.0285
D10	mm 0.00532
Uniformity Coefficient	24
Curvature Coefficient	1.2

**Remarks**  
Preparation and testing in accordance with test method unless noted below

**Accreditation status**

Hydrometer is the usual Sedimentation method carried out by Solmek and is part of the Solmek UKAS accreditation schedule.

Approved by	KW
Approval date	24/02/2021 11:32





# Final Report

---

**Report No.:** 21-04557-1

**Initial Date of Issue:** 19-Feb-2021

**Client** Solmek Ltd

**Client Address:** 12 Yarm Road  
Stockton-on-Tees  
TS18 3NA

**Contact(s):** Kathryn Watkin

**Project** D10015-2 Pegswood

**Quotation No.:** **Date Received:** 16-Feb-2021

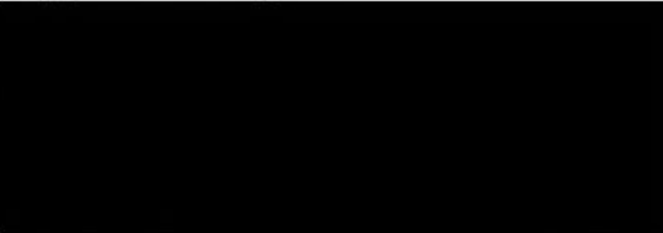
**Order No.:** LAB769 **Date Instructed:** 16-Feb-2021

**No. of Samples:** 3

**Turnaround (Wkdays):** 5 **Results Due:** 22-Feb-2021

**Date Approved:** 19-Feb-2021

**Approved By:**



**Details:** Glynn Harvey, Technical Manager

---



## Results - Soil

**Project: D10015-2 Pegswood**

<b>Client: Solmek Ltd</b>	<b>Chemtest Job No.:</b>				21-04557	21-04557	21-04557
Quotation No.:	<b>Chemtest Sample ID.:</b>				1142061	1142062	1142063
	Sample Location:				PWS02	PWS02	PWS03
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.40	1.20	0.50
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>			
Moisture	N	2030	%	0.020	16	5.6	8.7
pH	U	2010		4.0		[A] 8.7	
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	mg/l	10		[A] 25	
Organic Matter	U	2625	%	0.40	[A] 13		[A] 4.7



## Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

<b>Sample:</b>	<b>Sample Ref:</b>	<b>Sample ID:</b>	<b>Sample Location:</b>	<b>Sampled Date:</b>	<b>Deviation Code(s):</b>	<b>Containers Received:</b>
1142061			PWS02		A	Plastic Tub 1000g
1142062			PWS02		A	Plastic Tub 1000g
1142063			PWS03		A	Plastic Tub 1000g



## Test Methods

<b>SOP</b>	<b>Title</b>	<b>Parameters included</b>	<b>Method summary</b>
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.



## **Report Information**

### **Key**

---

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### **Sample Deviation Codes**

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- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

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All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

[customerservices@chemtest.com](mailto:customerservices@chemtest.com)



## **APPENDIX D**

### **Chemical Laboratory Results**







# DETS

## Certificate of Analysis

*Certificate Number* 21-02760

*Issued:* 16-Feb-21

*Client* Dunelm Geotechnical & Environmental Ltd  
Foundation House  
St. John's Road  
Meadowfield  
Durham  
DH7 8TZ

*Our Reference* 21-02760

*Client Reference* D10015-2

*Order No* PO22657/BL/D10015-2

*Contract Title* Pegswood

*Description* 5 Soil samples, 2 Leachate samples.

*Date Received* 10-Feb-21

*Date Started* 10-Feb-21

*Date Completed* 16-Feb-21

*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 full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



2139



## Summary of Chemical Analysis

### Matrix Descriptions

*Our Ref* 21-02760

*Client Ref* D10015-2

*Contract Title* Pegswood

Sample ID	Depth	Lab No	Completed	Matrix Description
PWS01	0.2	1799368	16/02/2021	Dark brown gravelly, very sandy CLAY
PWS01	0.5	1799369	16/02/2021	Dark brown sandy CLAY
PWS02	0.4	1799370	16/02/2021	Dark brown gravelly, very sandy CLAY
PWS02	0.8	1799371	16/02/2021	Dark brown gravelly, sandy CLAY
PWS03	0.15	1799372	16/02/2021	Dark brown GRAVEL (sample matrix outside MCERTS scope of accreditation)



## Summary of Chemical Analysis

### Soil Samples

Our Ref 21-02760  
 Client Ref D10015-2  
 Contract Title Pegswood

Lab No	1799368	1799369	1799370	1799371	1799372
Sample ID	PWS01	PWS01	PWS02	PWS02	PWS03
Depth	0.20	0.50	0.40	0.80	0.15
Other ID					
Sample Type	ES	ES	ES	ES	ES
Sampling Date	03/02/2021	03/02/2021	03/02/2021	03/02/2021	03/02/2021
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1799368	1799369	1799370	1799371	1799372
<b>Metals</b>								
Antimony	DETSC 2301*	1	mg/kg	< 1.0	1.0	3.4	1.5	< 1.0
Arsenic	DETSC 2301#	0.2	mg/kg	4.6	8.4	9.8	5.4	6.2
Barium	DETSC 2301#	1.5	mg/kg	390	93	240	110	77
Beryllium	DETSC 2301#	0.2	mg/kg	2.1	0.8	0.7	0.5	0.3
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.7	0.3	0.5	0.5	0.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.2	0.5	0.2	< 0.1
Chromium III	DETSC 2301*	0.15	mg/kg	11	20	17	13	8.8
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	15	19	68	22	32
Iron	DETSC 2301	25	mg/kg	12000	35000	28000	18000	21000
Lead	DETSC 2301#	0.3	mg/kg	17	28	190	20	8.5
Manganese	DETSC 2301#	20	mg/kg	2200	380	560	400	270
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	0.10	< 0.05	< 0.05
Molybdenum	DETSC 2301#	0.4	mg/kg	0.6	0.7	2.8	0.8	0.8
Nickel	DETSC 2301#	1	mg/kg	9.1	29	23	14	14
Selenium	DETSC 2301#	0.5	mg/kg	1.0	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	18	32	55	36	75
Zinc	DETSC 2301#	1	mg/kg	51	62	170	62	52
<b>Inorganics</b>								
pH	DETSC 2008#		pH	10.9	7.9	8.9	11.9	12.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Complex	DETSC 2130*	0.2	mg/kg	< 0.2	< 0.2	0.4	< 0.2	< 0.2
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	2.6	2.1	2.3	2.1	1.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	330	39	70	46	< 10
Sulphate as SO4, Total	DETSC 2321#	100	mg/kg	4950	165	1070	3930	4930



## Summary of Chemical Analysis

### Soil Samples

Our Ref 21-02760  
 Client Ref D10015-2  
 Contract Title Pegswood

Lab No	1799368	1799369	1799370	1799371	1799372
Sample ID	PWS01	PWS01	PWS02	PWS02	PWS03
Depth	0.20	0.50	0.40	0.80	0.15
Other ID					
Sample Type	ES	ES	ES	ES	ES
Sampling Date	03/02/2021	03/02/2021	03/02/2021	03/02/2021	03/02/2021
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1799368	1799369	1799370	1799371	1799372
<b>Petroleum Hydrocarbons</b>								
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C35-C44	DETSC 3072*	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C10-C44	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	0.20
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C35-C44	DETSC 3072*	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C10-C44	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
Ali/Aro C10-C44	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
<b>PAHs</b>								
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	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.2	0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.7	0.2	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	0.2	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	1.2	0.4	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.9	0.4	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.7	0.3	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.6	0.2	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	0.6	0.3	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.4	0.2	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.6	0.3	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	0.7	0.7	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.2	0.3	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	0.4	0.4	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	5.2	< 1.6	7.6	3.9	< 1.6
<b>Phenols</b>								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3



## Summary of Chemical Analysis

### Leachate Samples

Our Ref 21-02760  
 Client Ref D10015-2  
 Contract Title Pegswood

Lab No	1799373	1799374
Sample ID	PWS01	PWS02
Depth	0.20	0.80
Other ID		
Sample Type	ES	ES
Sampling Date	03/02/2021	03/02/2021
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>Preparation</b>					
BS EN 12457 10:1	DETSC 1009*			Y	Y
<b>Metals</b>					
Antimony, Dissolved	DETSC 2306	0.17	ug/l	1.2	0.34
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	2.1	0.62
Barium, Dissolved	DETSC 2306	0.26	ug/l	7.4	2.3
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	0.2	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	21	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	0.05	< 0.03
Chromium III, Dissolved	DETSC 2306*	1	ug/l	1.8	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	12	2.6
Iron, Dissolved	DETSC 2306	5.5	ug/l	54	300
Lead, Dissolved	DETSC 2306	0.09	ug/l	1.1	0.35
Manganese, Dissolved	DETSC 2306	0.22	ug/l	5.2	1.9
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.02	< 0.01
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	3.5	1.3
Nickel, Dissolved	DETSC 2306	0.5	ug/l	1.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	1.8	0.73
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	4.4	1.0
Zinc, Dissolved	DETSC 2306	1.3	ug/l	15	2.5
<b>Inorganics</b>					
pH	DETSC 2008		pH	9.3	8.0
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20
Cyanide, Complex	DETSC 2130*	40	ug/l	< 40	< 40
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	< 0.015	< 0.015
Sulphate as SO4	DETSC 2055	0.1	mg/l	11	3.9



## Summary of Chemical Analysis

### Leachate Samples

Our Ref 21-02760  
 Client Ref D10015-2  
 Contract Title Pegswood

Lab No	1799373	1799374
Sample ID	PWS01	PWS02
Depth	0.20	0.80
Other ID		
Sample Type	ES	ES
Sampling Date	03/02/2021	03/02/2021
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>Petroleum Hydrocarbons</b>					
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C10-C44	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C35-C44	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C35-C44	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C10-C44	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Ali/Aro C10-C44	DETSC 3072*	1	ug/l	< 1.0	< 1.0
<b>PAHs</b>					
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.03	0.11
Anthracene	DETSC 3304	0.01	ug/l	0.02	0.05
Fluoranthene	DETSC 3304	0.01	ug/l	0.04	0.22
Pyrene	DETSC 3304	0.01	ug/l	0.04	0.20
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.02	0.10
Chrysene	DETSC 3304	0.01	ug/l	0.03	0.11
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.03	0.13
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.05
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.03	0.11
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.03	0.09
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.03
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.03	0.09
PAH Total	DETSC 3304	0.2	ug/l	0.37	1.3
<b>Phenols</b>					
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100



## Summary of Asbestos Analysis

### Soil Samples

*Our Ref* 21-02760

*Client Ref* D10015-2

*Contract Title* Pegswood

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1799368	PWS01 0.20	SOIL	NAD	none	Darryl Fletcher
1799370	PWS02 0.40	SOIL	Chrysotile	Bundles of Chrysotile Fibres	Darryl Fletcher
1799371	PWS02 0.80	SOIL	NAD	none	Darryl Fletcher
1799372	PWS03 0.15	SOIL	NAD	none	Darryl Fletcher

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 21-02760  
 Client Ref D10015-2  
 Contract Pegswood

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1799368	PWS01 0.20 SOIL	03/02/21	GJ 250ml, GJ 60ml, PT 1L	Ammonia (3 days)	
1799369	PWS01 0.50 SOIL	03/02/21	GJ 250ml, GJ 60ml, PT 1L	Ammonia (3 days)	
1799370	PWS02 0.40 SOIL	03/02/21	GJ 250ml, GJ 60ml, PT 1L	Ammonia (3 days)	
1799371	PWS02 0.80 SOIL	03/02/21	GJ 250ml, GJ 60ml, PT 1L	Ammonia (3 days)	
1799372	PWS03 0.15 SOIL	03/02/21	GJ 250ml, GJ 60ml, PT 1L	Ammonia (3 days)	
1799373	PWS01 0.20 LEACHATE	03/02/21	GJ 250ml, GJ 60ml, PT 1L		
1799374	PWS02 0.80 LEACHATE	03/02/21	GJ 250ml, GJ 60ml, 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
DETS 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETS 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETS 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETS 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETS 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETS 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETS 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETS 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETS 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETS2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETS2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETS2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETS2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETS2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETS2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETS2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETS 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 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
DETS 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETS 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETS 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





# DETS

## Certificate of Analysis

*Certificate Number* 21-03607

*Issued:* 25-Feb-21

*Client* Dunelm Geotechnical & Environmental Ltd  
Foundation House  
St. John's Road  
Meadowfield  
Durham  
DH7 8TZ

*Our Reference* 21-03607

*Client Reference* D10015-2

*Order No* 22713BLD100152

*Contract Title* Pegswood

*Description* One Water sample.

*Date Received* 19-Feb-21

*Date Started* 19-Feb-21

*Date Completed* 25-Feb-21

*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 full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



2139



## Summary of Chemical Analysis

### Water Samples

Our Ref 21-03607

Client Ref D10015-2

Contract Title Pegswood

Lab No	1804646
Sample ID	PWS01
Depth	
Other ID	
Sample Type	WATER
Sampling Date	17/02/2021
Sampling Time	n/s

Test	Method	LOD	Units	
<b>Metals</b>				
Antimony, Dissolved	DETSC 2306	0.17	ug/l	3.2
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	3.0
Barium, Dissolved	DETSC 2306	0.26	ug/l	21
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	21
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03
Chromium III, Dissolved	DETSC 2306*	1	ug/l	6.9
Chromium, Hexavalent	DETSC 2203	7	ug/l	19
Copper, Dissolved	DETSC 2306	0.4	ug/l	71
Iron, Dissolved	DETSC 2306	5.5	ug/l	140
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.55
Manganese, Dissolved	DETSC 2306	0.22	ug/l	14
Mercury, Total	DETSC 2306*	0.01	ug/l	0.04
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	11
Nickel, Dissolved	DETSC 2306	0.5	ug/l	5.7
Selenium, Dissolved	DETSC 2306	0.25	ug/l	1.9
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	25
Zinc, Dissolved	DETSC 2306	1.3	ug/l	3.6
<b>Inorganics</b>				
pH	DETSC 2008		pH	10.8
Cyanide, Total	DETSC 2130	40	ug/l	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20
Cyanide, Complex	DETSC 2130*	40	ug/l	< 40
Thiocyanate	DETSC 2130	20	ug/l	< 20
Hardness	DETSC 2303	0.1	mg/l	87.3
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.040
Sulphate as SO4	DETSC 2055	0.1	mg/l	66
<b>Petroleum Hydrocarbons</b>				
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	2.8
Aliphatic C10-C44	DETSC 3072*	1	ug/l	280
Aliphatic C12-C16	DETSC 3072*	1	ug/l	17
Aliphatic C16-C21	DETSC 3072*	1	ug/l	44
Aliphatic C21-C35	DETSC 3072*	1	ug/l	180
Aliphatic C35-C44	DETSC 3072*	1	ug/l	29
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	8.2



## Summary of Chemical Analysis

### Water Samples

Our Ref 21-03607

Client Ref D10015-2

Contract Title Pegswood

Lab No	1804646
Sample ID	PWS01
Depth	
Other ID	
Sample Type	WATER
Sampling Date	17/02/2021
Sampling Time	n/s

Test	Method	LOD	Units	
Aromatic C12-C16	DETSC 3072*	1	ug/l	30
Aromatic C16-C21	DETSC 3072*	1	ug/l	71
Aromatic C21-C35	DETSC 3072*	1	ug/l	230
Aromatic C35-C44	DETSC 3072*	1	ug/l	63
Aromatic C10-C44	DETSC 3072*	1	ug/l	400
Ali/Aro C10-C44	DETSC 3072*	1	ug/l	670
<b>PAHs</b>				
Naphthalene	DETSC 3304	0.05	ug/l	0.24
Acenaphthylene	DETSC 3304	0.01	ug/l	0.04
Acenaphthene	DETSC 3304	0.01	ug/l	0.17
Fluorene	DETSC 3304	0.01	ug/l	0.11
Phenanthrene	DETSC 3304	0.01	ug/l	0.59
Anthracene	DETSC 3304	0.01	ug/l	0.20
Fluoranthene	DETSC 3304	0.01	ug/l	0.88
Pyrene	DETSC 3304	0.01	ug/l	1.1
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.48
Chrysene	DETSC 3304	0.01	ug/l	0.47
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.51
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.17
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.36
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.25
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	0.07
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.24
PAH Total	DETSC 3304	0.2	ug/l	5.9
<b>Phenols</b>				
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100



## Information in Support of the Analytical Results

Our Ref 21-03607

Client Ref D10015-2

Contract Pegswood

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1804646	PWS01 WATER	17/02/21	GB 1L x2, GV x2	pH/Cond/TDS (1 days)	

Key: G-Glass 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.

### 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





# DETS

## Certificate of Analysis

*Certificate Number* 21-06139

*Issued:* 25-Mar-21

*Client* Dunelm Geotechnical & Environmental Ltd  
Foundation House  
St. John's Road  
Meadowfield  
Durham  
DH7 8TZ

*Our Reference* 21-06139

*Client Reference* D10015-2

*Order No* PO22657/BL/D10015-2

*Contract Title* Pegswood

*Description* One Soil sample.

*Date Received* 10-Feb-21

*Date Started* 23-Mar-21

*Date Completed* 25-Mar-21

*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 full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



2139



## Summary of Asbestos Analysis

### Samples

*Our Ref* 21-06139

*Client Ref* D10015-2

*Contract Title* Pegswood

Lab No	Sample ID	Sample Location	Material Type	Result	Comment*	Analyst
--------	-----------	-----------------	---------------	--------	----------	---------

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 21-06139  
 Client Ref D10015-2  
 Contract Title Pegswood

Lab No	1821277
Sample ID	PWS02
Depth	0.40
Other ID	
Sample Type	SOIL
Sampling Date	03/02/2021
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	61.74
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 %	na
% Chrysotile bundles in sample		Mass %	<0.001
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 21-06139  
 Client Ref D10015-2  
 Contract Pegswood

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1821277	PWS02 0.40 SOIL	03/02/21	No containers logged		Cannot evaluate

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.

### 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 E**

### **Gas and Groundwater Monitoring Results**







# WATER QUALITY DATA SHEET

<b>PROJECT NUMBER</b>		D10015-2			<b>INSTRUMENT DETAILS</b>	
<b>CONTRACT NAME</b>		PI191009 Pegswood New Build Children's Home			<b>NAME</b>	
					Hannah HI 9829 Multiparameter	
					<b>SERIAL NUMBER</b>	
					<b>LAST CALIBRATION</b>	
<b>DATE &amp; TIME</b>						
<b>DAY</b>	<b>MONTH</b>	<b>YEAR</b>	<b>TIME (Start)</b>	<b>TIME (Finish)</b>		
17	02	2021	08:45	09:50		

<b>BH No.</b>	<b>Temperature (C)</b>	<b>Conductivity (mS/cm)</b>	<b>Redox Potential (mV)</b>	<b>Dissolved Oxygen (ppm)</b>	<b>pH</b>	<b>Quantity Sampled (l)</b>
PWS01	4.10	0.508	-93.0	0.97	7.91	2x2ltr GB, 2x40ml GV





# GAS MONITORING DATA SHEET

PROJECT NUMBER	D10015-2
CONTRACT NAME	PI191009 Pegswood New Build Children's Home

DATE & TIME					REGIONAL TREND		INSTRUMENT DETAILS		NOTES	
DAY	MONTH	YEAR	TIME (Start)	TIME (Finish)	Rising		NAME	GFM435		
17	02	2021	08:45	09:50			SERIAL NUMBER	11939		
AMBIENT READINGS					PID reading (ppm)		LAST CALIBRATION	08/09/2020	VISIT NO	
O2 (% v/v)	20	CO2 (% v/v)	ND	CH4 (% v/v)	ND	NR	NAME		1	12
ATMOSPHERIC PRESSURE (mbar)				START	995	FINISH	997	SERIAL NUMBER		WEATHER CONDITIONS
AIR TEMPERATURE °C				START	7	FINISH	7	LAST CALIBRATION		GROUND CONDITIONS
									Cloudy	Wet

BH No.	Pipe Diameter	Flow Rate (l/hr)		Differential pressure mbar	CH <sub>4</sub> (%v/v)		CO <sub>2</sub> (%v/v)		O <sub>2</sub> (%v/v)		PID (ppm)		H <sub>2</sub> S (ppm)	CO (ppm)	SWL (m bgl)	Base of pipe (m bgl)	Remarks
		Peak	Steady		Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Low					
PWS01	50	ND	ND	ND	ND	ND	ND	ND	17.90	17.90	NR	NR	ND	ND	0.52	1.10	
PWS02	50	ND	ND	ND	ND	ND	1.10	1.10	17.70	17.70	NR	NR	ND	ND	0.92	1.00	
PWS03	50	ND	ND	ND	ND	ND	0.40	0.40	18.70	18.70	NR	NR	ND	ND	DRY	1.50	

MONITORING ORDER IS FROM LEFT TO RIGHT ACROSS THE TABLE  
REGIONAL TREND IS THAT SHOWN AT THE NEAREST MET OFFICE LOCATION AT THE TIME OF MONITORING.

KEY:	
ND	None Detected
NR	Not Recorded
SWL	Standing Water Level





# GAS MONITORING DATA SHEET

PROJECT NUMBER	D10015-2
CONTRACT NAME	PI191009 Pegswood New Build Children's Home

DATE & TIME					REGIONAL TREND		INSTRUMENT DETAILS		NOTES	
DAY	MONTH	YEAR	TIME (Start)	TIME (Finish)	Rising		NAME	GFM435		
04	03	2021	08:40	09:00			SERIAL NUMBER	11939		
AMBIENT READINGS					PID reading (ppm)		LAST CALIBRATION		VISIT NO	
O2 (% v/v)	20	CO2 (% v/v)	ND	CH4 (% v/v)	ND	NR	08/09/2020		2	12
ATMOSPHERIC PRESSURE (mbar)				START	1024	FINISH	1024	WEATHER CONDITIONS		GROUND CONDITIONS
AIR TEMPERATURE °C				START	4	FINISH	5	Raining		Wet

BH No.	Pipe Diameter	Flow Rate (l/hr)		Differential pressure mbar	CH <sub>4</sub> (%v/v)		CO <sub>2</sub> (%v/v)		O <sub>2</sub> (%v/v)		PID (ppm)		H <sub>2</sub> S (ppm)	CO (ppm)	SWL (m bgl)	Base of pipe (m bgl)	Remarks
		Peak	Steady		Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Low					
PWS01	50	ND	ND	ND	ND	ND	ND	ND	18.80	18.80	NR	NR	ND	ND	DRY	1.27	
PWS02	50	ND	ND	ND	ND	ND	1.70	1.70	17.50	17.50	NR	NR	ND	ND	0.85	0.94	
PWS03	50	ND	ND	ND	ND	ND	0.70	0.70	19.00	19.00	NR	NR	ND	ND	DRY	1.38	

MONITORING ORDER IS FROM LEFT TO RIGHT ACROSS THE TABLE  
 REGIONAL TREND IS THAT SHOWN AT THE NEAREST MET OFFICE LOCATION AT THE TIME OF MONITORING.

KEY:	
ND	None Detected
NR	Not Recorded
SWL	Standing Water Level





# GAS MONITORING DATA SHEET

PROJECT NUMBER	D10015-2
CONTRACT NAME	PI191009 Pegswood New Build Children's Home

DATE & TIME					REGIONAL TREND		INSTRUMENT DETAILS		NOTES		
DAY	MONTH	YEAR	TIME (Start)	TIME (Finish)	Rising		NAME	GFM436			
25	03	2021	09:50	10:10			SERIAL NUMBER	12666			
AMBIENT READINGS					PID reading (ppm)		LAST CALIBRATION	08/06/2021	VISIT NO		
O2 (% v/v)	20.2	CO2 (% v/v)	ND	CH4 (% v/v)	ND	NR	NAME		3	12	
ATMOSPHERIC PRESSURE (mbar)				START	1002	FINISH	1002	SERIAL NUMBER		WEATHER CONDITIONS	
AIR TEMPERATURE °C				START	8	FINISH	8	LAST CALIBRATION		Cloudy	
										GROUND CONDITIONS	Damp

BH No.	Pipe Diameter	Flow Rate (l/hr)		Differential pressure mbar	CH <sub>4</sub> (%v/v)		CO <sub>2</sub> (%v/v)		O <sub>2</sub> (%v/v)		PID (ppm)		H <sub>2</sub> S (ppm)	CO (ppm)	SWL (m bgl)	Base of pipe (m bgl)	Remarks
		Peak	Steady		Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Low					
PWS01	50	ND	ND	ND	ND	ND	ND	ND	19.40	19.40	NR	NR	ND	ND	DRY	1.27	
PWS02	50	ND	ND	ND	ND	ND	1.80	1.80	17.40	17.40	NR	NR	ND	ND	0.86	0.94	
PWS03	50	ND	ND	ND	ND	ND	0.40	0.40	19.70	19.70	NR	NR	ND	ND	DRY	1.38	

MONITORING ORDER IS FROM LEFT TO RIGHT ACROSS THE TABLE  
REGIONAL TREND IS THAT SHOWN AT THE NEAREST MET OFFICE LOCATION AT THE TIME OF MONITORING.

KEY:	
ND	None Detected
NR	Not Recorded
SWL	Standing Water Level



## **APPENDIX F**

### **Dunelm Notes On Limitations**





## Dunelm Conditions of Offer and Notes on Limitations of Investigation

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, soil gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

The firm cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. The firm are not responsible for the action negligent or otherwise of subcontractors or third parties.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.2.7 of *BS 10175:2011 +A2:2017* in order to confirm the conceptual assumptions, and in accordance with *BS5930:2015*. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, the firm cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.



## **Appendix 3**

### **Contamination Summary**









Leachates	Determinand		Surface Waters	Ground Water	1799373	1799374
			Fresh		PWS01 Depth: 0.20mbgl Made Ground Granular	PWS02 Depth: 0.80mbgl Made Ground Granular
<b>Metals</b>						
Antimony	ug/l	-	5.0	1.20	0.34	
Arsenic	ug/l	50	10	2.10	0.62	
Barium	ug/l	-	700	7.40	2.30	
Beryllium	ug/l	-	4.0	0.20	<0.1	
Boron (water soluble)	ug/l	2,000	1,000	21.00	<12	
Cadmium	ug/l	0.09	5.0	0.05	<0.03	
Chromium (III)	ug/l	4.7	50	1.80	<1.0	
Chromium (VI) - hexavalent	ug/l	3.40	-	<7	<7	
Copper	ug/l	10.0	2,000	12.00	2.60	
Iron	ug/l	1,000	200	54.00	300.00	
Lead	ug/l	7.2	10	1.10	0.35	
Manganese	ug/l	-	50	5.20	1.90	
Mercury (Elemental)	ug/l	-	-	0.02	<0.01	
Molybdenum	ug/l	-	-	3.50	1.30	
Nickel	ug/l	20	20	1.50	<0.5	
Selenium	ug/l	-	10	1.80	0.73	
Vanadium	ug/l	20	-	4.40	1.00	
Zinc	ug/l	50.0	3,000	15.00	2.50	
<b>Inorganics</b>						
Ammonia	ug/l	200	500	<15	<15	
Cyanide Complex	ug/l	-	-	<40	<40	
Cyanide Free	ug/l	1.0	50	<20	<20	
Cyanide Total	ug/l	-	-	<40	<40	
pH	-	6.0 - 9.0	6.5 - 8.5	9.30	8.00	
Sulphate Water Soluble (SO4)	mg/l	-	250	11.00	3.90	
Thiocyanate	ug/l	-	-	<20	<20	
<b>TPHs</b>						
Aliphatic EC >5-6 (benzene)	ug/l	20	300	<0.1	<0.1	
Aliphatic EC >6-8 (toluene)	ug/l	20	300	<0.1	<0.1	
Aliphatic EC >8-10	ug/l	20	300	<0.1	<0.1	
Aliphatic EC >10-12	ug/l	20	300	<1.0	<1.0	
Aliphatic EC >12-16	ug/l	20	300	<1.0	<1.0	
Aliphatic EC >16-21	ug/l	NV	NV	<1.0	<1.0	
Aliphatic EC >21-C35	ug/l	NV	NV	<1.0	<1.0	
Aliphatic EC >35-44	ug/l	NV	NV	<1.0	<1.0	
Aromatic EC >5-7	ug/l	10	1.0	<0.1	<0.1	
Aromatic EC >7-8	ug/l	50	700	<0.1	<0.1	
Aromatic EC >8-10	ug/l	20	300	<0.1	<0.1	
Aromatic EC >10-12	ug/l	20	100	<1.0	<1.0	
Aromatic EC >12-16	ug/l	20	100	<1.0	<1.0	
Aromatic EC >16-21	ug/l	20	90	<1.0	<1.0	
Aromatic EC >21-35	ug/l	20	90	<1.0	<1.0	
Aromatic EC >35-44	ug/l	20	90	<1.0	<1.0	
Aliphatic + Aromatic EC >44-70	ug/l	-	-	<1	<1	
<b>PAHs</b>						
Acenaphthene	ug/l	NV	-	0.01	<0.01	
Acenaphthylene	ug/l	NV	-	<0.01	<0.01	
Anthracene	ug/l	0.10	-	0.02	0.05	
Benzo(a)anthracene	ug/l	0.05	-	0.02	0.10	
Benzo(a)pyrene	ug/l	0.05	0.01	0.03	0.11	
Benzo(b)fluoranthene	ug/l			0.03	0.13	
Benzo(k)fluoranthene	ug/l	0.03 sum		0.01	0.05	
Benzo(ghi)perylene	ug/l		0.10 sum	0.03	0.09	
Indeno(123-cd)pyrene	ug/l	0.002 sum		0.03	0.09	
Chrysene	ug/l	NV	-	0.03	0.11	
Dibenzo(ah)anthracene	ug/l	0.05	-	<0.01	0.03	
Fluoranthene	ug/l	0.10	-	0.04	0.22	
Fluorene	ug/l	NV	-	<0.01	<0.01	
Naphthalene	ug/l	2.40	-	<0.05	<0.05	
Phenanthrene	ug/l	NV	-	0.03	0.11	
Pyrene	ug/l	-	-	0.04	0.20	
PAH (total)	mg/kg	-	-	0.37	1.30	
<b>Phenols</b>						
Phenol	ug/l	7.7	-	<100	<100	



Groundwaters	Determinand		Surface Waters	Ground Water	1804646 PWS01 GROUND WATER
			Fresh		
<b>Metals</b>					
Antimony	ug/l	-	5.0	3.20	
Arsenic	ug/l	50	10	3.20	
Barium	ug/l	-	700	21.00	
Beryllium	ug/l	-	4.0	<0.1	
Boron (water soluble)	ug/l	2,000	1,000	21.00	
Cadmium	ug/l	0.09	5.0	<0.03	
Chromium (III)	ug/l	4.7	50	6.90	
Chromium (VI) - hexavalent	ug/l	3.40	-	19.00	
Copper	ug/l	10.0	2,000	71.00	
Iron	ug/l	1,000	200	140.00	
Lead	ug/l	7.2	10	0.55	
Manganese	ug/l	-	50	14.00	
Mercury (Elemental)	ug/l	-	-	0.04	
Molybdenum	ug/l	-	-	11.00	
Nickel	ug/l	20	20	5.70	
Selenium	ug/l	-	10	1.90	
Vanadium	ug/l	20	-	25.00	
Zinc	ug/l	50.0	3,000	3.60	
<b>Inorganics</b>					
Ammonia	ug/l	200	500	40.00	
Cyanide Complex	ug/l	-	-	<40	
Cyanide Free	ug/l	1.0	50	<20	
Cyanide Total	ug/l	-	-	<40	
pH	-	6.0 - 9.0	6.5 - 8.5	10.80	
Sulphate Water Soluble (SO4)	mg/l	-	250	66.00	
Thiocyanate	ug/l	-	-	<20	
<b>TPHs</b>					
Aliphatic EC >5-6 (benzene)	ug/l	20	300	<0.1	
Aliphatic EC >6-8 (toluene)	ug/l	20	300	<0.1	
Aliphatic EC >8-10	ug/l	20	300	<0.1	
Aliphatic EC >10-12	ug/l	20	300	2.80	
Aliphatic EC >12-16	ug/l	20	300	17.00	
Aliphatic EC >16-21	ug/l	NV	NV	44.00	
Aliphatic EC >21-C35	ug/l	NV	NV	180.00	
Aliphatic EC >35-44	ug/l	NV	NV	29.00	
Aromatic EC >5-7	ug/l	10	1.0	<0.1	
Aromatic EC >7-8	ug/l	50	700	<0.1	
Aromatic EC >8-10	ug/l	20	300	<0.1	
Aromatic EC >10-12	ug/l	20	100	8.20	
Aromatic EC >12-16	ug/l	20	100	30.00	
Aromatic EC >16-21	ug/l	20	90	71.00	
Aromatic EC >21-35	ug/l	20	90	230.00	
Aromatic EC >35-44	ug/l	20	90	63.00	
Aliphatic + Aromatic EC >44-70	ug/l	-	-	670.00	
<b>PAHs</b>					
Acenaphthene	ug/l	NV	-	0.17	
Acenaphthylene	ug/l	NV	-	0.04	
Anthracene	ug/l	0.10	-	0.20	
Benzo(a)anthracene	ug/l	0.05	-	0.48	
Benzo(a)pyrene	ug/l	0.05	0.01	0.36	
Benzo(b)fluoranthene	ug/l			0.51	
Benzo(k)fluoranthene	ug/l	0.03 sum		0.17	
Benzo(ghi)perylene	ug/l		0.10 sum	0.24	
Indeno(123-cd)pyrene	ug/l	0.002 sum		0.25	
Chrysene	ug/l	NV	-	0.47	
Dibenzo(ah)anthracene	ug/l	0.05	-	0.07	
Fluoranthene	ug/l	0.10	-	0.88	
Fluorene	ug/l	NV	-	0.11	
Naphthalene	ug/l	2.40	-	0.24	
Phenanthrene	ug/l	NV	-	0.59	
Pyrene	ug/l	-	-	1.10	
PAH (total)	mg/kg	-	-	5.90	
<b>Phenols</b>					
Phenol	ug/l	7.7	-	<100	



## Appendix 4

### Assessment Criteria



SOIL ASSESSMENT CRITERIA FOR HUMAN HEALTH RISK ASSESSMENT

Parameter	Residential						Commercial			Allotment			Public Open Space near Residential land (POSres)			Public Park Land (POSpark)			Source	Model
	With Home Grown Produce			Without Home Grown Produce			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )				
	1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )			1-6% SOM (mg kg <sup>-1</sup> )				
<b>Metals/Metalloids (a)</b>																				
Antimony	Not Derived			550			7,500			Not Derived			-			-			CL-AIRE	CLEA v1.06
Arsenic (inorganic)	37			40			640			43			79			170			LQM/CIH S4ULs	CLEA v1.071
Barium	Not Derived			1,300			22,000			Not Derived			-			-			CL-AIRE	CLEA v1.06
Beryllium	1.7			1.7			12			35			2.2			63			LQM/CIH S4ULs	CLEA v1.071
Boron	290			11,000			240,000			45			21,000			46,000			LQM/CIH S4ULs	CLEA v1.071
Cadmium (d)	11			85			190			1.9			120			560			LQM/CIH S4ULs	CLEA v1.071
Chromium (III)	910			910			8,600			18,000			1,500			33,000			LQM/CIH S4ULs	CLEA v1.071
Chromium (VI) (e)	6			6			33			1.8			7.7			220			LQM/CIH S4ULs	CLEA v1.071
Copper	2,400			7,100			68,000			520			12,000			44,000			LQM/CIH S4ULs	CLEA v1.071
Lead (f)	200			310			2,330			80			630			1,300			CL-AIRE C4SL	CLEA
Mercury (Elemental)	1.2			1.2			58			21			16			30			LQM/CIH S4ULs	CLEA v1.071
Mercury (Inorganic)	40			56			1,100			19			120			240			LQM/CIH S4ULs	CLEA v1.071
Mercury (Methyl)	11			15			320			6			40			68			LQM/CIH S4ULs	CLEA v1.071
Molybdenum	Not Derived			670			17,000			Not Derived			-			-			CL-AIRE	CLEA v1.06
Nickel	130			180			980			53			230			800			LQM/CIH S4ULs	CLEA v1.071
Selenium	250			430			12,000			88			1,100			1,800			LQM/CIH S4ULs	CLEA v1.071
Vanadium	410			1,200			9,000			91			2,000			5,000			LQM/CIH S4ULs	CLEA v1.071
Zinc	3,700			40,000			730,000			620			81,000			170,000			LQM/CIH S4ULs	CLEA v1.071
<b>Other Inorganics</b>																				
Asbestos	Non Detection			Non Detection			Non Detection			Non Detection			Non Detection			Non Detection				
Free Cyanide	34			34			34			34			34			34			ATKINS ATRISK SSV	CLEA v1.04
pH	<5			<5			<5			<5			<5			<5			-	-
Total Sulphate	2400			2400			2400			2400			2400			2400			BRE (2005)	
Water-Soluble Sulphate	0.5g/l			0.5g/l			0.5g/l			0.5g/l			0.5g/l			0.5g/l			BRE (2005)	
<b>Parameter</b>	<b>Residential</b>						<b>Commercial</b>			<b>Allotment</b>			<b>Public Open Space near Residential land (POSres)</b>			<b>Public Park Land (POSpark)</b>			<b>Source</b>	<b>Model</b>
	<b>With Home Grown Produce</b>			<b>Without Home Grown Produce</b>			<b>(mg kg<sup>-1</sup>)</b>			<b>(mg kg<sup>-1</sup>)</b>			<b>(mg kg<sup>-1</sup>)</b>			<b>(mg kg<sup>-1</sup>)</b>				
	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>	<b>1% SOM</b>	<b>2.5% SOM</b>	<b>6% SOM</b>		
<b>Organics</b>																				
Biphenyl	66	160	360	220	500	980	18,000	33,000	48,000	14	35	83	-	-	-	-	-	-	CL-AIRE	CLEA v1.06
<b>Organometals</b>																				
Tributyl tin oxide	0.25	0.59	1.3	1.4	3.1	5.7	130	180	200	0.042	0.1	0.24	-	-	-	-	-	-	CL-AIRE	CLEA v1.06
<b>PAHs</b>																				
Acenaphthene	210	510	1,100	3,000	4,700	6,000	84,000	97,000	100,000	34	85	200	15,000	15,000	15,000	29,000	30,000	30,000	LQM/CIH S4ULs	CLEA v1.071
Acenaphthylene	170	420	920	2,900	4,600	6,000	83,000	97,000	100,000	28	69	160	15,000	15,000	15,000	29,000	30,000	30,000	LQM/CIH S4ULs	CLEA v1.071
Anthracene	2,400	5,400	11,000	31,000	35,000	37,000	520,000	540,000	540,000	380	950	2,200	74,000	74,000	74,000	150,000	150,000	150,000	LQM/CIH S4ULs	CLEA v1.071
Benzo(a)anthracene	7.2	11	13	11	14	15	170	170	180	2.9	6.5	13	29	29	29	49	56	62	LQM/CIH S4ULs	CLEA v1.071
Benzo(a)pyrene	2.2	2.7	3.0	3.2	3.2	3.2	35	35	36	0.97	2	3.5	5.7	5.7	5.7	11	12	13	LQM/CIH S4ULs	CLEA v1.071
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4.0	4.0	44	44	45	0.99	2.1	3.9	7.1	7.2	7.2	13	15	16	LQM/CIH S4ULs	CLEA v1.071
Benzo(g,h,i)perylene	320	340	350	360	360	360	3,900	4,000	4,000	290	470	640	640	640	640	1,400	1,500	1,600	LQM/CIH S4ULs	CLEA v1.071
Benzo(k)fluoranthene	77	93	100	110	110	110	1,200	1,200	1,200	37	75	130	190	190	190	370	410	440	LQM/CIH S4ULs	CLEA v1.071
Chrysene	15	22	27	30	31	32	350	350	350	4.1	9.4	19	57	57	57	93	110	120	LQM/CIH S4ULs	CLEA v1.071
Dibenz(a,h)anthracene	0.24	0.28	0.30	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.43	0.57	0.57	0.58	1.1	1.3	1.4	LQM/CIH S4ULs	CLEA v1.071
Fluoranthene	280	560	890	1,500	1,600	1,600	23,000	23,000	23,000	52	130	290	3,100	3,100	3,100	6,300	6,300	6,400	LQM/CIH S4ULs	CLEA v1.071
Fluorene	170	400	860	2,800	3,800	4,500	63,000	68,000	71,000	27	67	160	9,900	9,900	9,900	20,000	20,000	20,000	LQM/CIH S4ULs	CLEA v1.071
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	500	510	510	9.5	21	39	82	82	82	150	170	180	LQM/CIH S4ULs	CLEA v1.071
Naphthalene	2.3	5.6	13	2.3	5.6	13	190	460	1,100	4.1	10	24	4,900	4,900	4,900	1,200	1,900	3,000	LQM/CIH S4ULs	CLEA v1.071
Phenanthrene	95	220	440	1,300	1,500	1,500	22,000	22,000	23,000	15	38	90	3,100	3,100	3,100	6,200	6,200	6,300	LQM/CIH S4ULs	CLEA v1.071
Pyrene	620	1,200	2,000	3,700	3,800	3,800	54,000	54,000	54,000	110	270	620	7,400	7,400	7,400	15,000	15,000	15,000	LQM/CIH S4ULs	CLEA v1.071
Coal Tar (Bap as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	15	15	15	0.32	0.67	1.2	2.2	2.2	2.2	4.4	4.7	4.8	LQM/CIH S4ULs	CLEA v1.071
<b>TPHs</b>																				
Aliphatic EC 5-6 (benzene)	24	40	80	24	40	80	2,400	4,000	8,000	752	1,730	3,900	570,000	590,000	600,000	95,000	130,000	180,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >6-8 (toluene)	52	110	250	52	110	250	5,200	11,000	25,000	2,304	5,580	13,000	600,000	610,000	620,000	150,000	220,000	320,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >8-10	13	30	70	13	30	70	1,300	3,000	7,000	321	770	1,700	13,000	13,000	13,000	14,000	18,000	21,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >10-12	60	150	360	60	150	360	6,000	15,000	32,000	2,153	4,300	7,150	13,000	13,000	13,000	21,000	23,000	24,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >12-16	500	1,200	2,600	500	1,200	2,600	42,000	72,000	90,000	10,800	12,400	13,200	13,000	13,000	13,000	25,000	25,000	26,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >16-35	41,000	69,000	94,000	41,000	69,000	94,000	140,000	160,000	180,000	240,000	260,000	260,000	250,000	250,000	250,000	450,000	480,000	490,000	LQM/CIH S4ULs	CLEA v1.071
Aliphatic EC >35-44	41,000	69,000	94,000	41,000	69,000	94,000	140,000	160,000	180,000	240,000	260,000	260,000	250,000	250,000	250,000	450,000	480,000	490,000	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >5-7	50	110	240	155	300	630	15,000	28,000	55,000	12	25	57	56,000	56,000	56,000	76,000	84,000	92,000	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >7-8	100	240	550	370	800	1,800	33,000	68,000	130,000	21	50	117	56,000	56,000	56,000	87,000	95,000	100,000	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >8-10	20	50	110	20	53	125	2,000	5,000	120,000	8.6	21	50	5,000	5,000	5,000	7,200	8,500	9,300	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >10-12	63	150	340	120	280	650	11,000	22,000	31,000	12.5	31	74	5,000	5,000	5,000	9,200	9,700	10,000	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >12-16	140	320	660	1,100	1,900	2,300	35,000	37,000	38,000	23	57	134	5,100	5,100	5,000	10,000	10,000	10,000	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >16-21	260	540	930	1,800	1,900	1,900	28,000	28,000	28,000	47	112	260	3,800	3,800	3,800	7,600	7,700	7,800	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >21-35	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	LQM/CIH S4ULs	CLEA v1.071
Aromatic EC >35-44	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	LQM/CIH S4ULs	CLEA v1.071
Aliphatic + Aromatic EC >44-70	1,600	1,800	1,900	1,900	1,900	1,900	28,000	28,000	28,000	1,200	2,100	3,000	3,800	3,800	3,800	7,800	7,800	7,900	LQM/CIH S4ULs	CLEA v1.071
<b>BTEX</b>																				
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	27	47	90	0.017	0.									



Assessment Criteria Substance	Waters					
	Surface Waters (mg/l) Fresh Water	Source	Surface Waters (mg/l) Marine	Source	Groundwater (mg/l)	Source
<b>METALS</b>						
Aluminium					0.2	UK DWS
Antimony					0.005	EU DWS
Arsenic	0.05	Annex G EQS	0.025	Annex G EQS	0.01	EU DWS
Barium					0.7	WHO DW
Beryllium					0.004	US EPA
Boron	2	Annex G EQS	7	Annex G EQS	1	EU DWS
Cadmium	0.00008 - 0.00025(a)	EU standard	0.0002	EU standard	0.005	EU DWS
Chromium (III)	0.0047	proposed UKTAG	N/A		0.05 (total Cr)	EU DWS
Chromium (VI)	0.0034	proposed UKTAG	0.0006	proposed UKTAG		
Copper	0.001 - 0.028(a)	Annex G EQS	0.005	Annex G EQS	2	EU DWS
Iron	1	Annex G EQS	1	Annex G EQS	0.2	EU DWS
Lead	0.0072	EU standard	0.0072	EU standard	0.01	EU DWS
Manganese					0.05	UK DWS
Mercury (methyl)	0.00005	EU standard	0.00005	EU standard	0.001	EU DWS
Molybdenum						
Nickel	0.02	EU standard	0.02	EU standard	0.02	EU DWS
Selenium					0.01	EU DWS
Silver	0.00005	Annex G EQS	0.00005	Annex G EQS	0.01	UK DWS
Tin	0.025	Annex G EQS	0.01	Annex G EQS		
Vanadium	0.02	Annex G EQS	0.1	Annex G EQS		
Zinc	0.008 - 0.125(a)	Annex G EQS	0.04	Annex G EQS	3	WHO taste threshold
<b>INORGANICS</b>						
Free cyanide	0.001 (free)	Annex G EQS	0.001 (free)	Annex G EQS	0.05(total)	EU DWS
Ammonia	0.2 - 0.6 (alkalinity dependant)	proposed UKTAG	0.021	proposed UKTAG	0.5	UK DWS
Bromate					0.01	UK DWS
Sulphate					250	UK DWS
Nitrates					50	EU DWS
Chlorine	0.002	proposed UKTAG	0.001 (short term)	proposed UKTAG	5	WHO
pH	6.0 - 9.0	Annex G EQS			6.5 - 8.5	US EPA (SDWR)
<b>ORGANICS</b>						
<b>ORGANOMETALS</b>						
Triphenyltin	0.00002	Annex G EQS	0.000008	Annex G EQS		
Tributyl tin (oxide)	0.0000002	EU standard	0.0000002	EU standard		
<b>Hydrocarbons</b>						
<b>BTEX</b>						
Benzene	0.01	Annex G EQS	0.008	Annex G EQS	0.001	UK DWS
Ethylbenzene	0.02	Annex G EQS	0.02	Annex G EQS	0.3	WHO DW
Toluene	0.074	proposed UKTAG	0.074	proposed UKTAG	0.7	WHO DW
P-xylene	0.03 (all isomers)	Annex G EQS	0.03 (all isomers)	Annex G EQS	0.5	WHO DW
<b>TPH</b>						
Aliphatic 5-6	0.02		0.02		0.3	
Aliphatic 6-8	0.02		0.02		0.3	WHO DWS for C8-C16
Aliphatic 8-10	0.02	Ethylbenzene EQS used as surrogate	0.02	Ethylbenzene EQS used as surrogate	0.3	
Aliphatic 10-12	0.02		0.02		0.3	
Aliphatic 12-16	0.02		0.02		0.3	WHO DWS
Aliphatic 16-35	NV insoluble	TPHCWG	NV insoluble	TPHCWG	NV insoluble	TPHCWG
Aliphatic 35-44	NV insoluble	TPHCWG	NV insoluble	TPHCWG	NV insoluble	TPHCWG
Aromatic 5-7 (waters 6-7)	0.01	benzene EQS	0.008	benzene EQS	0.001	UK DWS for benzene
Aromatic 7-8 (waters 7-8)	0.05	toluene EQS	0.04	toluene EQS	0.7	WHO DWS for toluene
Aromatic 8-10	0.02		0.02		0.3	WHO DWS for ethyl benzene
Aromatic 10-12	0.02		0.02		0.1	WHO DWS
Aromatic 12-16	0.02	ethylbenzene EQS as a surrogate	0.02	ethylbenzene EQS as a surrogate	0.1	WHO DWS
Aromatic 16-21	0.02		0.02		0.09	WHO DWS
Aromatic 21-35	0.02		0.02		0.09	WHO DWS
Aromatic 35-44	0.02		0.02		0.09	WHO DWS
<b>PAH (US EPA-16)</b>						
Acenaphthene	NV		NV			
Acenaphthylene	NV		NV			
Anthracene	0.0001	EU standard	0.0001	EU standard		
Benzo(a)anthracene	0.00005	B(a)P threshold	0.00005	B(a)P threshold		
Benzo(a)pyrene	0.00005	EU standard	0.00005	EU standard	0.00001	EU DWS
Benzo(b)fluoranthene						
Benzo(k)fluoranthene	0.00003(sum)	EU standard	0.00003(sum)	EU standard	0.0001 (sum)	EU DWS
Benzo(ghi)perylene						
Indeno(123-cd)pyrene	0.000002(sum)	EU standard	0.000002 (sum)	EU standard		
Chrysene	NV		NV			
Dibenzo(ah)anthracene	0.00005	B(a)P threshold	0.00005	B(a)P threshold		
Fluoranthene	0.0001	EU standard	0.0001	EU standard		
Fluorene	NV		NV			
Naphthalene	0.0024	EU standard	0.0012	EU standard		
Phenanthrene	NV		NV			
Pyrene						
<b>OTHER (unchlorinated)</b>						
Phenol	0.0077	proposed UK TAG	0.0077	proposed UK TAG		
MTBE	0.015	EA report MTBE			0.015	EA report MTBE
Carbon disulphide						
Styrene	0.05	Annex G EQS	0.05	Annex G EQS	0.02	WHO DW

Key	
s ( )	The assessment criterion exceeds the solubility of the hydrocarbon fraction (where the solubility limit is lower than the vapour limit). This means that the GAC cannot be correctly calculated. The fraction will not pose a significant risk. However, it is considered reasonable to use the GAC as it would be unrealistic to curtail the GAC to the solubility limit (the value in brackets). However, qualitative assessment should be done to determine if FREE-PHASE is a problem if these limits are exceeded. See Section 4.12 in the EA CLEA Software (1.05) Handbook.
v ( )	The assessment criterion exceeds the vapour limit of the hydrocarbon fraction (where the vapour limit is lower than the solubility limit). This means that the GAC cannot be correctly calculated. The fraction will not pose a significant inhalation risk. However, it is considered reasonable to use the GAC as it would be unrealistic to curtail the GAC to the volatility limit (the value in brackets). However, qualitative assessment should be done to determine if FREE-PHASE is a problem if these limits are exceeded. See Section 4.12 in the EA CLEA Software (1.05) Handbook.
**	SGV curtailed at saturation limit (conservative assumption – chemicals unlikely to pose a significant risk at any concentration).
*	Residential without Plant Uptake GACs derived by WAF by modifying the default EA model



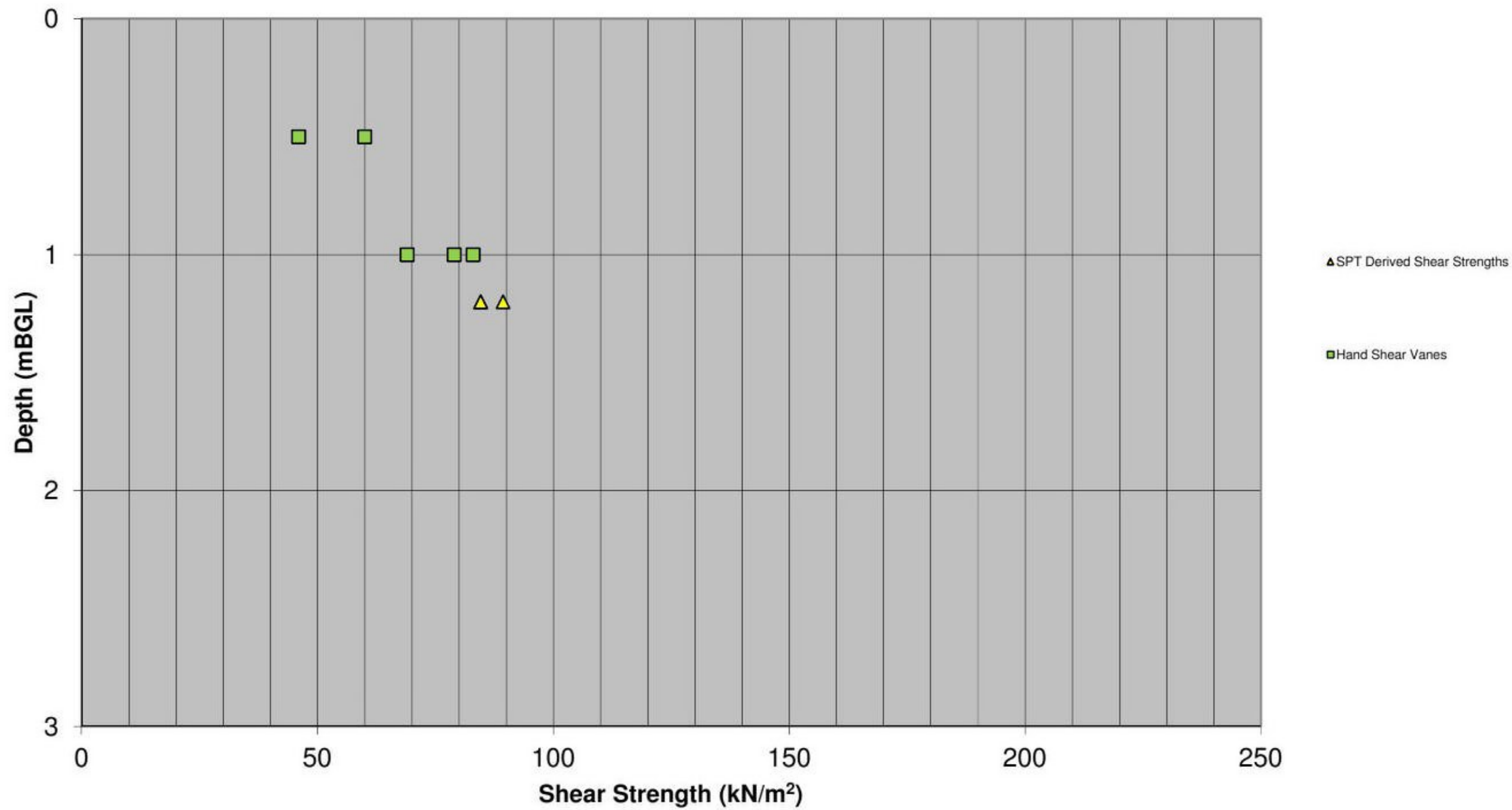
## Appendix 5

### Geotechnical Parameters



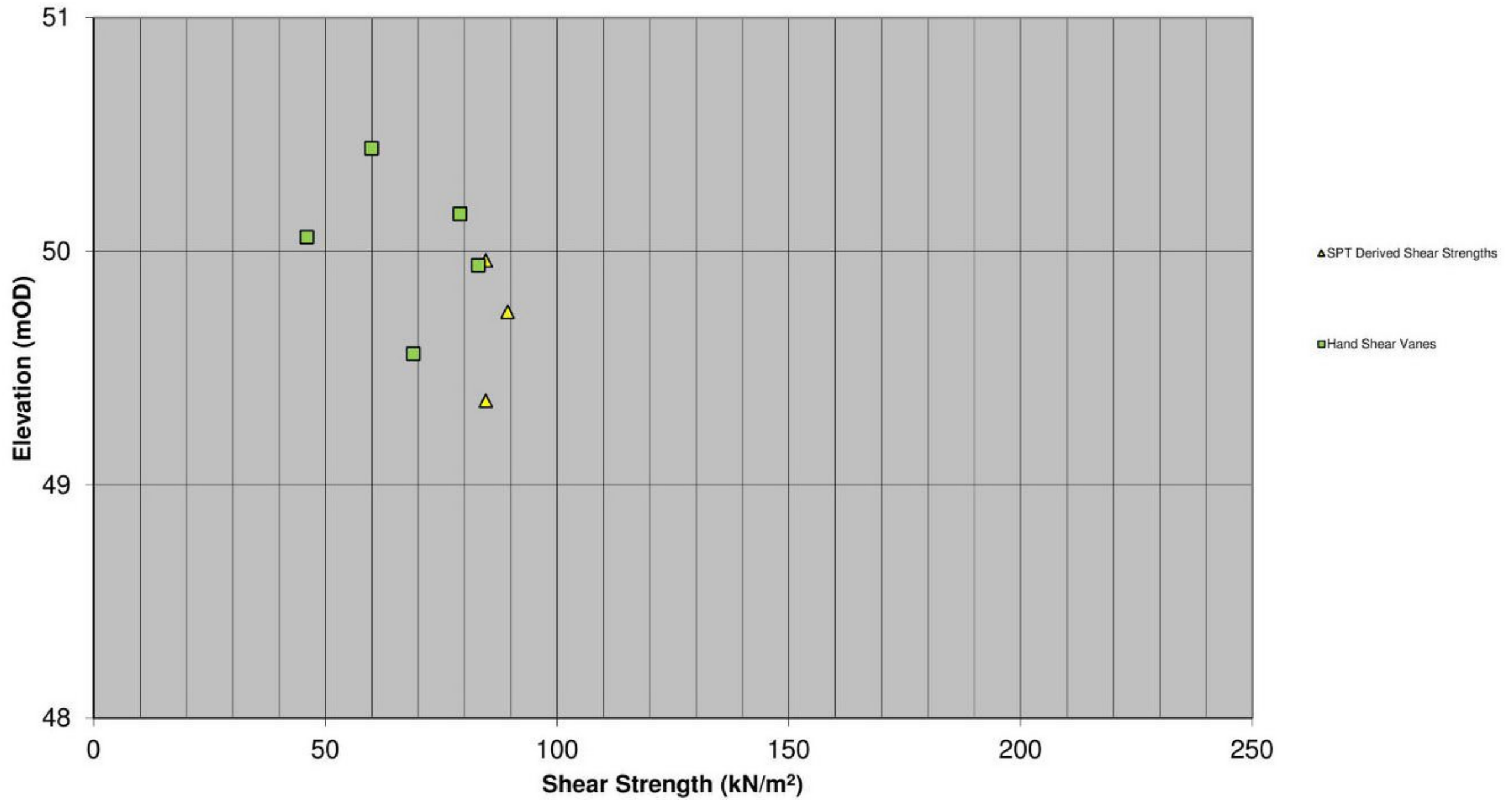


**Fig 1 - Undrained Shear Strength vs Depth (Glacial Till)**  
**New Children's Home, Pegswood**





**Fig 2 - Undrained Shear Strength vs Elevation (Glacial Till)**  
**New Children's Home, Pegswood**





## Appendix 6

### Supplementary Gas and Groundwater Monitoring Data





















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