

Location (Site/Block)	Element / Sub Element	Construction Type	Construction Type Code	Basis of Assessment	Grade	Condition Grade %	Repair Priority	Photo Reference
EFA1/EFAB	09. Redecorations / 09.04. Internal - Ceilings /	Unpainted	09.04.01	Seen	A Bx C Cx D	100 0 0 0 0 0	4 N/A N/A N/A N/A	
EFA1/EFAB	10. Fixed Furniture and Fittings / 10.01. Fixed Furniture and Fittings /	Teaching - General / Other (Non Science / Sports)	10.01.03	Seen	A Bx C Cx D	100 0 0 0 0 0	4 N/A N/A N/A N/A	



# Annex A: How to Read Your Condition Data Table

This annex provides a description for each of the column headings in your condition data table found in Section 3 of this report, and explains how to cross-reference with the photos in your CDC Photo Pack (which will be made available for you to download separately from the CDC Portal).

You will need to have your CDC Site Plan to hand when reading this report. It provides a visual key to the block references used in Section 3 of this report, which are explained below.

### 'Location'

#### Standard blocks

The relevant site and block reference. Site references contain a unique number; block references (with the exception of 'Ancillary blocks') are labelled A-Z. The example below refers to block 'B' of site '1'.



Figure 1: Location field naming convention

#### **External areas**

Some rows in the condition data table will show a **site reference only** in the location column (i.e. the block reference is absent). This means that the information contained in that row relates to external areas, and is not 'attached' to a block.

The Condition Data Table does not provide condition information for 'ancillary blocks'

CDC surveyors do not record condition data for ancillary blocks such as garages, sheds and external stores, which is why ancillary blocks do not appear in the Condition Data Table.



# 'Element / Sub Element' and 'Construction Type'

Condition is assessed for twelve main building 'elements'. Each of these is split into sub-elements that in turn are split into construction types.

Example:

Element:	Roofs
Sub element:	Pitched roof – coverings and insulation
Construction type:	Natural slates

#### Table 3: Element, sub element and construction type hierarchy

Condition grades and repair priority information is recorded against each construction type assessed by surveyors (condition grade and repair priority columns are described below).

### 'Basis of Assessment'

As part of the data captured for each Construction Type present, surveyors record the relevant 'basis of assessment' against the condition assessment they have made. The three basis of assessment options are:

Basis of Assessment	Explanation
Seen	The surveyor has seen the Construction Type and has been able to make an appropriate assessment of condition.
Unseen – Based on School Discussion / Report	The surveyor has not seen the Construction Type during the site visit, but has received information from the school representative and/or has been provided with a copy of a professional third party report, document or other evidence that describes the current condition of the Construction Type.
Unseen – Surveyor's Judgement	Surveyor has not seen the Construction Type during the site visit, but has made an assessment of the condition based on other indicators observed and/or based on their professional experience.

Table 4: Basis of assessment descriptors

# 'Condition Grade', 'Condition Grade %' and 'Repair Priority'

These columns show the condition assessment grade and repair priority information for each Construction Type assessed within each block.

Where there are different grades of condition apparent across a construction type when assessed by the surveyors, a percentage grading approach is applied. For example, 'internal flooring' could have 40% at condition grade B and 60% condition grade C.

Grade	Condition	Description
A	Good	Performing as intended
В	Satisfactory	Performing as intended, but exhibiting minor deterioration
С	Poor	Exhibiting major defects and/or not operating as intended
D	Bad	Life expired and/or serious risk of imminent failure
X	Full Replacement	Supplementary designation assigned in addition to 'B' and 'C' where full replacement is required For example, a boiler may be assessed as "Cx" if the surveyor judges it to be in poor condition but is aware that it is obsolete and that it will no longer be possible to get the necessary spare parts due to its age

The condition grading and priority ratings are defined as follows:

#### Table 5: Condition Grade descriptors

Priority	Time Frame	Description
4	> 5 Years	More than 5 years before remedial action required. All condition 'Grade As' will be priority rating 4 by default
3	3 – 5 Years	Between 3 and 5 years before remedial action is required
2	1 -2 Years	Between 1 and 2 years before remedial action required
1	0 Years	Immediate remedial action or replacement required (default priority rating for condition grade D)

Table 6: Priority score descriptor



Example:

This extract from the right-hand side of the condition data table shown here reflects how condition and priority information is presented in the Section 3 data table.

It shows that the surveyors recorded 60% 'B' with priority '3' and 40% 'C' with priority '2'.

Grade	Condition Grade %	Repair Priority
Α	0	N/A
В	60	3
Bx	0	N/A
С	40	2
Cx	0	N/A
D	0	N/A

 Table 7: Condition assessment example

#### 'Photo Reference'

This column provides a reference that you can use to look up the relevant photo in the School Photo Pack. A photo reference contains the 'Location' (block) and 'Construction Type Code' information from the same row in the table





#### **END OF REPORT**



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# Appendix D Pre-planning Enquiry Response



Curtins Rose Wharf East Street Leeds LS9 8EE elspeth.fraser@curtins.com Yorkshire Water Services Developer Services Pre-Development Team PO BOX 52 Bradford BD3 7AY

> Tel: 0345 120 8482 Fax:

Email: technical.sewerage@yorkshirewater.co.uk

Your Ref: Our Ref: Z003280

For telephone enquiries ring: George Mullaney on 0345 120 8482

6th July 2023

Dear Ms Fraser,

# Hemplands Primary School, Whitby Avenue, York, YO31 1ET - Pre- Planning Enquiry V164990

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Foul Sewers

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 225 mm diameter public foul sewer recorded in Whitby Avenue, at a point to the north of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.





# YorkshireWater

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

It is understood that surface water is proposed to discharge to watercourse (Tang Hall Beck) located to the south of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

#### Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply online or obtain an application form from our website (www.yorkshirewater.com/developers/sewerage/sewerage-connections/) or by telephoning 0345 120 84 82.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network or interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off- site foul and surface water sewer may be required which may be provided by the developer and considered for Code for Adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off- site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

The site is within an area that may be affected by river, coastal or estuarine flooding. We would advise you to contact the Environment Agency for details.

All the above comments are based upon the information and records available at the



# YorkshireWater

present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

George Mullaney Development Services Technician









Appendix E Phase 2 Site Investigation Report (Relevant Pages)



# Ground Investigation





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## HEMPLAND PRIMARY SCHOOL, YORK

for Department for Education

Engineer : Mott MacDonald Ltd

Project Number PC218325

April 2022

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for Department for Education

Engineer : Mott MacDonald Ltd Project No: PC218325 April 2022

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Any plans, diagrams, cross sections or images are for illustrative purposes only and should be checked for accuracy on-site. In the event of changes to the proposed end use of the Site, the report may require updating to reflect such changes. Although reference may be made to archaeological or ecological issues, invasive species, flood risk and the presence of asbestos containing materials (ACMs), this report does not constitute an archaeological assessment, ecological assessment, invasive species survey, flood risk assessment or asbestos survey.

We have prepared this report in our professional capacity using reasonable skill, care and diligence. The assessments, conclusions and recommendations within this report pertain to the study site defined herein, and the immediate area in continuity with the Site. They are based on the established historical uses, and information available at the time of writing and the proposed use of the Site. Where any information supplied by the client or other sources have been utilised, it has been assumed that the information is correct. No responsibility can be accepted by Geotechnics for inaccuracies in data supplied by any other party.

New information relating to environmental matters can come to light after the report has been prepared and changes in conditions and regulatory requirements may occur in future. Either of those factors may change the conclusions presented in our report. If development does not take place within the expected timescales, consideration should be given to reviewing this assessment to confirm that no changes to the site or relevant legislation have taken place. No part of this report is intended to provide legal advice or opinion of any nature.

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# Preliminary Ground Investigation Report with Interpretive Chapter at HEMPLAND PRIMARY SCHOOL, Project I YORK

# 1.0 INTRODUCTION

This Geo-environmental and Geotechnical Ground Investigation was carried out to the instruction of the Engineer, Mott McDonald Limited, on behalf of the Client, The Department for Education, with the purpose of providing design input with respect to Civil, Structural and Geo-Environmental engineering for the redevelopment of a primary school in York. The site is currently developed as a school. The proposals for the redevelopment of the site consist of refurbishment of existing buildings, or demolition and rebuild of existing school buildings. If the rebuild option is chosen, this would consist of the demolition of existing school buildings and construction of a new two-storey block either to the east, south or west of the main school building; with the footprint of the existing building reinstated as a play area.

A Desk Study has already been prepared by Geotechnics Limited to which reference should be made for full details of the site history and its environmental setting. It is advised that this report is read in conjunction with the Desk Study report (Ref: PC218325 Geoenvironmental and Geotechnical Desk Study Report at Hempland Primary School, York dated 26<sup>th</sup> October 2021).

This report summarises the findings of the desk study and presents the findings of an intrusive geo-environmental and geotechnical survey undertaken in accordance with Stage 1 of RIBA Plan of Work 2020 Overview. The report aims to reduce uncertainty in geo-environmental and geotechnical risks identified in the previous Desk Study. It is intended to be used by the Client to aid in later stages of the design and construction of the proposed rebuild should that option be chosen. In addition, this report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Part IIA of the Environment Protection Act, 1990.
- Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, April 2012).
- National Planning Policy Framework (HCA, July 2021).
- BS EN 1997-1:2004+A1:2013: "Eurocode 7. Geotechnical Design".
- B\$5930:2015 +A1:2020 : "Code of Practice for Ground Investigations".
- BS10175: 2011 +A2:2017 "Investigation of Potentially Contaminated Sites Code of Practice".
- The Building Regulations 2010. Part C (HM Government 2013).
- Environment Agency (2020) "Land Contamination Risk Management" .
- Environment Agency (2011) Report GPLC1 "Guiding Principles for Land Contamination".
- Environment Agency (2017) "The Environment Agency's Approach to Groundwater Protection" November 2017 Version 1.1.
- Sustainable Remediation Forum UK (SuRF) Framework.

The purpose of this report is to gain a preliminary understanding of the ground conditions at the site and within the limitations of the scope of the Ground Investigation authorised by the Department for Education. The ground investigation was commissioned to help Contractors assess the ground related risks and make suitable cost allowances for the most likely design solution and undertake a preliminary assessment of the risks relating to identified source-pathway-receptor linkages.

Contractors for the scheme shall only use the factual data from this preliminary Ground Investigation Report. Contractors should obtain any additional investigation work that may be required to prepare their own detailed Ground Investigation Report and Geotechnical Design Report to Eurocode 7 and to prepare their own contaminated land risk assessment in line with Land Contamination Risk Management (LCRM, 2020) guidance including further



ground investigation and risk assessment, remediation options appraisal and remediation strategy and verification (if required), which are to be used as the basis of the contractors detailed design.

# 2.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 3 to 6. The factual data so obtained are presented in Appendices 2 to 12 of this report.

A Desk Study to seek information which may already exist about the site, its history, geology and ground conditions was carried out by Geotechnics Limited in October 2021.

An interpretation of the data obtained is presented in Section 7 and a geotechnical evaluation of its significance in relation to proposals available at the time of preparation of this report is presented in Section 8. A geo-environmental assessment is presented in Sections 9 and 10 with conclusions and recommendations in Section 11.

Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 13 to aid an understanding of the procedures followed and the context in which the report should be read.

In addition, data in electronic format in accordance with "The Electronic Transfer of Geotechnical Data from Ground Investigations" published by the AGS (the AGS Format) are presented separately.

# 3.0 THE SITE

For full details of the site's history, environmental setting and sensitive land use, reference should be made to the Desk Study mentioned in Section 1.0 above. A Site Location Plan can be found in Appendix 1 and the site location is summarised in the table below.

Location	Hempland Primary School, Whitby Ave, Heworth, York
Grid Reference	462581, 452930
Post Code	YO31 1ET
Site Area	Approximately 2.28 Ha
Site Shape	The site is irregular in shape with maximum plan dimensions of 179m by 147m
Topography	The site is generally flat with elevations of approximately 15m OD to 16m OD around the school buildings in the northern half of the site. The southern half of the site slopes down to around 13m OD along the southern boundary of the site, towards the minor valley along which Tang Hall Beck flows. The topography of the surrounding land is fairly flat.
Trees	Mature / semi mature trees spread around the site with two rows of trees being observed along the southern boundary. A hedge runs along the western site boundary.

# 4.0 PRELIMINARY CONCEPTUAL SITE MODEL & CONTAMINANT LINKAGES

The Desk Study for the site (Ref: PC218325, October 2021) presented a preliminary conceptual site model based on publicly available information and on-site observations. The preliminary conceptual site model identified several potential contaminant linkages (source  $\rightarrow$  pathway  $\rightarrow$  receptor). Potential risks were assessed for these contaminant linkages, which identified where additional information was required. These are summarised below.



# 4.1 Preliminary Conceptual Site Model

In accordance with BS 10175 and LCRM, a schematic Initial Conceptual Site Model was developed, and this is shown below.



The ground model and proposed end use described above have been considered in relation to Nathaniel et al. 2015, The LQM/CIEH S4ULs for Human Health Risk Assessment. The proposed development generally does not conform to the conceptual models defined in Nathaniel et al. 2015 however for the purpose of this geoenvironmental assessment, the site is closest to public open space (parkland) and residential without home grown produce.

## 4.2 Potential Contaminant Linkages Assessment

For each potential contaminant linkage, an assessment was made of the potential impact upon identified sensitive receptors. Potential contaminant linkages requiring further investigation are summarised below:

- Contaminants in soil and groundwater  $\rightarrow$  Dermal contact, ingestion, inhalation  $\rightarrow$  Construction workers
- Contaminants in soil and groundwater → Dermal contact, ingestion, inhalation → Future site workers, visitors and pupils
- Contaminants in soil and groundwater  $\rightarrow$  Downward / lateral migration  $\rightarrow$  Principal Aquifer



Further details of the potential contaminant linkage assessment are presented in the Desk Study (reference: PC218325, October 2021). No credible source of ground gases were identified, although confirmatory monitoring has been undertaken as part of the scope of the works.

# 5.0 PROCEDURE

#### 5.1 Commissioning

The intrusive ground investigation was awarded following submission of a proposal for ground investigation of the site in consultation with Mott MacDonald Limited.

#### 5.2 General

The procedures followed in this site investigation are based on BS 5930:2015+A1:2020 – Code of Practice for Site Investigations and BS 10175:2011+A2:2017 - Investigation of Potentially Contaminated Sites. The soils and rocks encountered have been described in accordance with BS5930:2015+A1:2020 and BS EN ISO 14688-1:2018 and BS EN ISO 14689:2018. The positions of the exploratory holes are shown on the Exploratory Hole Location Plan in Appendix 12.

The exploratory hole locations were selected by Geotechnics Limited, and approved by Mott MacDonald Limited, to give a general coverage of the site as well as focus on any targets identified in the Desk Study within the constraints posed by buried and overhead services on the site. The number and type of exploratory holes was kept within the Client's financial limits, with the investigation being considered as a preliminary phase of the investigation works.

The co-ordinates and levels shown on the Exploratory Hole Records were measured using a Leica SmartRover GPS survey device. The depths quoted on the exploratory hole records are in metres below ground level.

Prior to commencement of the intrusive investigative works, the available service drawings were consulted to check for the presence of buried services at the proposed exploratory hole locations.

Prior to breaking ground at each exploratory hole location, the location was scanned using a cable avoidance tool (CAT) by a suitably trained engineer. At each exploratory hole location an inspection pit was excavated using hand tools to a depth of 1.20m below ground level to also check for the presence of underground services. On completion of the excavation, the location was scanned again using a CAT.

#### 5.3 Cable Percussion Boreholes

Four (4 No.) 150mm diameter boreholes (numbered CP01 to CP04) were each sunk by Cable Percussion Tool techniques to a depth of 8.45m below ground level. This boring work was carried out between 22<sup>nd</sup> and 25<sup>th</sup> November 2021.

Representative disturbed (D and B) and driven open-tube thin-walled (UT) samples of the soils encountered were obtained at regular intervals. Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BSEN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata. In addition, environmental soil samples (ES) were recovered at the depths indicated on the Borehole Records, presented in Appendix 2.

No groundwater was encountered during the boring operations. It should be noted that the addition of water to the borehole as part of the boring process may have masked the presence of groundwater in the borehole. Where water was added it has been noted on the Borehole Records.

On completion, standpipes were installed in the cable percussion boreholes (see Section 5.6).



### 5.4 Dynamic Sample Boreholes

Three (3 No.) Dynamic Sample Boreholes (numbered WS01 to WS03) were undertaken at the site to a depth of 4.45m below ground level. This dynamic sampling work was carried out on 26<sup>th</sup> November 2021 and was supervised on site by a geotechnical/geo-environmental engineer.

The Dynamic Samples were taken using Super-Heavy Dynamic Probe apparatus which drives lined steel tubes into the ground in 1m lengths. Samples are retrieved in the plastic liners and placed in jars. The retrieved liners were split and the recovered soils described before being sub-sampled into ES, D and B samples as shown on the Borehole Records, presented in Appendix 3. The hole is cased and progress depends on the nature of the strata penetrated.

Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata.

Groundwater was not observed during the Dynamic Sampling. On completion, Dynamic Sample Boreholes WS01 and WS03 were backfilled with bentonite pellets to 0.30m below ground level and finished with arising's (WS01) or asphalt (WS03). A standpipe was installed in WS02 (see Section 5.6).

#### 5.5 Dynamic Cone Penetration Tests

Five (5 No.) Dynamic Cone Penetration (DCP) Tests were carried out at the locations marked on the Exploratory Hole Location Plan (see Appendix 12) and numbered DCP01 to DCP05. The tests were either commenced from Ground Level (DCP02, DCP03 and DCP05) or following removal of the asphalt (DCP01 and DCP04) and were performed to give an indication of CBR values at shallow depths to aid pavement design. All DCP test locations were adjacent to another exploratory hole and the relevant inspection pit was used to check for buried services. The relevant adjacent locations are as follows:

DCP Location	Adjacent Exploratory Hole Location
DCP01	CP01
DCP02	WS02
DCP03	WS03
DCP04	CP04
DCP05	CP03

The test comprises the measurement of increments of penetration of a 60° cone driven into the ground using an 8kg hammer falling a distance of 575mm. The CBR is obtained from the relationship between the CBR and the DCP readings;

 $Log_{10}(CBR) = 2.48 - 1.057 \text{ x } Log_{10}(mm/blow)$ 

as defined in 'Operating Instructions for the TRL Dynamic Cone Penetrometer' by Jones & Rolt (1991) published by the Transport Research Laboratory. The test results are presented in Appendix 4.

#### 5.6 Instrumentation and Monitoring

Long-term monitoring of the gas and groundwater levels was made possible by the installation of standpipes as follows:



Exploratory Hole	Standpipe Slotted Pipe & Filter Zone (m)	Strata Monitored
CP01	1.00 to 8.00	Glaciolacustrine Clay and Glacial Till
CP02	1.00 to 8.00	Glaciolacustrine Clay and Glacial Till
CP03	1.00 to 8.00	Glaciolacustrine Clay and Glacial Till
CP04	1.50 to 8.00	Glaciolacustrine Clay and Glacial Till
WS02	2.00 to 4.00	Glaciolacustrine Clay and Glacial Till

The response zones above cross over natural strata boundaries. The site was classified as having a low gas risk as no plausible sources of gas were identified during the desk study or during the on-site investigation.

Monitoring of the gas and groundwater levels at the site commenced on 2<sup>nd</sup> December 2021 with further visits on 9<sup>th</sup>, 16<sup>th</sup> and 23<sup>rd</sup> December 2021.

On each of the monitoring visits a record of the groundwater level in the standpipes was obtained where possible. All monitoring wells were dry for each monitoring visit. The following parameters were measured and recorded in each standpipe using a Gas Data Limited GFM435 Gas Analyser:-

- Concentrations (% Vol) of CH<sub>4</sub>, O<sub>2</sub>, CO<sub>2</sub>, along with (ppm) H<sub>2</sub>S, CO.
- Flow Rate.
- Differential Pressure.
- Barometric Pressure.

The results of the monitoring are presented in Appendix 5.

# 6.0 LABORATORY TESTING

#### 6.1 Geotechnical

The laboratory testing schedule was formulated by Geotechnics Limited, and approved by Mott MacDonald Limited, in order to relate to the proposed development plans available at the time of scheduling. The number and type of testing undertaken was constrained by the Client's financial limits, with the investigation being considered as a preliminary phase of the investigation works. Unless otherwise stated, the tests were carried out in Geotechnics Limited's UKAS accredited Laboratory (Testing No. 1365) and were undertaken in accordance with the appropriate Standards as indicated below and on the Laboratory Test Certificate in Appendix 7. Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

Standard	Test Description	Quantity
BS EN ISO 17892-1:2014	Water Content Determination	22
BS EN ISO 17902 4:2014	Particle Size Distribution Determination – Sieving Method	3
BS EN ISU 17692-4:2016	Particle Size Distribution Determination – Pipette Method	3
BS EN ISO 17892-5:2017	Incremental Loading Oedometer Test	2
BS EN ISO 17892-8:2018	Unconsolidated Undrained Triaxial Test – Single Stage	5
BS EN ISO 17892-12:2018	Determination of Liquid and Plastic Limits	17
BS 1277:1000 Dort 4 2 2	Dry Density/Moisture Content relationship determination.	2
B3 1377.1990 Pall 4 - 3.3	Compaction Test – British Standard (2.5 kg Hammer)	Z

The following testing was carried out at the laboratories of Derwentside Environmental Testing Services (DETS) (UKAS Accredited Laboratory, Number 2139).



#### **BRE Special Digest 1 Suite**

8 No. Suites comprising Soluble Sulphate and pH.

#### Asbestos

4 No. Asbestos screens

The results of these tests are also presented in Appendix 7.

#### 6.2 Contamination

Twelve (12No.) selected samples of soil and three (3No.) samples of groundwater were tested at the laboratories of Derwentside Environmental Testing Services Limited for a number of determinands in order to allow assessment of potential site contamination. The determinands were specified by the Engineer and are detailed below and on the results sheets in Appendix 8 together with the test result as well as the test method, accreditation and detection limit. The laboratory testing schedule was formulated by Geotechnics Limited, and approved by Mott MacDonald Limited, in order to relate to the proposed development plans available at the time of scheduling. The number and type of testing undertaken was constrained by the Client's financial limits, with the investigation being considered as a preliminary phase of the investigation works. The soil samples were tested for the following determinands:-

#### Metals

Antimony	Arsenic	Barium
Beryllium	<ul> <li>Boron (Water Soluble)</li> </ul>	<ul> <li>Chromium</li> </ul>
Chromium (Hexavalent)	Copper	• Iron
Lead	<ul> <li>Molybdenum</li> </ul>	Nickel
Selenium	Vanadium	Zinc
anics		
рН	Cyanide (Free)	Total Organic Carbon
Sulphate (Water Soluble)	Total Sulphur	0
r		
Petroleum Hydrocarbons	Polyaromatic Hydrocarbons	Phenols
(Aliphatic / Aromatic speciated)	(Speciated)	
Volatile Organic Compounds (VOC)	• MTBE	Asbestos
	Antimony Beryllium Chromium (Hexavalent) Lead Selenium anics pH Sulphate (Water Soluble) r Petroleum Hydrocarbons (Aliphatic / Aromatic speciated) Volatile Organic Compounds (VO C)	Antimony Beryllium Chromium (Hexavalent) Lead Selenium Antics pH Sulphate (Water Soluble) Sulphate (Water Soluble) Sulpha

The groundwater samples were analysed for the following determinands:

#### Metals

- Antimony
- Beryllium
- Chromium
- Copper
- Magnesium
- NickelZinc
- ZINC

#### Inorganics

- pH
- Sulphate
- Fluoride

- Arsenic
- Boron
- Chromium III
- Iron
- ManganeseSelenium
- Selemun
- Cyanide (Total & Free)
- Sulphide
- Total Hardness

- Barium
- Calcium
- Chromium (Hexavalent)
- Lead
- Molybdenum
- Vanadium
- Ammoniacal Nitrogen
- Chloride

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#### Other

- Petroleum Hydrocarbons (Aliphatic / Aromatic speciated)
- Polyaromatic Hydrocarbons . (Speciated)

In addition, three (3No.) leachate samples were prepared from selected soil samples in accordance with the BS EN 12457 and analysed for the determinands detailed below and on the results sheets in Appendix 8.

#### Metals

- Antimony ٠
- Beryllium •
- Chromium •
- Copper
- Magnesium
- Nickel
- Zinc

#### Inorganics

- рΗ
- Sulphate (Water Soluble)
- Fluoride

#### Other

Speciated Phenols

The results are presented in Appendix 8.

#### 7.0 **INTERPRETATION**

#### 7.1 Ground Conditions

On the basis of the expected geology discussed in the Desk Study and the findings of the exploratory holes it has been possible to classify the various strata proved in the investigation into the following divisions:-

- Made Ground •
- Glaciolacustrine Clay .
- Glacial Till

The ground profile exposed in the exploratory holes represents the conditions at discrete locations. The degree to which they represent conditions between or beyond the exploratory holes is a matter for conjecture and these can only be interpolated and hence, the uncertainties arising from this should be recognised.

The ground profile at the site is summarised as follows:-

Stratum	Typical Description	Depth to Top (m bgl)	Level of Top (m OD)	Thickness (m)
Mado Cround	Asphalt	GL	12.08 to	0.15
Made Ground	(Found in CP01, CP04, WS03)		13.65	
	Dark brown slightly gravelly clayey/silty sand with	GL	13.01 to	0.10 to
Made Ground	occasional rootlets. The gravel variously composed		13.58	0.55
(Surface	of brick, sandstone and mudstone.			
covering)	(Found as a topsoil-like surface covering in CP02, CP03, WS01, WS02)			



- Barium . Calcium •
- Chromium (Hexavalent) • •
- Lead
- Molybdenum • Vanadium
- Ammonical Nitrogen
- Chloride
- Cyanide (Total & Free)
- Sulphide

Arsenic

Boron

Iron

•

٠

٠

Chromium III

Manganese

Selenium

	Reddish brown, light brown, light grey and light	0.15	11.93 to	0.35 to
	greyish brown sandy gravel (with a low cobble		13.50	0.65
Mado Cround	content – CP04). The gravel variously composed			
(Grapular)	of brick fragments, concrete, asphalt, sandstone			
(Granular)	and mudstone. Cobble content is of brick and			
	sandstone.			
	(Found in CP01, CP04, WS03)			
	Soft and firm brown, varying to brownish grey,	0.50 to	11.28 to	0.50 to
	greyish brown and mottled grey slightly sandy	0.80	13.15	1.00
Made Ground	slightly gravelly clay (with a low cobble content –			
(Cohesive)	CPU2). The gravel variously composed of			
	contont is of candstone and brick			
	(All holes except CP03)			
	Firm fissured brown mottled grey and light grey	0.10 to	10.78 to	0.50 to
	slightly sandy CLAY with occasional calcareous	1.50	12.91	1.90
Glaciolacustrine	inclusions (up to 20mm in size) and occasional			
Clay	sandy pockets (up to 20mm in size). Fissures are			
	extremely closely, varying to closely, spaced,			
	randomly orientated, smooth and dull.			
	Firm to stiff brown slightly sandy slightly gravelly	2.00 to	10.08 to	2.00 to
Giaciai I III	calcareous CLAY. Gravel is composed of	3.00	11.47	6.45
	mudstone and sandstone.			proven*

\* Base of stratum not found

This table provides a brief summary of the ground profiles found in the exploratory holes. Reference should be made to the Exploratory Hole Records for detailed descriptions of the soils encountered.

#### 7.1.1 Made Ground

Made Ground was encountered in all the exploratory holes.

Boreholes CP01, CP04 and WS03 were surfaced with black asphalt. The thickness of the asphalt at all three locations was 0.15m.

The surface of Boreholes CP02, CP03, WS01 and WS02 were covered with Made Ground that appeared topsoillike and included brick fragments. The thickness was between 0.10 to 0.55m.

Granular Made Ground was present in all of the exploratory holes (except CP03) either starting from ground level (WS01 and WS02), or below the topsoil or asphalt (at 0.10m or 0.15m depth, respectively). The thickness varies between 0.35 and 0.65m across the site. The granular Made Ground typically comprises sand or gravel containing varying proportions of clay, silt and cobbles. The gravel content includes sandstone, mudstone, asphalt, concrete and brick fragments. The cobbles, where present, are of sandstone and brick. Rootlets were noted in exploratory hole locations CP02, WS01 and WS02.

Cohesive Made Ground was present in all of the exploratory holes (except CP03). The cohesive Made Ground underlay the granular Made Ground at depths ranging between 0.50m and 0.80m below ground level. Its thickness varies between 0.50m and 1.00m. The cohesive Made Ground is typically firm, with the exceptions of CP01 and WS02 where it is described as soft. It typically comprises slightly sandy slightly gravelly clay with the addition of a low cobble content in CP02. The gravel content comprises sandstone, mudstone and brick fragments. The cobbles are of sandstone and mudstone.

Two (2No.) Standard Penetration Tests were carried out in the cohesive Made Ground at locations CP04 and WS03, both producing a result of N=12. The blows recorded for the part of the test within the cohesive Made Ground is indicative of a firm clay.



A single (1No.) Particle Size Distribution test on a sample of the cohesive Made Ground from Borehole WS03 at 0.50m showed the sample to comprise 73% fine material (<63µm) with 24% sand and 3% gravel fractions. A combined plot for this test is presented in Figure 2 of Appendix 9.

Four (4No.) water content tests were carried out on samples of the cohesive Made Ground. The results ranged from 20% to 29%. Atterberg Limit tests on three (3No.) of the same samples gave a modified plasticity index of 32.64%, 38.61% and 18.7%. A combined plot of moisture content against depth is presented in Figure 3 of Appendix 9. The plasticity index results have been plotted in Figure 4 of Appendix 9.

A single (1No.) compaction test on a sample of the cohesive Made Ground from borehole WS03 showed the optimum moisture content (20.0%) to be slightly drier than the natural moisture content (21.4%), the sample achieving a maximum dry density of 1.70Mg/m<sup>3</sup>.

A table summarising these test results for the Made Ground is presented in Table 1 of Appendix 9.

#### 7.1.2 Glaciolacustrine Clay

Glaciolacustrine Clay was encountered below the Made Ground, typically at depths of between 1.00m and 1.50m below ground level. The exception was CP03 where there the Glaciolacustrine Clay was present from 0.10m depth below topsoil. The Glaciolacustrine Clay was between 0.70m and 2.20m thick. It typically comprises firm sandy clay with closely to extremely closely spaced fissures, sandy pockets and calcareous nodules. A 0.35m thick layer of slightly gravelly slightly clayey sand was encountered in WS01 contained within the clay.

Standard Penetration Tests carried out within the Glaciolacustrine Clay showed a range of N values of between N=8 and N=20. Such results are indicative of a low varying to high strength clay with an undrained shear strength of the order of 35 to 90kN/m<sup>2</sup>, based on the tentative relationship  $c_u = f_1x$  (kN/m<sup>2</sup>) proposed by Stroud & Butler, where  $f_1 = 4.5$  for clay based on the Plasticity Index (PI). From the mean PI of 37% an undrained strength of 65kN/m<sup>2</sup> (medium strength) is estimated. Triaxial compression tests carried out on a single (1No.) undisturbed sample of the Glaciolacustrine Clay from Boreholes CP01 yielded a result for the undrained shear strength of 124kN/m<sup>2</sup>. This result indicates a high strength clay. A plot of the estimated Undrained Shear Strength from SPT N -values against depth for the Glaciolacustrine Clay is presented in Figure 1 in Appendix 9.

Measurements on the triaxial test specimen yielded a bulk density value of 2.01Mg/m<sup>3</sup>.

Two (2N o.) Particle Size Distribution tests were undertaken on samples of the Glaciolacustrine Clay. These showed the samples to comprise between 81% and 90% fines ( $<63\mu$ m) material, with sand fractions between 8% and 14% and gravel fractions between 2% and 5%. A combined plot for these two tests is presented in Figure 2 of Appendix 9.

Water content tests carried out on five (5No.) samples of the Glaciolacustrine Clay yielded values ranging from 25% to 31%. A plot of water content against depth for these deposits, presented in Figure 3 of Appendix 9, suggests a trend for the water content to decrease with depth.

Three (3No.) Atterberg Limit tests were completed on samples of the Glaciolacustrine Clay and showed the soils to have a medium to high plasticity with modified plasticity index results of 31% 35% and 42%. The results of the tests have been plotted in Figure 4 of Appendix 9.

A single (1N o.) compaction test on a sample of the Glaciolacustrine Clay from Cable Percussion Borehole CP01 showed the optimum moisture content (23.0%) to be drier than the natural moisture content (29.4%), the sample achieving a maximum dry density of 1.55Mg/m<sup>3</sup>. The plot in Figure 3 shows the results of all the natural moisture content tests to be greater than the optimum moisture content of this sample. Therefore it is anticipated that the soils may need treating before reusing on site, by either drying or the addition of a suitable material such as lime, in order to achieve the optimum moisture content.

A single (1No.) oedometer consolidation test carried out on an undisturbed sample from Borehole CP02 yielded a value for the coefficient of volume compressibility,  $m_v$  of  $0.09m^2/MN$  for the applied pressure range of 100 - 200kN/m<sup>2</sup>. This is indicative of low compressibility clay. Typically, a *fluvio-glacial clay* would be of medium



compressibility with an  $m_v$  value of 0.10-0.30m<sup>2</sup>/MN . As the test result is below this range, which is considered conservative, the result should be treated as anomalous.

From the results of insitu and laboratory testing, it can be summarised that the Glaciolacustrine Clay is typically of medium strength, high plasticity and has a natural moisture content of 25% to 31%. A table summarising the test results for the clay deposits, with range, mean and median values (where applicable) is presented in Table 2 of Appendix 9.

#### 7.1.3 Glacial Till

Glacial Till was encountered below the Glaciolacustrine Clay in all exploratory hole locations at depths ranging between 2.00m and 3.00m below ground level (10.08m OD to 11.47m OD). The depth to the base of the Glacial Till is unknown. The deposits were proven to a depth of 8.45m below ground level (3.63m OD to 5.20m OD), with a proven thickness of between 5.45 and 6.45m, in the Cable Percussion boreholes. The Glacial Till typically comprises firm to stiff slightly sandy slightly gravelly calcareous clay. The gravel is of sandstone and mudstone.

Standard Penetration Tests carried out within the Glacial Till deposits showed a range of N values between N=12 and N=41. Such results are indicative of a medium to very high strength clay with an undrained shear strength of the order of  $65kN/m^2$  to  $225kN/m^2$ , averaging at  $130kN/m^2$ , based on the tentative relationship  $c_u = f_1.xN$  (kN/m<sup>2</sup>) proposed by Stroud & Butler, where  $f_1 = 5.5$  for clay with a mean Pl of 17% Triaxial compression tests carried out on undisturbed samples of the Glacial Till from Boreholes CP01 (4.00 - 4.45m), CP02 (5.00 - 5.45m) and CP03 (2.00 - 2.45m and 6.00 - 6.45m) yielded undrained shear strengths of  $68kN/m^2$  to  $167kN/m^2$ . These results again indicate medium to very high strength clay. A plot of the estimated Undrained Shear Strength from SPT N -values against depth for the Glacial Till deposits is presented in Figure 1 in Appendix 9. The plot shows a weak correlation of increase in Undrained Shear Strength with increase in depth.

Measurements on the triaxial test specimens yielded bulk density values of 2.19Mg/m<sup>3</sup> to 2.25Mg/m<sup>3</sup>.

A single (1No.) oedometer consolidation test carried out on an undisturbed sample from Borehole CP03 yielded values for the coefficient of volume compressibility,  $m_v$  of 0.13MN/m<sup>2</sup> and 0.14MN/m<sup>2</sup> for the applied pressure ranges of 50 – 100kN/m<sup>2</sup> and 100 - 200kN/m<sup>2</sup>, respectively. Such  $m_v$  values are indicative of medium compressibility clay and are typical of a *weathered boulder clay*.

Water content tests carried out on sixteen (16No.) samples of the Glacial Till deposits yielded values ranging from 11% to 17% with a mean of 13.7%. A plot of moisture content against depth for these deposits, presented in Figure 3 of Appendix 9, suggests a slight decrease in water content with an increasing depth.

Eleven (11No.) Atterberg Limit tests were completed on samples of the Glacial Till deposits and showed the soils to have a low plasticity with a modified plasticity index range of 11.7% to 16.2% and a mean of 14.3%. The results of the test have been plotted in Figure 4 of Appendix 9.

From the results of insitu and laboratory testing, it can be summarised that the Glacial Till is typically of medium to very high strength, low plasticity and has a natural moisture content of 11% to 17%. A table summarising the test results for the clay deposits, with range, mean and median values (where applicable) is presented in Table 3 of Appendix 9.

#### 7.1.6 Ground Model

A cross section from approximately west to east is presented in Appendix 6.

#### 7.2 Groundwater

Groundwater was not encountered during the sinking of the exploratory holes.

Standpipes were installed in Boreholes CP01 to CP04, and WS02, and with the exception of WS02, which was installed at 4.00m, all recorded water during the monitoring visits. The results can be summarised as follows.



	Stratum covorad by	Groundwa	Remarks		
Borehole	Filter Zone	Depth (m bgl)	Level (m OD)		
CP01	Glaciolacustrine Clay and Glacial Till	1.76 – 1.92	11.73 – 11.89	Slight rise over monitoring visits	
CP02	Glaciolacustrine Clay and Glacial Till	4.42 - 7.78	5.69 — 9.05	Rising over monitoring visits	
CP03	Glaciolacustrine Clay and Glacial Till	0.30 - 5.00	8.01 - 12.71	Varying over monitoring visits	
CP04	Glaciolacustrine Clay and Glacial Till	1.10 – 1.38	10.70 – 10.98	Slight fall over monitoring visits. Stopcock cover noted as flooded during visit 3 and 4.	
WS02	Glaciolacustrine Clay and Glacial Till	3.58 (Visit 1) DRY (Visits 2 to 4)	10.00 (Visit 1)	Dry during visits 2 to 4	

It should be noted that groundwater levels can vary both seasonally and after prolonged periods of wet or dry weather.

The groundwater levels recorded at the site are variable with high groundwater levels recorded in CP03. The filter zones of all the standpipes include both the Glaciolacustrine Clay and the Glacial Till and as no water -bearing granular layers were noted within these soils, it is unlikely that the high water levels represent perched water. However, perched water may be present in the Made Ground which was detected during the investigation.

The results of the groundwater monitoring are presented in Appendix 5.

# 8.0 GEOTECHNICAL EVALUATION

#### 8.1 Proposals

It is understood that proposals for the site include the construction of a new secondary school comprising a twostorey school building along with associated infrastructure, car parking and soft landscaping. A plan showing the proposed rebuild location options at the time of preparation of this report is presented in Appendix 11. The following structural loadings have been provided by the engineer, for a two storey steel framed building.

	SLS (kN)	ULS (kN)
Internal	1500.0	2075.0
Edge	825.0	1150.0
Corner	450.0	625.0

Details of proposed finished levels had not been made available at the time of preparation of this report. It has been assumed that finished levels will be close to the existing ground levels.

#### 8.2 Foundation Solutions

The approach to design and selection of suitable foundation options for this site is based on a hierarchy of complexity and expense. If the simplest and cheapest solution case can be shown to be appropriate, then further discussion is considered superfluous. Where such simple and proven techniques are not expected to be suitable, then other options are examined in more detail. It should be noted that the following comments on foundation solutions are



based on the proposals discussed in Section 8.1 above; if proposals for the site are changed, it may be necessary to reconsider the foundation solutions. The following options have been considered:

- Traditional strip/pad foundations at shallow depth.
- Traditional strip/pad foundations, but using trench fill to transfer loads to soils at greater depths.

#### 8.2.1 Strip/Pad Foundations

It is anticipated that foundations, floor slabs and other substructures will have been removed as part of the demolition of the existing school buildings. Should the proposed new school building overlie part of the footprint of the existing school building, remnant demolition fill is likely to be encountered within new foundation excavations. Other Made Ground has been noted elsewhere across the site.

Made Ground is typically heterogeneous, of variable composition, thickness, relative density or consistency, compressibility, with a potential for further degradation and could potentially be chemically aggressive in nature. Hence, in its present condition, the Made Ground is deemed too variable to support the proposed school buildings on traditional strip/pad foundations without the risk of excessive and unacceptable settlements occurring.

Following a topsoil strip (where required) and relatively minor re-grading of the site in order to achieve the proposed finished floor levels, it is evident that the Glaciolacustrine Clay should provide a suitable bearing stratum for structural foundations.

The Glaciolacustrine Clay can generally be taken as being of medium compressibility (being firm in consistency) and traditional strip/pad foundations can be used to support the proposed buildings. Foundations should be installed at a minimum depth of 1.25m below ground level. The founding depths should also take account any existing trees and shrubs, and any that are proposed or removed, see Section 8.2.3 below. Any old foundations or buried structures should be removed to prevent hard spots below the new buildings. The resulting voids should be filled with suitably compacted clean crushed stone or similar suitable hardcore and the new foundations taken below this.

It is recommended that careful inspection of foundation trenches is carried out by a Geotechnical Engineer or other suitably qualified person prior to concreting, to ensure that natural undisturbed firm or stiff clay is present at the base. Should foundation depth be extended to below 1.50m, consideration should be given to the use of concrete trench fill foundations (see Section 8.2.2 below). Foundation settlement will be partly dependent on the applied loadings but for suitably designed strip / pad foundations settlements should be designed to be within normal tolerable limits for low sensitivity structures (i.e. 25mm).

#### 8.2.2 Trench Fill Foundations

In some areas foundation depths will be required to increase to:

- 1) take account of the effect of nearby trees and hedgerows (both current and pre-existing) in line with NHBC Standards Chapter 4.2, 'Building near Trees' (2022),
- 2) extend through any greater thicknesses of Made Ground, or,
- 3) extend through any softer Glaciolacustrine Clay to stiffer soils.

Placing foundations at a greater depth in clay soil would generally mean that they could benefit from a higher undrained shear strength for the soil. However, notwithstanding this, the allowable bearing capacity of the clay soil at greater depth would increase by virtue of the increase in depth factor. Where practicable the foundations should bear onto a uniform stratum to minimise the risk of differential settlements.

It is again recommended that the foundation excavations are carefully inspected by a geotechnical engineer or other suitably qualified person prior to concreting.

#### 8.2.3 Building near Trees

Several mature / semi-mature trees are present around the site, mainly to the north, east and west of the existing school buildings, and along the western edge of the play area in the east of the site. The distribution of trees across



the site is likely to impact the foundation design of all of the development options.

Tree root systems in clay soils can cause shrinkage and swelling movements due to moisture extraction by the trees. NHBC Standards Chapter 4.2, 'Building near Trees' (2022) gives guidance on foundation depths and precautions against heave where foundations are to be constructed within influencing distance of trees. It should be noted that special precautions may be required relating to heave where trees have been or are to be removed.

The volume change potential of the soils found during the investigation are based on the Modified Plasticity Index, I'p, which is calculated as follows:

#### l'p = lp x <u>% less than 425µm</u> 100

The Atterberg limit (plasticity index) tests have been carried out on samples of the Cohesive Made Ground, Glaciolacustrine Clay and Glacial Till. These test results can be used to determine the volume change potential in accordance with NHBC Chapter 4.2. The results are summarised in the following table:

Sam ple	PI (%)	%less than 425µm	Modified Plasticity Index I'p (%)	Volume Change Potential			
Cohesive Made Ground							
CP01 0.80m	34	96	32.6	Medium			
CP02 0.50m	39	99	38.6	Medium			
CP04 0.80m	22	85	18.7	Low			
Glaciolacustrine Clay							
CP01 1.50m	36	99	35.6	Medium			
CP02 1.20-1.65m	42	100	42.0	High			
CP03 0.50m	34	92	31.3	Medium			
Glacial Till							
CP01 4.00-4.45m	17	83	14.1	Low			
CP02 2.50m	18	86	15.5	Low			
CP02 4.50m	17	85	14.5	Low			
CP03 2.00-2.45m	15	86	12.9	Low			
CP03 3.50m	17	85	14.5	Low			
CP04 2.50m	17	84	14.3	Low			
CP04 3.50m	17	88	15.0	Low			
WS01 3.00-3.50m	18	90	16.2	Low			
WS02 2.50m	17	93	15.8	Low			
WS03 2.50m	15	78	11.7	Low			
WS03 3.50-4.00m	15	87	13.0	Low			

On the basis of these results it is recommended that a high volume change potential is adopted when determining foundation depths in relation to trees and the requirements for compressible materials/voids adjacent to foundations or below floor slabs.

As a guide, based on the procedures outlined in NHBC Standards Chapter 4.2 for a High Volume Change Potential soil with a high, moderate and low water demand mature tree of 20m in height, the following minimum foundation depths are indicated;



Distance of	Broad Leaf Tree			Coniferous Tree	
foundation from Tree (m)	High W ater Demand	Moderate W ater Demand	Low W ater Demand	High W ater Demand	Moderate W ater Demand
0	>2.50	2.35	1.75	>2.50	2.20
10	2.50	1.50	1.00	1.45	1.00
20	1.50	1.00	1.00	1.00	1.00

These foundation depths are for guidance only. As part of the design process, the foundation depths should be assessed in relation to the tree species, its water demand and its mature height for existing or planned trees and for its actual height for one which is to be removed.

For High Volume Change Potential soils the NHBC recommend a 35mm minimum void dimension against the sides of foundations or sides of ground beams constructed within the zone of influence of trees.

#### 8.3 Ground Floor Slabs

In accordance with NHBC Chapter 4.2, 'Building near Trees', special precautions may also be required relating to heave on ground slabs, where trees have been, or are to be removed. As previously stated in Section 8.2.3 above, the Glaciolacustrine Clay can generally be taken as having a High Volume Change Potential based on NHBC Chapter 4.2.

For High Volume Change Potential soils, the NHBC recommend the following minimum void dimensions below ground beams or ground floor slabs constructed within the zone of influence of trees.

Туре	Under Ground Beam and Suspended In Situ Concrete Ground Floor	Under Precast Concrete Ground Floor		
Minimum Void	150mm	300mm		

Should cast in situ suspended floor slabs be adopted then a void former will be required in order to create the minimum required void dimension beneath the slabs to protect against potential heave of the underlying clay soils.

#### 8.4 Buried Concrete

The results of the chemical testing on samples from the site during this preliminary investigation show the following:

#### Made Ground (2 No. samples)

Water Soluble Sulphate	56 mg/l and 60 mg/l
pH	7.3 and 7.8

#### Glaciolacustrine Clay (2No. sam ples)

5	• • •
Water Soluble Sulphate	68 mg/l and 1100 mg/l
рН	9.1 and 11.6

#### Glacial Till (4No. samples)

Water Soluble Sulphate	250 to 930 mg/l
рН	8.6 to 11.7

The characteristic water soluble sulphate concentrations for the Glaciolacustrine Clay and the Glacial Till lie within Design Sulphate Class DS2 of BRE Special Digest 1. The site is unlikely to contain chemical residues produced by or associated with industrial production and hence can be considered to be a "natural ground location". Given the occasional presence of sand bands within the low permeability clay soils, groundwater is conservatively considered to be "mobile". The soils are not expected to be pyritic and the ACEC Class for the site is therefore AC-2. It is recommended that all subsurface concrete is designed to meet the requirements of this classification.



#### 8.5 Excavations

The soils below this site would all be classed as 'easy digging' for normal backhoe excavation plant. However, following demolition, any areas of hardstanding and concrete floor slabs from the existing school development, together with any remnant foundations or other substructure remains will require the use of hydraulic breakers to assist with their removal.

Support to the sides of excavations should be in accordance with the recommendations of CIRIA Report 97, 1983. Close-boarded support will be required for excavations in excess of 1.20m depth where any granular materials or soft cohesive deposits are encountered.

For excavations below 1.20m depth in firm clay, half- boarding will be required. Shallower excavations will need support or battering back to a safe slope angle (gradient no steeper than 1 vertical to 3 horizontal), if they are to remain open for extended periods or if personnel are expected to enter.

Maximum groundwater levels of between 0.30 to 4.42m bgl (9.05 to 12.71m OD) were recorded over the monitoring period and for groundwater levels greater than 1m bgl, some form of dewatering / groundwater control will be necessary during construction.

All plant and machinery will need to maintain an appropriate stand off from the crest of all open excavations.

All formations should be protected from mechanical disturbance and assumed to be frost-susceptible.

#### 8.6 Pavement Design

The conditions prevailing at the time of construction will affect the CBR of the subgrade soil and its strength. Research has shown the importance of the equilibrium moisture content of the subgrade. The relationship between soil suction and the moisture content shows that a soil that becomes wet during construction will retain water and will therefore be weaker under the pavement in the equilibrium condition than a foundation that has remained dry, particularly for soils of low to medium plasticity.

The formation for new pavements is likely to be comprised of either Made Ground and/or Glaciolacustrine Clay. The Plasticity Indices (PI) obtained from tests on these materials ranged between 22% to 39% for the Cohesive Made Ground, and between 34% and 42% for the Glaciolacustrine Clay.

Equilibrium CBR values for various materials for poor and good construction conditions are given in a report by the TRRL (Report 1132). The following equilibrium CBR values are indicated for poor and good construction conditions assuming a high water table, and a thick pavement construction, in the TRRL Report.

וס	Equilibrium CBR (%)				
PI	Poor Conditions	Good Conditions			
20	4	7			
30	3.5	5			
40	2.5	3			

CBR values for the soils at a nominal 600mm depth, estimated from in situ dynamic cone penetration tests are presented in the following table:

CBR Test	CBR (%) At 600mm depth	Material
DCP01	10.2	Cohesive Made Ground
DCP02	12.5	Cohesive Made Ground
DCP03	18.8	Cohesive Made Ground
DCP04	17.6	Granular Made Ground
DCP05	6.0	Glaciolacustrine Clay



With the variations in CBR encountered, it would be prudent to adopt a conservative approach to pavement design, with the adoption of a preliminary design CBR value of 4% for the site. Where any weaker zones are encountered, the exposed surface should be proof-rolled and any soft spots that depress unduly should be removed and replaced with clean crushed stone or similar suitable granular fill. Further testing of the formation surface following the site strip and any re-grading would help to confirm the design CBR value.

In accordance with Road Note 29, "A Guide to the Structural Design of Pavements for New Roads", 1970, where poorly-drained cohesive soils have a PI of less than 20% they are considered to be frost susceptible. Based on this criteria, the Made Ground and Glaciolacustrine Clay can be considered as non-frost susceptible. Should the base of any foundations be taken into the Glacial Till, it would be prudent to consider these soils as being frost susceptible.

#### 8.7 Retaining Walls

Due to the generally flat topography of the site, it is anticipated that retaining walls will be unlikely to be required as part of the school redevelopment.

#### 8.8 Soakaway Drainage

This investigation did not include any trial pit soakaway tests. The natural soils below the site comprised mainly clay and silt and such materials will likely exhibit poor to negligible infiltration rates. If the possible use of soakaway drain age is to be investigated for the new school, it would be necessary to carry out soakaway tests in accordance with BRE Digest 365 'Soakaway Design', 2016.

#### 8.9 Earthworks

Due to the generally flat-lying nature of the site, significant earthworks are not anticipated. However, surplus spoil will arise from excavations for foundations. These arisings could be used, if required, for any landscape mounds, subject to their geo-environmental suitability. Laboratory testing on a single (1No.) sample of Made Ground and a single (1No.) sample of the Glaciolacustrine Clay have shown both to have moisture contents wet of optimum. As a result should they be required for use as engineered fill, it may prove necessary to dry the soils by either spreading them out and allowing to dry naturally or by the addition and mixing of a suitable material, such as lime.

#### 8.10 Updated Geotechnical Risk Register

A preliminary geotechnical risk register for the site was presented in the Desk Study (reference: PC218325, October 2021). The geotechnical risk register has been updated to reflect the findings of this investigation and above recommendations, as follows:

	Condition	Hazard	Potential Impact	Before Control		Comments / Proposed	After Control			
				Probability	Im pact	Risk	Mitigation	Probability	lm pact	Risk
R1	Compressible ground	Insufficient bearing capacity leading to potential increased total and differential settlement problems. The underlying Glaciolacustrine Clay could include highly compressible soft clay and silt layers.	Failure / excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings. Potential for differential settlement.	3 (P)	4 (H)	12 (Md)	Use concrete strip/pad or trench fill foundations to transfer foundation loads onto the firm or stiffer Glaciolacustrine Clay and/or Glacial Till.	1 (VU)	4 (H)	4 (N)
R2	Mad e Ground	Variable behaviour and thickness leading to variable bearing capacities and unpredictable total and differential settlements. A	Failure / excessive movement of the foundations / ground bearing floor slabs	4 (L)	4 (H)	16 (Sb)	Use concrete strip/pad or trench fill foundations to transfer foundation loads onto the firm or stiffer Glaciolacustrine Clay and/or Glacial Tills.	1 (VU)	4 (H)	4 (N)


		thickness of Made Ground of up to about 1m could be present.	leading to cracking of buildings. Potential for differential settlement.							
R3	Swelling / Shrinking Soils	Shallow foundation movement due to seasonal shrinkage / swelling of clay soils associated with trees and shrubs. Trees and shrubs are present on the site, some of which may be removed during development and the underlying Glaciolacustrine Clay is of High Volume Change Potential.	Excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings.	4 (L)	4 (H)	16 (Sb)	If any foundations are within influencing distance of existing or removed trees, determine foundation depths and requirements for compressible materials/voids adjacent to foundations/below floor slabs using guidance in NHBC Chapter 4.2 'Building Near Trees'.	1 (VU)	4 (H)	4 (N)
R4	Obstruction / Hard Strata	Affecting excavations during construction works and potential hard spots below foundations / floor slabs. Obstructions possibly within Made Ground and boulders possibly within Glacial Till.	Differential movement of the foundations / ground bearing floor slabs leading to cracking of buildings. Delays to excavations during construction	3 (P)	4 (H)	12 (Md)	Use backhoe excavation plant but have hydraulic breakers available to assist with the removal of any remnant hardstanding, concrete floor slabs, foundations or other substructure remains following the demolition of the previous school development.	1 (VU)	4 (H)	4 (N)
R5	High groundwater	Instability of foundation excavations and problems with foundation, floor slab and road / hardstanding formations.	Excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings and subsidence of roads / hardstanding areas.	3 (P)	4 (H)	12 (Md)	Maximum groundwater levels of between 0.30 and 4.42m bgl recorded during monitoring. Excavations will require control measures to control groundwater.	1 (VU)	4 (H)	4 (N)
R6	Chemically Aggressive Soil	Corrosive attack of buried concrete.	Degradation of concrete foundation and buried concrete structures leading to failure.	3 (P)	3 (M)	9 (Md)	Use concrete to AC-2 classification of BRE SD1 for all subsurface concrete.	1 (VU)	3 (M)	3 (N)
R7	Buried services	Damage during construction works posing risk to Health and Safety of site personnel and public.	Increased cost and delay for unplanned diversions, protection or repair.	2 (U)	5 (VH)	10 (Md)	All Statutory Service Plans to be provided to the Specialist Contractors prior to works taking place. Vigilance throughout any excavation work for any indications of unrecorded buried services.	2 (U)	5 (VH)	10 (Md)

R8	Slopes	Failure of existing slopes along southern edge of site along river bank and any slope created during development separating different areas.	Not expected.	1 (VU)	4 (H)	4 (N)				
R9	Retaining Walls	Failure or movement of any created retaining walls or structures during development separating different site areas.	Not expected.	1 (VU)	4 (H)	4 (N)				
R10	Solution Features	Potential collapse or settlement of ground affecting buildings, hardstanding and infrastructure.	Not expected.	1 (VU)	4 (H)	4 (N)				
R11	Mining Activities	Potential collapse or settlement of ground affecting buildings, hardstanding and infrastructure.	Not expected.	1 (VU)	4 (H)	4 (N)				
R12	Frost Susceptibility	Affecting the subgrade of roads and areas of hardstanding.	Subsidence and cracking of roads and areas for hardstanding and increased maintenance and management costs.	3 (P)	3 (P)	9 (Mn)	Atterberg limit testing indicates that the cohesive Made Ground and Glaciolacustrine Clay are non-frost susceptible. The Glacial Till is frost susceptible.	1 (VU)	3 (P)	3 (N)
R13	UXO	Affecting investigation and construction works and posing risk to Health and Safety of site personnel and the public.	Increased costs and delay to the project and potential serious injury or death.	2 (U)	5 (VH)	10 (Md)	Preliminary UXO Threat Assessment carried out and risk assessed as very low and no further action required. Vigilance throughout investigation and construction works required.	1 (VU)	5 (VH)	5 (Mn)

## 9.0 GENERIC QUANTITATIVE RISK ASSESSMENT

### 9.1 Introduction

The UK approach to the assessment of contaminated land is based upon the principles of risk assessment, which is founded on the use of 'source-pathway-receptor' principles in order to establish the potential presence of 'pollutant linkage' as detailed in the LCRM.

Geotechnics Limited adopts a tiered approach to risk assessment in accordance with current UK guidance and good practice. The initial step of this process, known as Tier 1 or Generic Quantitative Risk Assessment (GQRA), is the comparison of site-derived data with relevant guideline levels.

Should the adopted criteria be exceeded, then two courses of action are available. The first is to break the pollutant linkage by undertaking remedial works such as removing or treating the contaminated soil. Alternatively, a more detailed risk assessment (DQRA) can be carried out to determine whether a contamination risk exists.



The UK approach to the assessment of human health risk from contaminated land is set out in the CLEA (Contaminated Land Exposure Assessment) framework, which was first published in 2002 by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA). The original guidance was withdrawn, and revised guidance issued in 2009, which is set out in the following documents published by the EA:

'Human Health Toxicological Assessment of Contaminants in Soil, Science Report SC050021/SR2; and

'Updated Technical Background to the CLEA Model, Science Report SC050021/SR3.

The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment and a generic conceptual model for site conditions together with human behaviour to estimate long term human exposure to soil contaminants. Soil Guideline Values (SGV) were previously derived using the CLEA Model by comparing estimated exposure with 'Health Criteria Values' (HCV) that represent a tolerable risk to health from chronic exposure.

The CLEA model has also been used to determine other generic assessment criteria (GACs), including those used within this assessment.

### 9.2 Risk Assessment Methodology

Based on site size, homogeneous ground conditions and site history, the site has been considered as one averaging zone. Relevant guidance issued by the Chartered Institute of Environmental Health (CIEH), in association with LQM, published November 2015 has been adopted.

Laboratory testing results were directly compared to the adopted GAC for residential without home grown produce / public open space (parkland), and results are shown in full in Appendix 10.

#### 9.3 Risk Assessment for Human Health

Of the twelve samples tested, one sample exceeded the relevant SGV/GAC. This was a soil sample taken from location WS02 at 0.30m depth. The sample exceeded the SGV of 1mg/kg for Benzo(a)pyrene for residential without home grown produce with a reported concentration of 1.6mg/kg. However the concentration is below the relevant LQM Suitable for Use Level (S4UL) for residential without home grown produce of 3.2mg/kg. Therefore the sample is not considered to pose a significant risk to human health.

The twelve samples were laboratory screened for asbestos; and asbestos was not detected in any of the samples.

### 9.4 Risk Assessment for Phytotoxic Effects

Concentrations of the phytotoxic metals copper, nickel and zinc nickel do not exceed the guideline values for the protection of plants as presented in the <u>Defra Sewage Sludge Code of Practice</u>. Any risks to plants are assessed as being very low. Mercury and cadmium were not included in the analytical suite. The results of the phytotoxic screening are presented in the tables below.

Determinand	Number of samples	GAC (mg/kg)	Results Exceeding GAC (mg/kg)	Exceeds GAC (Y/N)
Arsenic	12	All pH - 50	-	Ν
Copper	12	pH>7 - 200	-	Ν
Cadmium	-	All pH – 3	Not analysed for	-
Chromium	12	All pH - 400	-	Ν
Nickel	12	pH>7 – 110	-	Ν
Mercury	-	All pH - 1	Not analysed for	-
Lead	12	All pH – 300	-	N
Zinc	12	pH>7 – 300	-	N
Selenium	12	All pH - 3	-	N



### 9.5 Assessment for the Protection of Controlled Waters

The risks to controlled waters (groundwater and surface waters) from contaminants on-site have been assessed in accordance with the Environment Agency (EA) documents (The Environment Agency's Approach to Groundwater Protection, 2017 and Remedial Targets Methodology, 2006). Pollutant inputs from contaminated land sites are considered as passive inputs under the European Water Framework Directive (2000/60/EC) (WFD) and its daughter Directives, and as such are regulated under the Agency's 'limit' pollution objective. Acceptable water quality targets (WQT) are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)).

Groundwater was not encountered during progression of exploratory holes. During the four rounds of monitoring all wells, with the exception of WS02, have recorded groundwater (although CP02 had insufficient water for sampling during the first visit). Groundwater gauging show that groundwater levels vary by up to approximately 3m across the site during the final monitoring visit.

It is considered that groundwater encountered in monitoring wells is likely to be due to a mixture of infiltration of rainfall being trapped within monitoring wells and potentially hydraulically isolated groundwater within the low permeability cohesive deposits. Relatively large fluctuations in elevation have been encountered between monitoring rounds for individual monitoring wells. Head differences of over 4m further show that there is very limited lateral hydraulic connectivity between any true groundwater encountered as wells as rainwater collecting within monitoring wells which are acting as sumps. Therefore, any lateral or downward pathways for the migration of groundwater or contaminants leached from soils will be tortuous and slow

Recovered water samples from the first monitoring visit, as well as soil samples selected for soil leaching analysis with the leaching aliquot, were analysed and screened against Environmental Quality Standards (EQS) rather than the Drinking Water Standards (DWS). EQS are considered the most appropriate screening criteria as there are no groundwater abstractions in the vicinity of the site and groundwater will form base flow to local rivers. There are no groundwater abstractions in the vicinity of the site, and base flow to surface water courses is the most appropriate receptor to consider.

Determinand	Unadjusted EQS GAC (µg/l)	DW S GAC (µg/l)	Results Exceeding EQS (µg/I)	Results Exceeding DW S (µg/l)
Copper	1	2000	CP01 – Soil Leachate – 4.6 CP01 – Groundwater – 1.8 CP03 – Groundwater – 4.4 CP04 – Groundwater – 1.5 WS02 – Soil Leachate – 1.4	
Iron	1000	200	CP01 – Soil Leachate – 1300	WS02 – Groundwater – 290
Lead	1.2	10	CP01 – Soil Leachate – 3.1 WS02 – Soil Leachate - 1.9	
Manganese	123	50	CP01 – Groundwater – 180 CP04 – Groundwater – 550	
Selenium	-	10		CP01 – Groundwater – 29 CP03 – Groundwater – 37
Zinc	10.9	3000	CP01 – Soil Leachate – 300 CP01 – Groundwater – 63 CP03 – Groundwater – 140 CP04 – Groundwater – 50 WS02 – Soil Leachate – 110	
Fluroa nthene	0.0063	-	CP01 – Groundwater – 0.06 CP04 – Groundwater – 0.02	
Benzo(b) fluoranthene	0.00017 (BaP value)	0.10	CP01 – Groundwater – 0.01	

Exceedances of the relevant guidance criteria are summarised in the table below.

The results above show that there are some exceedances of EQS DWS values for some heavy metals and Benzo(b)fluoranthene. As discussed above these concentrations are likely to reflect concentrations from localised groundwater or from the relatively aggressive leaching of soils via leaching tests. The combination of the concentrations present, the presence of tortuous pathways and a lack of identified sources means that these



exceedances will not present a risk to sensitive receptors.

#### 9.6 Ground Gas Risk Assessment

The four rounds of ground gas monitoring results obtained are presented in Appendix 5. Two rounds of the monitoring were undertaken when atmospheric pressure was less than 1000mbar (996 mbar on 9 December 2021 and 997 mbar on 16 December 2021).

The conceptual model has not shown any significant sources of ground gas to be present, such as active or recently closed landfills, thick Made Ground containing labile carbon or bedrock subject to mining and possibly mineshafts. The measured flow rates show that there is no significant source of ground gases at depth. Slightly elevated ground gases and depleted oxygen are typically widespread in soils and the soils ground gas regime and strata encountered are considered to be typical of Gas Regime A and no ground gas protection measure are required within any foundations (Card et al. 2019).

## **10.0 REVISED CONTAMINANT LINKAGE ASSESSMENT**

An updated assessment of pollutant linkages has been made following the completion of a ground investigation and generic quantitative risk assessment to assess potential sources.

	Hazaro	Identification			Hazard As	sessment	
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Contaminant Linkage Assessment
1	Contaminated soil/groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	A- Humans using the site during construction	Negligible / Not credible	Medium	Low	NAR
2		Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	B- Humans using the site after development completion	Negligible / Not credible	Medium	Low	NAR
3		Downward / Lateral migration	D – Unproductive strata D – Principal Aquifer	Low / Unlikely	Medium	Medium / Low	NAR – the severity is borderline mild, which would give a low risk. There are also no credible sources on site.
4		Inhalation	B- Humans using the site after development completion	Negligible / Not credible	Medium	Low	NAR
5	Gas – methane & carbon dioxide	Inhalation, dermal/direct contact	E- Ecology (Flora/Fauna)	Negligible / Not credible	Negligible	Near Zero	NAR
6		Inhalation, dermal/direct contact	B - Humans using the site after development completion	N/A	Severe	Low	NAR



7	Contaminated soil/waste/ groundwater	Interface between Made Ground / Topsoil and Unproductive strata	E- Ecology (Flora/Fauna)	Negligible	Mild	Low	NAR
8	Contaminated groundwater	Direct contact.	F- Building structures	Negligible	Mild	Low	NAR

## 11.0 CONCLUSIONS

### 11.1 Geotechnical

This preliminary ground investigation has shown the site to be typically underlain by variable depths (typically less than 1.2m) of Made Ground above firm Glaciolacustrine Clay (Alne Glaciolacustrine Formation) extending to between 2m and 3m depth which in turn overlies firm becoming stiff Glacial Till.

It is anticipated that the proposed school buildings could be supported on traditional concrete strip/pad foundations or concrete trench fill foundations, these being constructed on the Glaciolacustrine Clay and/or the Glacial Till.

Several mature / semi mature trees are spread around the site. Hence, as a precaution against heave in the underlying clay soils there are requirements for compressible materials/voids adjacent to foundations/below floor slabs in accordance with NHBC guidelines.

Testing carried out during this preliminary investigation indicates that subsurface concrete should be designed to comply with the AC-2 classification of BRE Special Digest 1.

It would be prudent to adopt a conservative approach to pavement design, with the adoption of a preliminary design CBR value of 4% for the site. Where weaker zones are present at formation level, the exposed surface should be proof-rolled and any soft spots that depress unduly should be removed and replaced with clean crushed stone or similar suitable granular fill. Further CBR testing of the likely formation surface is advised prior to final design/construction.

The natural soils below the site comprised mainly clay and silt and such materials will likely exhibit poor to negligible infiltration rates. If the possible use of soakaway drainage is to be investigated for the new school, it would be necessary to carry out soakaway tests in accordance with BRE Digest 365 'Soakaway Design', 2016.

Significant earthworks are not anticipated on this generally flat-lying site. Surplus spoil will arise from excavations for foundations. These arising's could be used, if required, for any landscape mounds, subject to their geo-environmental suitability.

Due to the generally flat topography of the site, it is anticipated that retaining walls will be unlikely to be required as part of the school redevelopment.

Potential abnormal geotechnical costs may arise from the following:

- Deeper excavations for concrete trench fill foundations in order to extend through locally thicker Made Ground (e.g. CP04), through softer zones in the clay soils, and to install footings on clay soils outside of the zone of influence of trees on the site in accordance with NHBC guidelines.
- As a precaution against heave in the underlying clay soils there are requirements for compressible materials/voids adjacent to foundations/below floor slabs in accordance with NHBC guidelines.
- Potential weaker zones at pavement formation surface requiring removal and replacement.



### 11.2 Updated Environmental Risk Assessment

A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, in accordance with BS 10175: 2011 +A2 2017 "Investigation of Potentially Contaminated Sites – Code of Practice" and LCRM. In order to make a more detailed assessment of the potential hazards, a preliminary Phase 2 intrusive investigation was carried out to reduce uncertainty and produce a more comprehensive conceptual site model of the site. This detailed the characteristic ground conditions and elements of the surrounding environment and has assisted with identifying contaminant linkages

There are no exceedances of human health GACs for future site users or construction staff. Concentrations of soil leaching and groundwater contaminants show that there are no significant risks to controlled water receptors. Ground gas monitoring has confirmed that there are no significant sources of ground gases present affecting the site and the ground gas regime is classified as Gas Regime A for methane and carbon dioxide and no ground gas protection measures are required for any proposed structures.

Based on the scope of the works undertaken during this preliminary investigation, there are no anticipated abnormal costs relating to geoenvironmental conditions. However, there may be special conditions appertaining to the site which were not revealed by this investigation and which have not been taken into account in this report.



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## **APPENDIX 1**

## Site Location Plan



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Geotechnical and Geoenvironmental Desk Study at Trial Site Location for Department for Education





	NOTES:			
M		School Site Bound	lary	
$\rightarrow$ $//$	1	School Playing Fie	eld Boun	dary
$\zeta M$		Separation of 2 ad	lioinina ł	olocks
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- L		Typical Block dime	ensions	
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	ANC1	Ancillary Block Re	ference	
$   / \rightarrow$	Car Park, etc.	Annotation to spec	cific area	as
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	Rev Date Description	n & Skills Agency	Educ Func	Dm Ch cation ding
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	Rev Date Description	n & Skills Agency - 19	Educ Func Age	Dm Ch cation ding ncy
	Rev Date Description Education Funding A	n & Skills Agency - 19	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17	n & Skills Agency - 19	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844	n & Skills Agency - 19	Educ Func Age	Drn Ch
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplanc	n & Skills Agency - 19 d Primary A	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplanc	n & Skills Agency - 19 d Primary A	Edua Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplanc Site Address	n & Skills Agency - 19 d Primary A	Educ Func Age	Dm Ch cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address	n & Skills Agency - 19 d Primary A	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address	n & Skills Agency - 19 d Primary A	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET	n & Skills Agency - 19 d Primary A	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP	n & Skills Agency - 19 d Primary A on Lane	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TII	n & Skills Agency - 19 d Primary A on Lane	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TII Checked C.ST	an & Skills Agency - 19 d Primary An on Lane	Educ Func Age	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TH Checked C.ST Scale: NTS	on & Skills Agency - 19 d Primary Ad on Lane	Educ Func Age	Drm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TH Checked C.ST Scale: NTS Document Staus:	on & Skills Agency - 19 d Primary Ar on Lane	Educ Func Ager cade	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TH Checked C.ST Scale: NTS Document Staus:	n & Skills Agency - 19 d Primary A on Lane	Educ Func Ager cade	Dm Ch Cation ding ncy
	Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hempland Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawn K.TII Checked C.ST Scale: NTS Document Staus:	n & Skills Agency - 19 d Primary Ad on Lane	Educ Func Agei	Ecation ding ncy
	Rev Date Description Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address Whitby Avenue, Stockt York, North Yorkshire YO13 1ET Survey Organisation CAP Drawin K.TII Checked C.ST Scale: NTS Document Staus:	an & Skills Agency - 19 d Primary Ad on Lane	Educ Func Age	Ervision:
	Rev Date Description Rev Date Description Education Funding A CDC 17 SCHOOL: 142844 Hemplance Site Address Whitby Avenue, Stockt York, North Yorkshire YOTA 1ET Survey Organisation CAP Drawin K.THI Checked C.ST Scale: NTS Document Staus: Drawing Number: 142	on & Skills Agency - 19 d Primary Ad on Lane ITA BBS Dat ITA BBS Dat ITA BBS Dat ITA BBS Dat ITA BBS Dat ITA SER ITA ITA BBS Dat ITA ITA SER ITA ITA BBS Dat ITA ITA ITA ITA ITA ITA ITA ITA ITA ITA	Educ Func Age cade	erwision: Revision: REV

# **APPENDIX 2**

## Cable Percussion Borehole Records

## DATA SHEET - Symbols and Abbreviations used on Records

Sample	e Types	Groundwater		Strata, Continued	
В	Bulk disturbed sample	Water Strike	$\nabla$	Mudstone	
BLK	Block sample	Depth Water Rose To	Y		
С	Core sample			Siltstone	*****
D	Small disturbed sample (tub/jar)	Instrumentation		Sitistone	* * * * * *
Е	Environmental test sample		22	Metamorphic Rock	* * * * *
ES	Environmental soil sample	Seal	11	Fine Grained	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
EW	Environmental water				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
G	Gas sample		-	Medium Grained	~~~~
L	Liner sample	Filtor	-	Coorce Crained	$\sim$
LB	Large bulk disturbed sample	FIILEI	1	Coarse Grained	$\sim\sim$
Р	Piston sample (PF - failed P		-	laneous Rock	$\sim$
ΤW	Thin walled push in sample			Fine Grained	v v v v v v v v v v v v v v
U	Open Tube - 102mm	Seal			++++
	diameter with blows to take sample. (UF - failed U			Medium Grained	+ + + + +
	sample)				+ + + +
UT	Thin wall open drive tube sampler - 102mm diameter	Strata		Coarse Grained	
	with blows to take sample. (UTF - failed UT sample)	Made Ground Granular		Backfill Materials	
V	Vial sample				8
W	Water sample	Made Ground		Arisings	×
#	Sample Not Recovered	Collesive			X
Insitu <sup>-</sup>	Testing / Properties	Topsoil		Bentonite Seal	
CBRP	CBR using TRL probe				
CHP	Constant Head	Cobbles and Boulders	000		¢ •
COND	Permeability Test		200	Concrete	
TC	Thermal Conductivity	Gravel			<u>~</u>
TR	Thermal Resistivity		· · · · ·	Fine Gravel Filter	
HV	Strength from Hand Vane	Sand			-
ICBR	CBR Test			General Fill	1
IDEN	Density Test	Cill	× ^ .		<u>.</u>
IRES	Resistivity Test	SIII	× × ×		
MEX	CBR using Mexecone Probe Test		× ×	Gravel Filter	÷.
PKR	Packer Permeability Test	Clay	÷		1
PLT	Plate Load Test			Grout	1
PP	Strength from Pocket	Deal	NV2		000
Temp	Temperature	Peat	AK.	Sand Filter	
VHP	Variable Head Permeability		N/2		000
\ /NI	Lest	Noto: Composito coll tupo		<b>T</b>	2
w%	Water content	by combined symbols		Tarmacadam	
(All oth	er strengths from	Chalk		Deterny Core	
undrain	ed triaxial testing)			ROD Rock Quality Des	anation
3	(SPT)	Limostono		(% of intact core	>100mm)
С	SPT with cone	Limesione		FRACIURE INDEX Fractures/metre	
Ν	SPT Result			FRACTURE Maximum SPACING (m) Minimum	
-/-	Blows/penetration (mm) after seating drive	Sandstone		NI Non-intact o	ore
-*/-	Total blows/penetration			AZCL No core rec	overy ne of core
(mm)		Coal		loss (where core recovery is unknow	vn it is
( )	Extrapolated value			assumed to be at the base of the	e run)



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## BOREHOLE RECORD - Cable Percussion

Project	HEMP	LAND PR	IMARY SC	CHOOL,	YORK	<u> </u>	Engine	er	MOTT MAC	DONALD	LIMIT	ED		Boreho Project	ole C No ₽0	P01 2218325	
Client	DEPAI	RTMENT I	FOR EDUC	CATION			Nationa Coordi	al Grid nates	462516.2 452976.5	2 E 5 N			1	Ground	Level 1	3.65 m	OD
Sampl	ing		Tuntin	Prope	rties		Strat	a								Scale 1	:50
Depth		Sample Type	Cased & (to Water)	Strength kPa	w %	SPT N	Descri	ption							Depth	Legend	Level m OD
0.10		- ES					MADE	GROUND	: Asphalt						G.L. 0.15		13.65 13.50
0.30- 0.30 0.30 0.50-	· 0.50 · 1.00	- B - D - ES - B					MADE grave muds frag	GROUND el of a tone, s ments (	: Reddish ngular to andstone, Sub base)	brown suban concr	and l gular ete, a	ight gr fine to sphalt	ey sand coarse and bri	y of ck	0.50		13.15
0.80 0.80 1.20-	- 1.65	_ D _ ES - _ D	1.20 (DRY)		29	<b>S</b> 8	MADE grey is a muds	GROUND slight ngular	: Soft br ly sandy to subrou andstone	rown oc slight unded f and br	casion ly gra ine to ick fr	ally mo velly c coarse	ottled 1 lay. Gr	ight avel	 		12.45
1.50- 1.50	- 2.00	_ В - D 	1.70	124	27		Firm slig (up	fissur htly sa to 20mm	ed brown ndy CLAY ) and occ	mottle with s asiona	d grey ome ca 1 sand elv cl	and li lcareou y pocke	ght gre us inclu ets (up	y sions to			
2.50-	- 3.00	- B	(DRY)				rando At 2	omly or .00m, s	ientated, tiff.	smoot	h and	dull.	,		- - - - -		
2.50	3.15	D													-		t t
3.00-	- 3.45		1.70 (DRY)			s13	Firm calca fine	brown areous to coa:	slightly CLAY. Gra rse of mu	sandy vel is dstone	slight suban and s	ly grav gular t andstor	velly co subro ne.	unded	- 3.00 -		10.65
3.50-	- 4.00	_ В - D -													-	· · · · · ·	
4.00-	4.45	_UT39	1.70 (DRY)	68	13										- - - - -		
4.50- 4.50	- 5.00	- B - D -													- - - - -		
5.00-	- 5.45		1.70 (DRY)			S20	Belo	w 5.00m	, stiff.						- - - - -		
5.50	- 6.00	- D													-  -  -		
6.00-	6.45	UT53	1.70 (DRY)												- - - -		
6.50- 6.50	- 7.00	_ в - D					Belo	w 6.50m	, very st	iff.							
7.00-	7.45	D	1.70 (DRY)			S41									- - - -		
7.50- 7.50	- 8.00	В D													- - - -	· · · · · · · · · · · · · · · · · · ·	
8.00-	8.45	с - р	1.70 (DRY)			S41											 
															8.45	· · · · ·	5.20
		-							EI		orenoi	e			-		
		-													-		
		-													-		
		-													-		
		_													_		
Boring	Hole		Techniqu	<u> </u>	Стом	Depth	ess Depth	Depth to	Date	Time	Depth	Depth	Rose to	in	Depth	Rema	arks on
1.20 8.45	Dia 0.40 0.15	Inspect Cable 1	tion Pit Percussi	: Lon	KR/SR KR/SR	G.L. 8.45	1.70	DRY	25/11/21 25/11/21	08:00 18:00	Struck	Cased		Mins	Sealed	Grour None end during 1	idwater countered coring.
Remar	ks 🛺	Tarmaca and no ES samj	adam bro service ple = 1	oken ou es were x 1 li	t using found tre pla	g hydra astic t	ulic b	reaker. x 258ml	Inspecti amber gl	lon pit lass ja	hand rs and	excavat	ed to 1	.20m d	epth Logo Che Figu	ged by cked by re	CP JK 1 of 1
abbreviati explained accompar key sheet	ons are on the nying	A 50mm 8.00m v filter	standpi with upr up to 1	ight lo .00m, 1	insta ockable benton:	iled to e prote ite up	8.00m ctive to 0.3	with a cover. 1 Om, cond	geowrap <u>p</u> Backfill crete up	ed slo detail to gro	tted s s from und le	ection base c vel.	from 1. of hole:	00m to grave	ייקט וויקט רקו		13/04/2022
All dimens are in met	sions tres.	Logged in	accordance	with BS59	30:2015 +	+ A1:2020									<u>ک</u>		

#### -ir Cabla D

Project	HEMPI	LAND PRI	MARY SC	CHOOL,	YORK	Cal	Engine	er Er	MOTT MAC	DONALD	LIMIT	ED		Boreho	le C	P02	
Client							Nationa	l Grid	462617.1	E				Project	NO PO	2218325	~~
Sampl		RTMENT I	FOR EDUC	Prope	rties		Strata		452998.7	7 N				Ground	Level 13	3.47 m Scale 1	<u>50</u> :50
Depth	3	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Descrip	tion							Depth	Legend	Level m OD
0.10- 0.20 0.20 0.50- 0.50 0.50	0.50	- B - D - ES - B - D - ES			29		MADE fine 3mm d to co fragm Betwe brick	GROUND to medi liameter parse of pents. 1 pen 0.20	: Dark br ium sand r). Grave f mudston Many root 0-0.50m,	cown sl with o el is a ne, san clets t with a	ightly occasion ngular dstone to 0.10 low c	gravel nal roc to suk and br m depth obble c	ly clay ots (up orounded cick content	of	G.L.		13.47
1.00	1.65	ES - - - - - -	1.20 (DRY)		28		MADE sligh angul and h coars	GROUND: tly sau ar to s rick. ( se of m	: Firm gr ndy sligh subangula Gravel is udstone a	reyish htly gr ar cobb s angul and san	brown : avelly ble con ar to dstone	mottled clay w tent of subangu	l grey vith a l sandst lar fin	ow one le to			12.47
1.70- 1.70 2.00-	2.00 2.45	- B - D - D -	1.50 (DRY)			S12	Firm sligh (up t 15mm) rando	fissure tly sar o 15mm . Fissu omly or	ed brown ndy CLAY ) and occ ures are ientated,	mottle with s casiona extrem smoot	d grey come ca l sand hely cl h and	and li lcareou y pocke osely s dull.	ght gre is inclu its (up spaced,	y sions to	- - 2.00		11.47
2.50- 2.50	3.00	- В - D -			16		Firm	brown s reous (	slightly CLAY. Gra	sandy vel is	slight suban	ly grav gular t	velly to subro	ounded	- - - -		
3.00-	3.45	_UT43	1.50 (DRY)		12										- - - -		
3.50- 3.50	4.00	- В - D -													- - - -		
4.00-	4.45	- D - -	1.50 (DRY)			S18	Below	7 4.00m	, stiff.						- - - -		
4.50- 4.50	5.00	- В - D -			15										- - - -		
5.00 5.00-	5.45	 - UT50 -	1.50 (DRY)	167	11		At 5.	00m, ve	ery stiff						- - - -		
5.50- 5.50	6.00	в - D -													- - - -		
6.00-	6.45		1.50 (DRY)			S25											
6.50- 6.50	7.00	_ в - D -													- - - -		
7.00-	7.45		1.50 (DRY)												- - -		
7.50- 7.50	8.00	В 													- - - -		
8.00-	8.45	- D - -	1.50 (DRY)			S25									- - - -		
		-							En	nd of B	orehol	e			8.45 -	· • • • • • •	5.02
		- - - - -															
		- - - -													 - - -		
Borina							ess				Grou	ndwate	r				
Depth	Hole Dia		Techniqu	e	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth	Depth Cased	Rose to	in Mins	Depth Sealed	Rema	rks on dwater
1.20 8.45	0.40 0.15	Inspect Cable 1	tion Pit Percussi	lon	KR/SR KR/SR	G.L. 8.45	1.50	DRY	24/11/21 24/11/21	08:00 18:00						None enc during b	ountered oring.
Remar	ks 🛺	Inspect ES sam	tion pit ple = 1	: hand x 1 li	excavat tre pla	ted to astic t	1.20m d ub, 2 x	lepth an 258ml	nd no ser amber gl	vices ass ja	were f	ound. 2 x 60	ml voc	vials.	Logg	jed by	
Symbols a abbreviati	and ons are on the	A 50mm 8.00m v filter	standpi with up up to 1	ight l .00m,	insta ockable benton:	lled to e prote ite up	8.00m ctive c to 0.30	with a over. In m, cond	geowrapp Backfill crete up	ed slo detail to gro	tted s s from und le	ection base c vel.	from 1. of hole:	00m to grave	L Figur	re 1	, of 1  3/04/2022
accompar key sheet	iying														Ē	Digen	nies

All dimensions are in metres. Logged in accordance with BS5930:2015 + A1:2020

#### PODEUOI E DECODO Cable Dercussion

Project	HEMPI	LAND PRI	MARY SC	CHOOL, Y	YORK	Car	Engine	er	MOTT MAC	DONALD	LIMIT	ED		Boreho Project		P03	
Client	DEPAR	RTMENT F	OR EDUC	CATION			Nationa Coordir	al Grid nates	462557.3 452917.1	E N				Ground	Level 13	.01 m	OD
Sampli	ng		Denth	Prope	rties	1	Strata	3							1	Scale 1	:50
Depth		Sample Type	Cased & (to Water)	Strength kPa	w %	SPT N	Descrip	otion							Depth	Legend	Level m OD
0.10- 0.20 0.20 0.50- 0.50 0.50	0.50 1.00	- B - D - ES - D - ES			31		MADE silty subar sands rootl Firm	GROUND: y sand w ngular t stone, r lets to fissure	Light b vith occa to subrou nudstone 0.10m de	rown s sional nded f and br pth. mottle	lightly rootl ine to ick fra d grey	y grave ets. G coarse agments and li	elly sli cavel is of s. Many	ghtly	G.L. - 0.10 - - - - - -		13.01 12.91
1.20- 1.50-	1.65 2.00	В	1.50 (DRY)			S14	(up t 20mm) orier	co 20mm) . Fissu ntated,	) and occ res are smooth a	very c nd dul	l sand losely l.	y pocké spaced	ets (up d, rando	to mly	1.50		11.51
1.50 2.00-	2.45	- D UT41	1.50 (DRY)	129	14		Firm sligh inclu brown 20mm) orier	brown on tly sam sions ( and ye . Fissu tated,	occasiona ndy CLAY (up to 15 ellowish ures are smooth a	lly mo with o mm) an brown closel nd dul	ttled 1 ccasion d occas sandy 1 y space 1.	brownig nal cal sional pockets ed, rar	sh grey lcareous reddish (up to ndomly	, , , ,	2.00		11.01
2.50-2.50	3.00	- B - D -	1.50			-10	Stiff calca fine	brown reous ( to coar	slightly CLAY. Gra rse of mu	sandy vel is dstone	sligh suban and s	tly gra gular t andstor	avelly to subro ne.	ounded	- - - - -		· • • •
3.00-	3.45 4.00	 - - В	1.50 (DRY)			519											• • •
3.50 4.00-	4.45	D UT45	1.50 (DRY)		16 12										- - - -		• • • •
4.50- 4.50	5.00	- В - D													- - - -		- - - - - -
5.00-	5.45	- - D -	1.50 (DRY)			S21									- - - - -		- - - -
5.50- 5.50	6.00	В 													- - - -		- - - - -
6.00-	6.45	_UT51	1.50	115	12										- - - -		
6.50	7.45		1.50			521									- - - -		- - - - -
7.50	,		(DRY)			521									- - - -		•
7.50- 8.00-	7.95 8.45	- UT52 - D	1.50 (DRY) 1.50			s24									- - -		- - - -
			(DRY)						Fn	d of P	orchol				8.45		4.56
															- - - - - - -		
															- - - -		
Boring	1127	1	1	ļ		Progre	ess	Dentit	1	r	Grou	ndwate	er	<b>7</b>	Death		
Depth	Dia		Technique	e	Crew	of Hole	Cased	Water	Date	Time	Struck	Cased	Rose to	IN Mins	Sealed	Groun	dwater
1.20 8.45	0.40 0.15	Inspect Cable H	ion Pit Percussi	on	KR/SR KR/SR	G.L. 8.45	1.50	DRY	23/11/21 23/11/21	08:00 18:00						None end during h	ountered oring.
Remarl Symbols a abbreviatic	ks AGS	Inspect ES samp A 50mm 8.00m v	ion pit ble = 1 standpi vith upr	hand e x 1 lit pe was right lo	excavat tre pla instal ockable	ted to astic t lled to prote	1.20m d ub, 2 x 8.00m ctive d	lepth an 258ml with a cover. H	nd no ser amber gl geowrapp Backfill	vices ass ja ed slo detail	were for rs and tted so s from	ound. 2 x 60 ection base o	)ml VOC from 1. of hole:	vials. 00m to grave	Logg Chec <sub>L</sub> Figur	ed by ked by e	CP JK 1 of 1 13/04/2022
explained of accompany key sheet.	on the ying ions	TILEL	up (0 1		Jent OII:	Le up	20 0.30	, con	rece up	co gro	ana 16,	ver.			_ @=	 Deal	miæ

## BOREHOLE RECORD - Cable Percussion

Project HEMPLAND PRIMARY SCHOOL, YORK

DRK Engineer

MOTT MACDONALD LIMITED

Borehole CP04 Project No PC218325

Client	DEPAF	RTMENT F	OR EDUC	ATION			Nationa Coordir	l Grid ates	462644.8 452904.8	E N				Ground	Level 12	.08 m	OD
Samp	ling		_	Prope	rties		Strata	1								Scale 1	:50
Depth		Sample Type	Cased & (to Water)	Strength kPa	w %	SPT N	Descrip	otion							Depth	Legend	Level m OD
0.10		- ES					MADE	GROUND	: Asphalt	•					G.L. 0.15		12.08
0.30-0.30	- 0.80	B D ES					MADE fine suban concr	GROUND to medi gular i ete and	: Light g ium sand. Eine to c 1 brick f	reyish Grave oarse ragmen	brown l is an of sand ts (Sul	slight ngular dstone, b base)	ly grav to asphal	t,	0.30		11.78
0.80- 0.80 0.80 1.20- 1.50-	- 1.20 - 1.65 - 2.00	B D ES D B	1.20 (DRY)		20	s12	MADE a low sands suban concr	GROUND: angula tone an gular f	: Light r ar to sub nd brick. Eine to c sphalt an	eddish angula Grave oarse d bric	brown r cobbi l is au of muds k fragu	sandy le cont ngular stone, ments.	gravel ent of to sandsto	with	0.80  1.30		11.28
1.50 1.50 2.00-	- 2.45	- D - ES - D	1.70 (DRY)			s19	MADE sligh angul sands	GROUND tly san ar to s tone an	: Firm da ndy sligh subrounde nd brick	rk brow tly gra d fine fragmen	wnish g avelly to coa nts (So	grey mo clay. arse of ome ash	ottled r Gravel mudsto **).	red is one,	2.00		10.08
2.50- 2.50	- 3.00	- B - D			15		Firm sligh inclu brown	brown o tly san sions o and ye	occasiona ndy CLAY (up to 15 allowish	lly mot with of mm) and brown	ttled l ccasion d occas sandy p	brownis nal cal sional pockets	h grey careous reddish (up to	5 1 0			
3.00-	- 3.45	_ D	1.70 (DRY)			S21	20mm) orien	. Fissu tated,	smooth a	closel	y space	ed, ran	domly		 		
3.50- 3.50	- 4.00	В D			16		calca fine	to coar	CLAY. Gra	vel is dstone	subang and sa	gular t andston	subro	ounded			•
4.00-	- 4.45	D	1.70 (DRY)			S23									 		
4.50- 4.50	- 5.00	B D															•
5.00-	- 5.45	- D	1.70 (DRY)			s25									 - -		
5.50- 5.50	- 6.00	В D															
6.00-	- 6.45	_UT41 -	1.70 (DRY)		12										 		
6.50 6.50	- 7.00	В 													- - - -		
7.00-	- 7.45	- D	1.70 (DRY)			S26									  		
7.50 7.50-	- 7.95	D UT49	1.70 (DRY)													0 0 0 0 0	
8.00-	- 8.45	D	1.70 (DRY)			s24									 		
		Ē							En	d of B	orehole	e			8.45	· · · · · · · · · · · · · · · · · · ·	3.63
		E_															
Boring	9					Progre	ess				Grou	ndwate	r				
Depth	Hole Dia		Technique	e	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Rema Groun	rks on dwater
1.20 8.45	0.40 0.15	Inspect Cable F	ion Pit Percussi	on	KR/SR KR/SR	G.L. 8.45	1.70	DRY	22/11/21 22/11/21	08:00 18:00						None enc during b	ountered oring.
Remains Symbols abbreviation	rks RGS and ions are	Tarmaca and no ES samp ** Dril A 50mm	dam bro service ble = 1 lers de standri	oken ou s were x 1 li script	t using found tre pla ion.	g hydra astic t	ulic br ub, 2 x 8.00m	eaker. 258ml with a	Inspecti amber gl	on pit ass ja:	hand e	excavat 2 x 60	ed to 1 ml VOC	.20m de vials.	<sup>epth</sup> Logg Chec Figur	ed by d ked by d e f	CP JK 1 of 1 13/04/2022
explained accompar key sheet	l on the nying t.	8.00m w filter	vith upr up to 1	ight 10	ockable benton:	e prote	ctive c to 0.30	over. H	geowrapp Backfill Crete up	detail: to grou	s from und lev	base o vel.	f hole:	grave	ı 🗆	 Dech	nies
All dimens are in me	sions tres.	Logged in	accordance	with BS59	30:2015 +	A1:2020									5-		

**Project No** PC218325

Client Department for Education

Hole	l evel	Type	SWP	Seating	g Drive		Test	Drive		SPT 'N'		Un	correct	ed SPT		
	m bgl	m OD	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	1	0 2	'N' 20 30	40	50
CP01	1.20	12.45	s	-	1	1	1	2	2	3	8	*	 			
CP01	3.00	10.65	S	-	2	2	3	3	3	4	13		*			
CP01	5.00	8.65	S	-	3	4	4	5	5	6	20			*		
CP01	7.00	6.65	S	-	6	8	9	10	10	12	41				*	
CP01	8.00	5.65	S	-	8	9	9	10	11	11	41				*	
Driller Hammer No.			Kris R	toebuck			Remark	ks								
Energy Ratio	, Er (%)		70.00													
Calibration D	ate		12/03	/2021												
-/- Blows/pe -*/- Total blo SWP Penetrat	enetratior ws/penet	n (mm) at tration (m r own we	iter sea m)	ting m)		S - S C - S L - Si	tandard P PT with c	enetration	n Test (SF	PT)	G	ec	זת	3Cł	-N	CS

SWP Penetration under own weight (mm)



**Project No** PC218325

Client Department for Education

Hole	Denth	Level	Type	SWP	Seating	g Drive		Test	Drive		SPT 'N'	U	ncor	recte	d SPT	
	m bgl	m OD	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	10	20	'N' 30	40	50
CP02	2.00	11.47	s	-	1	2	2	3	3	4	12	*				
CP02	4.00	9.47	s	-	3	3	4	4	5	5	18		*			1
CP02	6.00	7.47	s	-	3	4	5	6	6	8	25			*		-
CP02	8.00	5.47	S	-	4	4	5	6	7	7	25			*		1
Driller			Kris R	coebuck			Remar	\$								
Hammer No.			AR66	5												
Energy Ratio	, Er (%)		70.00													
Calibration D	ate		12/03	/2021												
-/- Blows/pe -*/- Total blo SWP Penetrat	enetratior ws/pene	n (mm) af tration (m r own we	iter sea im) ight (mi	ting m)		S - S C - S L - S	tandard P PT with c	enetration one with liner	n Test (SF	PT)	G	eon	G	C⊢	N	CS

SWP Penetration under own weight (mm)

Project No PC218325

**Client** Department for Education

Hole Depth Level		Type	SWP	Seating	g Drive		Test	Drive		SPT 'N'		Un	corre	cted	SPT		
	m bgl	m OD	, she	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	1	0 2	יי 203	N' 30	40	50
CP03	1.20	11.81	s	-	2	2	3	3	4	4	14		   *	   	   	1	
CP03	3.00	10.01	s	-	3	4	4	4	5	6	19		   	*	   		
CP03	5.00	8.01	S	-	3	4	4	5	5	7	21		   	*	   		
CP03	7.00	6.01	S	-	3	4	4	5	6	6	21		 	*			
CP03	8.00	5.01	S	-	4	4	5	6	6	7	24		   	*			
Driller Hammer No. Energy Ratio Calibration D	, Er (%) ate		Kris R AR66 70.00 12/03	20ebuck 5 /2021			Remark	ks									
-/- Blows/pe -*/- Total blo	enetratior ws/pene	n (mm) at tration (m	iter sea im)	ting		S - S C - S	tandard P PT with c	enetration	n Test (SF	PT)	G	ec	זת	ЭС	H		cs

SWP Penetration under own weight (mm)

L - Split Spoon with liner used

**Project No** PC218325

Client Department for Education

Hole	Depth	Level	Type	SWP	Seating	g Drive		Test	Drive		SPT 'N'	U	ncorre	cted S	PT	
	m bgl	m OD	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	10	20	N' 30 4	0	50
CP04	1.20	10.88	s	-	1	2	2	3	3	4	12	*				
CP04	2.00	10.08	S	-	2	3	4	4	5	6	19		*			
CP04	3.00	9.08	S	-	3	4	4	5	5	7	21		*			
CP04	4.00	8.08	S	-	4	4	5	5	6	7	23		*			1
CP04	5.00	7.08	S	-	4	5	5	6	6	8	25		*			-
CP04	7.00	5.08	S	-	4	5	5	6	7	8	26		*			-
CP04	8.00	4.08	S	-	4	4	5	6	6	7	24		*			
Driller			Kris R	toebuck			Remark	ks								
Hammer No.			AR66	5												ĺ
Energy Ratio	, Er (%)		70.00													
Calibration D	ate		12/03	/2021												
-/- Blows/pe -*/- Total blo SWP Penetrat	enetratior ws/penet	n (mm) at tration (m r own we	fter sea nm) ight (mi	ting m)		S - S C - S L - S	tandard P PT with c	enetratior one with liner	n Test (SF	PT)	G	രാ	ec	H	10	CS

SWP Penetration under own weight (mm)



## SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

#### ARCHWAY ENGINEERING (UK) LTD AINLEYS INDUSTRIAL ESTATE ELLAND WEST YORKSHIRE HX5 9JP

- 54

#### Instrumented Rod Data

Diameter d <sub>r</sub> (mm):	54
Wall Thickness tr (mm):	6.3
Assumed Modulus E <sub>a</sub> (GPa):	208
Accelerometer No.1:	7080
Accelerometer No.2:	11609

SPT Hammer Ref:	AR665
Test Date:	12/03/2021
Report Date:	12/03/2021
File Name:	AR665.spt
Test Operator:	JL

#### **SPT Hammer Information**

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

#### **Comments / Location**



The recommended calibration interval is 12 months

## **APPENDIX 3**

## Dynamic Sample Borehole Records

## DATA SHEET - Symbols and Abbreviations used on Records

Sample	e Types	Groundwater		Strata, Continued	
В	Bulk disturbed sample	Water Strike	$\nabla$	Mudstone	
BLK	Block sample	Depth Water Rose To	Y		
С	Core sample			Siltstone	*****
D	Small disturbed sample (tub/jar)	Instrumentation		Situatione	* * * * * *
Е	Environmental test sample		22	Metamorphic Rock	* * * * *
ES	Environmental soil sample	Seal	11	Fine Grained	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
EW	Environmental water				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
G	Gas sample		-	Medium Grained	~~~~
L	Liner sample	Filtor	-	Coorce Crained	$\sim$
LB	Large bulk disturbed sample	FIILEI	1	Coarse Grained	$\sim\sim$
Р	Piston sample (PF - failed P		-	laneous Rock	$\sim$
ΤW	Thin walled push in sample			Fine Grained	v v v v v v v v v v v v v v
U	Open Tube - 102mm	Seal			++++
	diameter with blows to take sample. (UF - failed U			Medium Grained	++++
	sample)				+ + + +
UT	Thin wall open drive tube sampler - 102mm diameter	Strata		Coarse Grained	
	with blows to take sample. (UTF - failed UT sample)	Made Ground Granular		Backfill Materials	
V	Vial sample				8
W	Water sample	Made Ground		Arisings	×
#	Sample Not Recovered	Collesive			X
Insitu <sup>-</sup>	Testing / Properties	Topsoil		Bentonite Seal	
CBRP	CBR using TRL probe				
CHP	Constant Head	Cobbles and Boulders	000		¢ •
COND	Permeability Test		200	Concrete	
TC	Thermal Conductivity	Gravel			<u>~</u>
TR	Thermal Resistivity		· · · · ·	Fine Gravel Filter	
HV	Strength from Hand Vane	Sand			-
ICBR	CBR Test			General Fill	1
IDEN	Density Test	Cill	× ^ .		<u>.</u>
IRES	Resistivity Test	SIII	× × ×		
MEX	CBR using Mexecone Probe Test		× ×	Gravel Filter	÷.
PKR	Packer Permeability Test	Clay	÷		1
PLT	Plate Load Test			Grout	1
PP	Strength from Pocket	Deal	W.S.		000
Temp	Temperature	Peat	AK.	Sand Filter	
VHP	Variable Head Permeability		N/2		000
\ /NI	Lest	Noto: Composito coll tupo		<b>T</b>	2
w%	Water content	by combined symbols		Tarmacadam	
(All oth	er strengths from	Chalk		Deterny Core	
undrain	ed triaxial testing)			ROD Rock Quality Des	anation
3	(SPT)	Limostono		(% of intact core	>100mm)
С	SPT with cone	Limesione		FRACIURE INDEX Fractures/metre	
Ν	SPT Result			FRACTURE Maximum SPACING (m) Minimum	
-/-	Blows/penetration (mm) after seating drive	Sandstone		NI Non-intact o	ore
-*/-	Total blows/penetration			AZCL No core rec	overy ne of core
(mm)		Coal		loss (where core recovery is unknow	vn it is
( )	Extrapolated value			assumed to be at the base of the	e run)



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### BOREHOLE RECORD - Dynamic Sampler

All dimensions

are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Borehole Project HEMPLAND PRIMARY SCHOOL, YORK Engineer WS01 MOTT MACDONALD LIMITED PC218325 Project No National Grid 462528 E N Client Ground Level 13.37 m OD DEPARTMENT FOR EDUCATION Coordinates 452937 Sampling Properties Strata Scale 1:50 Depth Cased & Sample Strength w SPT N Level Description Depth Depth Leaend Туре (to Water kPa % m OD 13.37 G.L. 0.00- 0.50 в MADE GROUND: Dark brown slightly gravelly slightly clayey fine to medium sand with occasional rootlets. Gravel is angular to subrounded fine to coarse of sandstone and brick fragments. Many 0.10 D 0.10 ES 0.55 D rootlets to 0.10m depth. 0.55 12.82 0.55 ES MADE GROUND: Firm light orangish brown slightly 1.00- 1.50 в sandy slightly gravelly clay. Gravel is angular to subangular fine to coarse of mudstone, sandstone 1.00 1.20- 1.65 D s13 and brick fragments. 1.20 12.17 (DRY) ÷ Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions 1.50- 2.00 в 11.72 1.65 1.50 D (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are extremely closely spaced, randomly orientated, smooth and dull. 2.00- 2.50 2.00- 2.45 в 2.00 11.37 S20 D 1.00 Brown slightly gravelly slightly clayey SAND. Gravel is angular to subangular fine to coarse of (DRY) 2.50- 3.00 mudstone and sandstone. 2.45 10.92 в 2.50 D Stiff fissured brown mottled grey slightly sandy CLAY with some calcareous inclusions (up to 10mm) and occasional sandy pockets (up to 10mm). Fissures are closely spaced, randomly orientated, smooth and 3.00- 3.50 3.00- 3.45 13 в D 1.00 S21 (DRY) dull. Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. 3.50- 4.00 в 3.50 р 4.00-4.45 s25 1.00 D (DRY) 4.45 8.92 End of Borehole Boring Progress Groundwater Denth Depth )enth ta Denth Depth Depth Remarks on lole Depth Crew Date Rose to Technique Time of Hole Cased Water Struck Cased Mins Sealed Groundwater Dia 0.40 Inspection Pit 26/11/21 None encountered 1.20 KR/SR G.L 08:00 4.00 0.10 Dynamic Sampler KR/SR 4.45 1.00 DRY 26/11/21 18:00 during sampling. Inspection pit hand excavated to 1.20m depth and no services were found. Inspection pit hand excavated to 1.20m depth and no services were found. Backfill = 1 x 1 litre plastic tub, 2 x 258ml amber glass jars and 2 x 60ml VOC vials. Backfill details from base of hole: bentonite up to 0.30m, arisings up to ground level. Remarks Logged by Checked by CP JK 1 of 1 Symbols and Figure abbreviations are 13/04/2022 explained on the accompanying eeimiee ei key sheet.

### BOREHOLE RECORD - Dynamic Sampler

Engineer Borehole Project HEMPLAND PRIMARY SCHOOL, YORK WS02 MOTT MACDONALD LIMITED PC218325 Project No National Grid 462582.3 E N Client Ground Level 13.58 m OD DEPARTMENT FOR EDUCATION Coordinates 453006.5 Strata Scale 1:50 Sampling Properties Depth Cased & Sample Strength w SPT N Level Description Depth Depth Leaend Туре (to Water kPa % m OD 13.58 G.L. MADE GROUND: Dark brown slightly silty slightly gravely fine to medium sand with occasional rootlets. Gravel is angular to subangular fine to coarse of mudstone, sandstone and brick fragments. 0.30 D 0.30 ES 0.50 13.08 0.50- 1.00 в Many rootlets to 0.10m depth. MADE GROUND: Soft light greyish brown slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse of mudstone, sandstone 1.00 ъ 1.00 12.58 ES 1.00 1.20- 1.65 1.00 s13 and brick fragments. D (DRY) Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions 1.50- 2.00 в 1.50 D (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are very closely to extremely closely spaced, randomly orientated, smooth and 2.00- 2.45 D 1.00 s20 (DRY) dull. 11.38 2.20 Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. 2.50- 3.00 в 2.50 D 17 3.00- 3.45 1.00 s23 D (DRY) 3.50- 4.00 в 3.50 р 4.00 - 4.45s25 1.00 D (DRY) 9.13 4.45 End of Borehole Boring Progress Groundwater Depth Depth )enth ta Depth Depth Depth Remarks on Hole Depth Crew Date Rose to Technique Time Water Mins of Hole Cased Struck Cased Sealed Groundwater Dia 0.40 Inspection Pit 26/11/21 None encountered 1.20 KR/SR G.L 08:00 4.00 0.10 Dynamic Sampler KR/SR 4.45 1.00 DRY 26/11/21 18:00 during sampling. Inspection pit hand excavated to 1.20m depth and no services were found. ASSES sample = 1 x 1 litre plastic tub, 2 x 258ml amber glass jars and 2 x 60ml VOC vials. A 50mm standpipe was installed to 4.00m with a geowrapped slotted section from 2.00m to 4.00m with upright lockable protective cover. Backfill details from base of hole: gravel 4.00m with upright lockable protective cover. Backfill details from base of hole: gravel Remarks Logged by Checked by CP JK 1 of 1 Symbols and Figure abbreviations are 13/04/2022 filter up to 2.00m, bentonite up to 0.30m, concrete up to ground level. explained on the accompanying eeimiee ei key sheet. All dimensions

are in metres. Logged in accordance with BS5930:2015 + A1:2020

## **BOREHOLE RECORD** - Dynamic Sampler

Project	HEMPL	AND PR	IMARY SC	CHOOL,	YORK		Engine	er	MOTT MAC	DONALD	LIMIT	ED		<b>Borehc</b> Project	No PC	' <b>S03</b> 2218325	
Client	סגספס	THE NEW Y	FOR FRI				Nationa	al Grid	462616.6	E				Ground		200 m (	
Sampl	ling	IMENI	FOR EDUC	Prope	rties		Strata	ales	452943.1					Giouna	Level 13	Scale 1:	:50
Depth		Sample Type	Depth Cased & (to Water)	Strength kPa	1 W %	SPT N	Descrip	otion							Depth	Legend	Level m OD
0.10		- ES					MADE	GROUND	: Asphalt	•					G.L.		13.00 12.85
0.30-	- 0.50	B FC					MADE	GROUND	: Light b	rownis	h grey	mottle	d red	fine			12 50
0.50-	- 1.00	- B - D					to co	oarse of orick f	f mudston ragments.	e, san	dstone	, concr	ete, as	phalt /	Ē		12.50
0.80 0.80		_ D _ ES					POSSI	IBLE MAI	DE GROUND	: Firm	light	greyis	h brown Gravel	is.	-		
1.20-	- 1.65	D	1.00 (DRY)			S12	angul	lar to s stone an	subrounde nd brick	d fine fragme	to co	arse of	mudsto	one,	-		
1.50- 1.50	- 2.00	_ В - D					Firm	fissure htly sau	ed brown ndv CLAY	mottle with s	d grey ome ca	and li	.ght gre s inclu	y sions	- 1.50 -		11.50
2.00-	- 2.45	- D	1.00			s24	(up t 15mm)	co 20mm) ). Fissu	) and occ ures are	asiona extrem	l sand ely cl	y pocke osely s	ts (up paced,	to	2.00		11.00
		F	(DRY)				\ rando	mly ori  E brown	slightly	smoot sandy	h and sligh	dull. 	vellv	/	/= = -	· · · · · ·	
2.50-	- 3.00	_ В - D			13		calca fine	to coar	CLAY. Gra rse of mu	vel is dstone	suban and s	gular t andston	o subro	ounded		· · · · · · · · · · · · · · · · · · ·	
3.00-	- 3.00		1.00			S27									-	·····	
			(DRY)												-	· · · · · · · · · · · · · · · · · · ·	
3.50- 3.50	- 4.00	- - B - D			13										-	·····	
4 00	4 45		1 00			<b>4</b> 20									- - -	· · · · · ·	
4.00-	. 4.45		(DRY)			529									-		
		F							Fn						4.45		8.55
		F							ы	аогв	orenor	e			-		
		F															
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l		F													-		
Boring	J	·		<u> </u>		Progre	ess Depth	Depth to			Grou	ndwate	r	in	Denth	Remar	rks on
Depth	Dia	Transa	Technique	e	Crew	of Hole	Cased	Water	Date	Time	Struck	Cased	Rose to	Mins	Sealed	Ground	Jwater
4.00	0.40	Dynami	c Sample	; er	KR/SR KR/SR	G.L. 4.45	1.00	DRY	26/11/21	18:00						during s	ampling.
																1	
Remar	rks AGS	Tarmaca and no	adam bro service	oken ou es were	t using found	g hydra •	ulic b	ceaker.	Inspecti	on pit	hand	excavat	ed to 1	.20m d	epth Logg	ed by	CP
Symbols a	and ions are	ES sam Backfi	ple = 1 11 detai	x 1 li ils fro	tre pla m base	astic t of hol	ub, 2 z e: bent	¢ 258ml conite ι	amber gl up to 0.3	ass ja Om, co	rs and ncrete	2 x 60 up to	ml VOC 0.15m,	vials. asphal	Chec t up <sup>Figur</sup>	ked by J e 1	ΓΚ L of 1
explained accompar	on the nying	to grow	und leve	31.													~~~~
All dimens	sions	Logged in	accordance	with BS5	30.2015	+ A1·2020									٥	ਿਸਤਰਪ	ਆਤਿ
are in me	103.	Loggoa	40001441100	mai Beece		71112020											

Project No PC218325

**Client** Department for Education

Hole Depth Le			Type	SWD	Seating	g Drive		Test	Drive		SPT 'N'		Un	correc	ted S	PT	
Hole	m bgl	m OD	Type	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	1	0 2	'N 203	וי 04	0	50
WS01	1.20	12.17	s	-	2	3	3	3	3	4	13		*				   
WS01	2.00	11.37	s	-	3	3	4	5	5	6	20			* ! * !			
WS01	3.00	10.37	s	-	3	4	5	5	5	6	21			* ! * !			
WS01	4.00	9.37	S	-	4	4	5	6	6	8	25			*			
Driller			Kris R	toebuck			Remar	ks									
Hammer No.			AR24	75													
Energy Ratio	, Er (%)		66.00	10000													
Calibration D	ate		08/11	/2021													
-/- Blows/pe -*/- Total blo	enetratior ws/pene	n (mm) at tration (m	iter sea im)	ting		S - S C - S	tandard F PT with c	enetratior	n Test (SF	PT)	G	ec	זת	35	HÌ		CS

SWP Penetration under own weight (mm)

L - Split Spoon with liner used

Project No PC218325

**Client** Department for Education

Hole Depth Level			Type	SWD	Seating	g Drive		Test	Drive		SPT 'N'		Un	corre	cted	SPT	
nuie	m bgl	m OD	, she	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	1	0 2	20 :	N' 30	40	50
WS02	1.20	12.38	s	-	3	3	3	3	3	4	13			   	   	   	   
WS02	2.00	11.58	S	-	4	4	4	5	5	6	20		   	*		1	1
WS02	3.00	10.58	s	-	4	4	4	5	6	8	23		   	*	   		
WS02	4.00	9.58	S	-	4	5	5	6	7	7	25		   	*		1	
Driller Hammer No.			Kris R AR24	Roebuck 75			Remark	ks									
Energy Ratio	, Er (%)		66.00														
Calibration D	ate		08/11/	/2021													
-/- Blows/pe	enetratior ws/penet	n (mm) at tration (m	iter sea m)	ting		S - S C - S	tandard P PT with c	enetratior	n Test (SP	Ϋ́T)	G	ec	זת	ЭС	H		cs

SWP Penetration under own weight (mm)

L - Split Spoon with liner used

Project No PC218325

**Client** Department for Education

Hole Depth Leve		امىرما	Type	SWD	Seating	g Drive		Test	Drive		SPT 'N'	l ı	Unco	orrecte	d SPT	
nole	m bgl	m OD	Type	(mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	<b>0-75</b> (mm)	<b>75-150</b> (mm)	150-225 (mm)	<b>225-300</b> (mm)	Value	10	20	'N' 30	40	50
WS03	1.20	11.80	s	-	2	2	2	2	4	4	12	*				
WS03	2.00	11.00	s	-	3	4	5	5	7	7	24		1	*		
WS03	3.00	10.00	s	-	4	5	6	6	7	8	27			*		
WS03	4.00	9.00	s	-	4	5	6	7	7	9	29			*		
Driller			Kris R	Roebuck			Remark	ks								
Hammer No.	<b>F</b> <sub>2</sub> (9/)		AR24	75												
Calibration D	, ⊏r (%) ate		08/11	/2021												
-/- Blows/pe -*/- Total blo	enetratior ws/pene	n (mm) at tration (m	fter sea nm)	ting		S - S C - S	tandard P PT with c	enetration	n Test (SF	PT)	G	eon	G	CH	N	cs

SWP Penetration under own weight (mm)

L - Split Spoon with liner used

## **SPT Hammer Energy Test Report**

in accordance with BSEN ISO 22476-3:2005

#### ARCHWAY ENGINEERING (UK) LTD AINLEYS INDUSTRIAL ESTATE ELLAND WEST YORKSHIRE HX5 9JP

SPT Hammer Ref:	AR2475
Test Date:	08/11/2021
Report Date:	08/11/2021
File Name:	AR2475.spt
Test Operator:	KM

CRAIG'S RIG SYDOG

#### Instrumented Rod Data

Diameter d <sub>r</sub> (mm):	54
Wall Thickness tr (mm):	6.0
Assumed Modulus Ea (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 Leng	gth L (m):	12.0

#### **Comments / Location**



The recommended calibration interval is 12 months

## **APPENDIX 5**

# Monitoring Results

## FIELDWORK - Water Level Monitoring

HEMPLAND PRIMARY SCHOOL, YORK Project

#### Sheet No 1 Client Department for Education Borehole **CP01** CP02 CP03 CP04 WS02 Instrument (dia. mm) S (50mm) S (50mm) S (50mm) S (50mm) S (50mm) Depth to Base (m) 8.00 8.00 8.00 8.00 (Note 1) 4.00 Filter Zone (m) 1.00-8.00 1.00-8.00 1.00-8.00 1.50-8.00 2.00-4.00 Level 13.65 m OD 13.47 m OD 13.01 m OD 12.08 m OD 13.58 m OD Depth Depth Depth Depth Depth Depth Date Time Level Level Level Level Level Level (m) (m) (m) (m) (m) (m) 2 Dec 2021 1.92 11.73 7.78 5.69 5.00 8.01 1.10 10.98 3.58 10.00 9 Dec 2021 11.78 8.45 12.71 10.96 DRY 1.87 5.02 0.30 1.12 16 Dec 2021 DRY 11.83 5.02 10.70 1.82 8.45 0.75 12.26 1.38 23 Dec 2021 11.89 4.42 9.05 0.80 12.21 10.73 DRY 1.76 1.35 Remarks Note 1 - Installation cover flooded prior to monitoring during rounds 3 and 4.

abbreviations are explained on the accompanying key sheet. All dimensions are in metres.



Project No PC218325

Symbols and

## FIELDWORK - Insitu Gas Monitoring - Daily Record

Project HEMPI Client Depar	AND PRIMARY	SCHOOL, YC ucation	DRK				Proj <b>Date</b> She	ect No e et No.	PC218325 02/12/2021 1 (1 of 4)		
Equipment Us	sed										
GI Infra R	ed Gas Ana	lvser	МК	1 🗖	МК	2 🗌	GA200	0 🗌			
Other g	as Data GFM4	35;									
Weather / Site	e Conditions	3									
Wind			St	ill	Ligh	nt x	Moderat	e	Strong		
Cloud Co	ver		None		Slight		Cloudy		Overcast x		
Precipitat	ion		Dry x		Slight		Moderate		Heavy		
	Death to					<u>.</u>					
Borehole	Base	Depth to Water	Electrical Conductivi tv	рн	Redox	Oxygen	Methane (Peak) CH4	Methane (Steady) CH4	Remarks		
	(m)	(m bgl)	(uS/cm)	(pH Units)	(mV)	(mg/l)	(% VOL)	(% VOL)			
CP01	8.00						<0.1	<0.1			
CP02	8.00						<0.1	<0.1			
CP03	8.00						<0.1	<0.1			
CP04 WS02	4.00						<0.1	<0.1			
Remarks											
Estimbed en la company de la c											
Project HEMPLAND PRIMARY SCHOOL, YORK Project No PC218325   Date 02/12/2021   Client Department for Education Sheet No. 1 (2 of 4)											
--	-------------------------	---	--	---	--------------------	--------------------------------------	-----------------------------------	-----------------------------	------------	--	--
Equipment 11	ed										
GI Infra R	Red Gas Ana	lvser	МК	1 🗖	МК	2	GA200	о 🗖			
Other 9	as Data GFM4	35;									
Weather / Sit	e Conditions	3									
Wind			St	ill	Ligh	nt x	Moderat	e 🗌	Strong		
Cloud Co	ver		Non	e	Slight		Cloudy		Overcast x		
Precipitat	ion		Dry x		Slight		Moderate		Heavy		
Borehole	Depth to Base (m)	Carbon Dioxide (Peak) (% \/OL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak)	Oxygen (Steady)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Diff. Pressure (mbar)	Remarks		
(TD 0.1	()		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(/0 002)	(pp)	(PPIII)	1015			
CP01 CP02	8.00	1.4	1.4	19.8	19.8	<1	<1	1015			
CP03	8.00	0.3	0.3	18.6	18.6	<1	<1	1015			
CP04	8.00	0.4	0.4	18.9	18.9	<1	<1	1016			
WS02	4.00	2.3	2.3	17.6	17.6	<1	<1	1015			
Remarks											

Project HEMPI Client Depar	ProjectHEMPLAND PRIMARY SCHOOL, YORKProject NoPC218325Date02/12/2021ClientDepartment for EducationSheet No.1 (3 of 4)											
Equipment Us	sed											
GI Infra F	Red Gas Ana	lyser	МК	1	МК	2	GA200	0				
Other of	as Data GFM4	35;										
Weather / Sit	e Conditions	S										
Wind			St	ill	Ligh	nt x	Moderat	e	Strong			
Cloud Co	ver		Nor	ie 🗌	Slight		Cloud	ly 🗌	Overcast x			
Precipitat	ion		Di	y x	Slight		Moderate		Heavy			
	Depth to	Diff.	Flow Rate	Flow Rate	PID	Odour	Turbidity	Wind				
Borehole	Base	Pressure	(Peak)	(Steady)	Reading				Remarks			
	(m)	(Pa)	(l/hr)	(l/hr)	(ppm)	(-)	(FTU)	()				
CP01	8.00	<1	<0.1	<0.1				Light				
CP02	8.00	<1	<0.1	<0.1				Light				
CP03	8.00	<1	<0.1	<0.1				Light				
WS02	4.00	<1	<0.1	<0.1				Light				
Remarks												
								را ال	ਤਗਰਤਰਪਾਗਣਤ			

Project HEMPI Client Depar	Project No <b>Date</b> Sheet No.	PC218325 02/12/2021 1 (4 of 4)					
Equipment Us GI Infra R Other	sed Red Gas Ana Gas Data GFM4	lyser 35;	MK1 🗌		МК2	GA2000	
Weather / Sit Wind Cloud Co Precipitat	e Conditions ver ion	5	Still None Dry		Light x Slight Slight	Moderate Cloudy Moderate	Strong Overcast _x Heavy
Borehole	Depth to Base (m)	Cloud	Rain ()		Equipment Used	Monitored by	Remarks
CP01 CP02 CP03 CP04 WS02	8.00 8.00 8.00 4.00	Overcast Overcast Overcast Overcast		Dry Dry Dry Dry	Gas Data GFM435 Gas Data GFM435 Gas Data GFM435 Gas Data GFM435 Gas Data GFM435	АVМ АVМ АVМ АVМ	
Remarks						[	

Project HEMPI	PC218325 09/12/2021								
	rtment for Ed	ucation					Sile	el NO.	I (I OF 4)
GI Infra R	sed Gas Ana	lvser	МК	1	МК	2 🗖	GA200	0 🗖	
Other G	as Data GFM4	35:		· 🖂		-	0,1200	°Ц	
Weather / Sit	e Conditions	5							
Wind			St	ill x	Ligh	nt 🗌	Moderat	е	Strong
Cloud Co	ver		Non	e	Slight		Cloudy		Overcast x
Precipitat	ion		Dry x		Slight		Moderate		Heavy
Borehole	Depth to Base	Depth to Water	Electrical Conductivi	рН	Redox	Dissolved Oxygen	Methane (Peak)	Methane (Steady)	Remarks
	(m)	(m bgl)	(uS/cm)	(pH Units)	(mV)	(mg/l)	(% VOL)	(% VOL)	
CP01	8.00		1242	743	75.7	26.2	<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00		627	7.98	99.3	35.5	<0.1	<0.1	
CP04	8.00		862	7.98	98.2	46.6	<0.1	<0.1	
Remarks	<u> </u>	<u> </u>	<u>I</u>				<u> </u>	<u>ا ا ا ا ا</u>	
nomaino								_ 	

Project HEMPI	AND PRIMARY	SCHOOL, YO	RK				Proje Date	ect No e	PC218325 09/12/2021	
Client Depar	tment for Ed	ucation					She	et No.	1 (2 of 4)	
Equipment Us	sed Pod Cas Ana	lycor	МК		МК	2	GA 200			
Othor G	lag Data GEM4	35.	WIT	' []	WIX		04200			
Weather / Sit	e Conditions	<u> </u>								
Wind		-	St	ill x	Ligh	nt 🗌	Moderat	e	Strong	
Cloud Co	ver		Non	ie 🗌	Slight		Cloudy		Overcast x	
Precipitat	ion		Dry x		Slight		Moderate		Heavy	
	Depth to	Carbon	Carbon	Oxygen	Oxygen	Hydrogen	Carbon	Diff		
Borehole	Base	Dioxide (Peak)	Dioxide (Steady)	(Peak)	(Steady)	Sulphide H2S	Monoxide CO	Pressure	Remarks	
	(m)	(% VOL)	(% VOL)	(% VOL)	(% VOL)	(ppm)	(ppm)	(mbar)		
CP01	8.00	3.0	3.0	16.9	16.9	<1	<1	996		
CP02 CP03	8.00 8.00	0.9	0.9	18.0 15.7	18.0 15.7	<1	<1	996 996		
CP04	8.00	0.4	0.4	19.7	19.7	<1	<1	996		
WS02	4.00	3.0	3.0	16.9	16.9	<1	<1	996		
Remarks										
								<u>م</u>		

Project HEMPI Client Depar	AND PRIMARY	SCHOOL, YO ucation	DRK				Proje Date Shee	ect No et No.	PC218325 09/12/2021 1 (3 of 4)
<b>Equipment Us</b> GI Infra R Other G	sed Red Gas Ana Gas Data GFM4	lyser 35;	МК	1	МК	2	GA200	0	
Weather / Sit Wind Cloud Co Precipitat	5	St Non Di	ill x ie	Ligh Sligh Sligh	nt	Moderat Cloud Moderat	e 🗌 y 🛄 e 🗌	Strong Overcast _x Heavy	
Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (I/hr)	Flow Rate (Steady) (I/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
CP01 CP02 CP03 CP04 WS02	8.00 8.00 8.00 4.00		<0.1 <0.1 <0.1 <0.1 <0.1	<0.1 <0.1 <0.1 <0.1 <0.1		None None	1000 1000	Still Still Still Still	
Remarks	-	-						 贝	

Project HEMPI	AND PRIMARY	SCHOOL, YORK				Project No	PC218325
Client Depar	rtment for Ed	ucation				Date Sheet No.	09/12/2021 1 (4 of 4)
Equipment Us	sed						
GI Infra F	Red Gas Ana	lyser	MK1		MK2	GA2000	
Other of	as Data GFM4	35;					
Weather / Sit	e Conditions	5					
Wind			Still x		Light	Moderate	Strong
Cloud Co	ver	ı	None		Slight	Cloudy	Overcast x
Precipitat	Dry x		Slight	Moderate	Heavy		
Borehole	Depth to Base	Cloud	Rain		Equipment Used	Monitored by	Remarks
	(m)	()	()		()	()	
CP01	8.00	Overcast		Dry	Gas Data GFM435	AVM	
CP02	8.00	Overcast		Dry	Gas Data GFM435	AVM	
CP03	8.00	Overcast		Dry	Gas Data GFM435	AVM	
CP04	8.00	Overcast		Dry	Gas Data GFM435	AVM	
WS02	4.00	Overcast		Dry	Gas Data GFM435	AVM	
Remarks			ı			·	
							<u>eserecturas</u>

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Project HEMPI Client Depar	AND PRIMARY	SCHOOL, YC ucation	DRK		Proj <b>Dat</b> She	ect No <del>e</del> et No.	PC218325 16/12/2021 1 (1 of 4)		
Equipment Us	sed								
GI Infra R	Red Gas Ana	lyser	МК	1	MK	2	GA200	0	
Other G	as Data GFM4	35;							
Weather / Sit	e Conditions	6							
Wind			St	ill	Ligh	nt x	Moderat	e	Strong
Cloud Co	ver		None		Slight		Cloudy		Overcast x
Precipitat	ion		Dry x		Slight		Moderate		Heavy
Borehole	Depth to Base	Depth to Water	Electrical Conductivi ty	рН	Redox	Dissolved Oxygen	Methane (Peak) CH4	Methane (Steady) CH4	Remarks
	(m)	(m bgl)	(uS/cm)	(pH Units)	(mV)	(mg/l)	(% VOL)	(% VOL)	
CP01	8.00						<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00						<0.1	<0.1	
CP04 WS02	8.00						<0.1	<0.1	
Remarks			1	1	1				
								밀	Formering

Project HEMPLAND PRIMARY SCHOOL, YORK Project No PC218325   Date 16/12/2021   Client Department for Education Sheet No. 1 (2 of 4)											
	sod										
GI Infra R	Red Gas Ana	lvser	МК	1	МК	2	GA200	0 🗖			
Other 9	as Data GFM4	35;									
Weather / Sit	e Conditions	<u> </u>									
Wind			St	ill 🗌	Ligh	nt x	Moderat	e	Strong		
Cloud Co	ver		Non	ie 🗌	Slight		Cloudy		Overcast x		
Precipitat	ion		Dry x		Slight		Moderate		Heavy		
	Depth to Base	Carbon	Carbon	Oxygen	Oxygen (Steady)	Hydrogen Sulphide	Carbon Monoxide	Diff. Pressure			
Borehole	(m)	(Peak) (% VOL)	(Steady) (% VOL)	(% VOL)	(% VOL)	H2S (ppm)	CO (ppm)	(mbar)	Remarks		
CP01	8.00	2.7	2.7	15.8	15.8	<1	<1	997			
CP02	8.00	1.2	1.2	18.4	18.4	<1	<1	997			
CP03	8.00	0.5	0.5	19.5	19.5	<1	<1	997			
CP04	8.00	0.1	0.1	20.0	20.1	<1	<1	997			
W502	4.00	1.0	1.0	19.1	19.1	~1	~1	557			
nemdiks								ے ا			

Project HEMPI Client Depar	AND PRIMARY	SCHOOL, YO ucation		Proj Date She	ect No e et No.	PC218325 16/12/2021 1 (3 of 4)			
<b>Equipment Us</b> GI Infra R Other	sed Red Gas Ana Bas Data GFM4	lyser 35;	МК	1	МК	2	GA200	0	
Weather / Sit Wind Cloud Co Precipitat	5	St Nor Di	ill ne ry _x	Ligh Sligh Sligh	nt 💌 nt 🛄	Moderat Cloud Moderat	e	Strong Overcast _x Heavy	
Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (I/hr)	Flow Rate (Steady) (I/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
CP01 CP02 CP03 CP04 WS02	8.00 8.00 8.00 4.00		<0.1 <0.1 <0.1 <0.1	<0.1 <0.1 <0.1 <0.1 <0.1				Light Light Light Light	
Remarks								」 回	

Project HEMPI Client Depar	Project No <b>Date</b> Sheet No.	PC218325 16/12/2021 1 (4 of 4)					
Equipment Us GI Infra R Other	sed Red Gas Ana Gas Data GFM4	lyser 35;	MK1 🗌		МК2	GA2000	
Weather / Sit Wind Cloud Co Precipitat	e Conditions ver ion	5	Still None Dry		Light x Slight Slight	Moderate Cloudy Moderate	Strong Overcast _x Heavy
Borehole	Depth to Base (m)	Cloud	Rain ()		Equipment Used	Monitored by	Remarks
CP01 CP02 CP03 CP04 WS02	8.00 8.00 8.00 4.00	Overcast Overcast Overcast Overcast		Dry Dry Dry Dry	Gas Data GFM435 Gas Data GFM435 Gas Data GFM435 Gas Data GFM435 Gas Data GFM435	АVМ АVМ АVМ АVМ	
Remarks						[	

Project HEMPI Client Depar	AND PRIMARY	SCHOOL, YC ucation	ORK		Proj <b>Date</b> She	ect No e et No.	PC218325 23/12/2021 1 (1 of 4)		
Equipment Us	sed								
GI Infra R	Red Gas Ana	lyser	MK	1	MK	2	GA200	0	
Other G	as Data GFM4	35 <b>;</b>							
Weather / Sit	e Conditions	6		_		_		_	_
Wind			St	ill	Ligh	nt x	Moderat	e	Strong
Cloud Co	ver		None		Slight		Cloudy x		Overcast
Precipitat	ion		Dı	y x	Sligh	nt	Moderate		Heavy
Borehole	Depth to Base	Depth to Water	Electrical Conductivi ty	рН	Redox	Dissolved Oxygen	Methane (Peak) CH4	Methane (Steady) CH4	Remarks
	(m)	(m bgl)	(uS/cm)	(pH Units)	(mV)	(mg/l)	(% VOL)	(% VOL)	
CP01	8.00						<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00						<0.1	<0.1	
WS02	4.00						<0.1	<0.1	
Remarks	<u> </u>						1		
								e	

Project HEMPLAND PRIMARY SCHOOL, YORK Project No PC218325   Date 23/12/2021   Client Department for Education Sheet No. 1 (2 of 4)								PC218325 23/12/2021 1 (2 of 4)	
GI Infra R	мк	1 🗖	МК	2 🗖	GA200	0			
Other Gas Data GFM435;									
Uner das bata grass; Weather / Site Conditions									
Wind		-	Still		Light x		Moderate		Strong
Cloud Co	ver		None		Slight		Cloudy x		Overcast
Precipitat	ion		Dry x		Slight		Moderate		Heavy
Borehole	Depth to Base (m)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Diff. Pressure (mbar)	Remarks
CP01	8.00	4.2	4.2	14.4	14.4	<1	<1	1005	
CP02	8.00	1.4	1.4	18.8	18.8	<1	<1	1005	
CP03	8.00	0.6	0.6	18.6	18.6	<1	<1	1005	
CP04	8.00	0.2	0.2	20.0	20.0	<1	<1	1005	
WS02	4.00	2.2	2.2	15.8	15.8	1>	1>	1005	
Remarks									
								신빛	ອະຫຼອຍາທແລະ

Project HEMPLAND PRIMARY SCHOOL, YORK Project No PC218325 Date 23/12/2021 Client Department for Education Sheet No. 1 (3 of 4)								PC218325 23/12/2021 1 (3 of 4)	
Equipment Used									
GI Infra Red Gas Analyser			МК	1	МК	MK2		0	
Other Gas Data GFM435;									
Weather / Site Conditions									
Wind			Still		Light x		Moderate		Strong
Cloud Co	ver		None		Slight		Cloudy x		Overcast
Precipitat	ion		Dry x		Slight		Moderate		Heavy
Borehole	Depth to Base	Diff. Pressure	Flow Rate (Peak)	Flow Rate (Steady)	PID Reading	Odour	Turbidity	Wind	Remarks
	(m)	(Pa)	(l/hr)	(l/hr)	(ppm)	(-)	(FTU)	()	
CP01	8.00	<1	<0.1	<0.1				Light	
CP02	8.00	<1	<0.1	<0.1				Light	
CP03	8.00	<1	<0.1	<0.1				Light	
CP04 WS02	8.00 4.00	<1	<0.1	<0.1				Light	
Remarks									

Project HEMPLAND PRIMARY SCHOOL, YORK Project No PC218325								
Client Depar	Sheet No.	1 (4 of 4)						
Equipment Used								
GI Infra F	GA2000							
Other Gas Data GFM435; Weather / Site Conditions								
Weather / Sit	e conditions		Still		Light x	Moderate	Strong	
Cloud Co	ver	ŗ			Slight		Overcast	
Precipitat	ion				Slight			
Песірітат								
Borehole	Depth to Base	Cloud	Rain		Equipment Used	Monitored by	Remarks	
	(m)	()	()		0	()		
CP01	8.00	Cloudy		Dry	Gas Data GFM435	AVM		
CP02	8.00	Cloudy		Dry	Gas Data GFM435	AVM		
CP03	8.00	Cloudy		Dry	Gas Data GFM435	AVM		
WS02	4.00	Cloudy		Dry	Gas Data GFM435	AVM		
Remarks								
							<u>eeleenies</u>	

## **APPENDIX 6**

## **Ground Model Cross Section**





## **APPENDIX 11**

Proposed Layout Plan



## Possible location of redevelopment

## **APPENDIX 12**

## Exploratory Hole Location Plan



### Cable Percussive Borehole

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Dynamic Cone Penetrometer

Window Sample Borehole

Hole ID	Easting (mE)	Northing (mN)	Level (mOD)
CP01	462516.20	452976.51	13.65
CP02	462617.10	452998.72	13.47
CP03	462557.28	452917.08	13.01
CP04	462644.77	452904.80	12.08
DCP01	462514.72	452976.75	13.67
DCP02	462583.36	452995.52	13.57
DCP03	462620.66	452942.74	12.96
DCP04	462645.23	452905.05	12.08
DCP05	462558.82	452918.24	12.97
WS01	462527.98	452936.86	13.36
WS02	462581.01	452995.63	13.58
WS03	462616.65	452943.12	13.01



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 Phone:
 024 7669 4664

 Fax:
 024 7669 4642

 E:mail
 mail@geotechnics.co.uk
 www.geotechnics.co.uk

#### Mott MacDonald Ltd

Client:

Department for Education

Project:

Hempland Primary School

Drawing Title:

EXPLORATORY HOLE LOCATION PLAN

Scale: 1:500@A3

Project No: PC218325

Date: February 2022 File Name:

Geo-PC218325-002(1)

## **APPENDIX 13**

## Investigation Techniques and General Notes

#### INTRODUCTION

The following brief review of Ground Investigation techniques, generally used as part of most Site Investigations in the UK, summarises their methodology, advantages and limitations. Detailed descriptions of the techniques are available and can be provided on request. This review should be read in conjunction with the accompanying General Notes.

#### TRIAL PITS

The trial pit is amongst the simplest yet most effective means of identifying shallow ground conditions on a site. Its advantages include simplicity, speed, potential accuracy and cost-effectiveness. The trial pit is most commonly formed using a back-acting excavator which can typically determine ground conditions to some 4 metres below ground level. Hand excavation is often used to locate, expose and detail existing foundations, features or services. In general, it is difficult to extend pits significantly below the water table in predominantly granular soils, where flows can cause instability. Unless otherwise stated, the trial pits will not have been provided with temporary side support during their construction. Under such circumstances, entrance into the pit is not permitted and hence observations will have been made from the ground surface and samples taken from the excavator bucket.

Where access for personnel is required to allow close observation of the exposed strata, the taking of samples and the carrying out of in situ tests, the sides of the trial pits (Observation Pits in BS 5930.2015) will be made safe using temporary supports or the sides battered back to a stable angle. Some limited access to such Trial Pits (Observation Pits) at depths less than 1m may be allowed in stable conditions or where the sides are benched or battered back to a safe angle.

Trends in strata type, level and thickness can be determined, shear surfaces identified and the behaviour of plant, excavation sides and excavated materials can be related to the construction process. They are particularly valuable in land slip investigations. Some types of in situ test can be undertaken in such pits and large disturbed or block samples obtained.

#### CABLE PERCUSSION BORING

The light Cable Percussion technique of soft ground boring, typically at a diameter of 150mm, is a well-established simple and flexible method of boring vertical holes and generally allows data to be obtained in respect of strata conditions other than rock. A tubular cutter (for cohesive soils) or shell with a flap valve (for granular soils) is repeatedly lifted and dropped using a winch and rope operating from an "A" frame. Soil which enters these tools is regularly removed and either sampled for subsequent examination or test, or laid to one side for later removal off site and licensed disposal or, if permitted by the Client, use as backfill. Steel casing will have been used to prevent collapse of the borehole sides where necessary. A degree of disturbance of soil and mixing of layers is inevitable and the presence of very thin layers of different soils within a particular stratum may not be identified. Changes in strata type can only be detected on recognition of a change in soil samples at the surface, after the interface has been passed. For the foregoing reasons, depth measurements should not be considered to be more accurate than 0.10 metre. The technique can determine ground conditions to depths in excess of 30 metres under suitable circumstances and usually causes less surface disturbance than trial pitting.

In cohesive soils cylindrical samples are retrieved by driving or pushing in 100mm nominal diameter tubes. In soft soils, piston sampling or vane testing may be undertaken. In granular soils and often in cohesive materials, in situ Standard Penetration Tests (SPT's) are performed. The SPT records the number of standard blows required to drive a 50mm diameter open or cone ended probe for 300mm after an initial 150mm penetration. A modified method of recording is used in denser strata. Small disturbed samples are obtained throughout.

#### ROTARY DRILLING

Rotary Drilling to produce cores by rotating an annular diamond-impregnated tube or barrel into the ground is the technique most appropriate to the forming of site investigation boreholes through rock or other hard strata. It has the advantage of being able to be used vertically or at an angle. Core diameters of less than 100mm are most common for site investigation purposes. Core is normally retrieved in plastic lining tubes. A flushing fluid such as air, water or foam is used to cool the bit and carry cuttings to the surface. Depths in excess of 60 metres can be achieved under suitable circumstances using rotary techniques, with minimal surface disturbance.

Examination of cores allows detailed rock description and generally enables angled discontinuity surfaces to be observed. However, vertical holes do not necessarily reveal the presence of vertical or near-vertical fissures or joint discontinuities. The core type and/or techniques used will depend on the ground conditions. Where open hole rotary drilling is employed, descriptions of strata result from examination at the surface of small particles ejected from the borehole in the flushing medium. In consequence, no indication of fissuring, bedding, consistency or degree of weathering can be obtained. <u>DYNAMIC SAMPLING</u>

This technique involves the driving of an open-ended tube into the ground and retrieval of the soil which enters the tube. It was previously called window or windowless sampling. The term "window sample" arose from the original device which had a "window" or slot cut into the side of the tube through which samples were taken. This was superseded by the use of a thin-walled plastic liner to retrieve the soil sample from within a sampler (windowless sampling) which has a solid wall. Line diameters range from 36 to 86mm. Such samples can be used for qualitative logging, selection of samples for classification and chemical analysis and for obtaining a rudimentary assessment of strength.

Driving devices can be hand-held or machine mounted and the drive tubes are typically in 1m lengths. Depending on the type of rig used, the hole formed can be cased to prevent collapse of the borehole sides. Where the type of rig does not allow the insertion of casing, the success of this technique can be limited when soils and groundwater conditions are such that the sides of the hole collapse on withdrawal of the sampler. Obstructions within the ground, the density of the material or its strength can also limit the depth and rate of penetration of this light-weight investigation technique. Nevertheless, it is a valuable lool where access is constrained such as within buildings or on embankments. Depths of up to 10m can be achieved in suitable circumstances depending on the rig type but depths of 5m to 6m are more common.

#### EXPLORATORY HOLE RECORDS

The data obtained by these techniques are generally presented on Trial Pit, Borehole, Drillhole or Dynamic Sample Records. The descriptions of strata result from information gathered from a number of sources which may include published geological data, preliminary field observations and descriptions, in situ test results, laboratory test results and specimen descriptions. A key to the symbols and abbreviations used accompanies the records. The descriptions on the exploratory hole records accommodate but may not necessarily be identical to those on any preliminary records or the laboratory summaries.

The records show ground conditions at the exploratory hole locations. The degree to which they can be used to represent conditions between or beyond such holes, however, is a matter for geological interpretation rather than factual reporting and the associated uncertainties must be recognised.

#### DYNAMIC PROBING

This technique typically measures the number of blows of a standard weight falling over a standard height to advance a cone-ended rod over sequential standard distances (typically 100mm). Some devices measure the penetration of the probe per standard blow. It is essentially a profiling tool and is best used in conjunction with other investigation techniques where site-specific correlation can be used to delineate the distribution of soft or lose soils or the upper horizon of a dense or strong layer such as rock.

Both machine-driven and hand-driven equipment is available, the selection depending upon access restrictions and the depth of penetration required. It is particularly useful where access for larger equipment is not available, disturbance is to be minimised or where there are cost constraints. No samples are recovered and some techniques leave a sacrificial cone head in the ground. As with other lightweight techniques, progress is limited in strong or dense soils. The results are presented both numerically and graphically. Depths of up to 10m are commonly achieved in suitable circumstances.

The hand-driven DCP probing device has been calibrated by the Highways Agency to provide a profile of CBR values over a range of depths.

#### INSTRUMENTATION

The most common form of instrument used in site investigation is either the standpipe or else the standpipe piezometer which can be installed in investigation holes. They are used to facilitate monitoring of groundwater levels and water sampling over a period of time following site work. Normally a standpipe would be formed using rigid plastic tubing which has been perforated or slotted over much of its length whilst a standpipe piezometer would have a filter tip which would be placed at a selected level and the hole sealed above and sometimes below to isolate the zone of interest. Groundwater levels are determined using an electronic "dip meter" to measure the depth to the water surface from ground level. Piezometers can also be used to measure permeability. They are simple and inexpensive instruments for long term monitoring but response times can limit their use in dial areas and access to the ground surface at each instrument is necessary. Remote reading requires more sophisticated hydraulic, electronic or pneumatic equipment.

Settlement can be monitored using surface or buried target plates whilst lateral movement over a range of depths is monitored using slip indicator or inclinometer equipment.

Geotechnics

### GENERAL NOTES

- The report is prepared for the exclusive use of the Client named in the document and copyright subsists with Geotechnics Limited. Prior written permission must be obtained to reproduce all or part of the report. It is prepared on the understanding that its contents are only disclosed to parties directly involved in the current investigation, preparation and development of the site.
- 2. Further copies may be obtained with the Client's written permission, from Geotechnics Limited with whom the master copy of the document will be retained.
- 3. The report and/or opinion is prepared for the specific purpose stated in the document and in relation to the nature and extent of proposals made available to Geotechnics Limited at that time. Re-consideration will be necessary should those details change. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Geotechnics Limited.
- 4. The assessment of the significance of the factual data, where called for, is provided to assist the Client and their Engineer and/or Advisers in the preparation of their designs.
- 5. The report is based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. The data from any commissioned desk study and site reconnaissance are also drawn upon. There may be special conditions appertaining to the site, however, which are not revealed by the investigation and which may not be taken into account in the report.
- 6. Methods of construction and/or design other than those proposed by the designers or referred to in the report may require consideration during the evolution of the proposals and further assessment of the geotechnical and any geoenvironmental data would be required to provide discussion and evaluations appropriate to these methods.
- 7. The accuracy of results reported depends upon the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristics of the strata as a whole (see accompanying notes on Investigation Techniques). Where such measurements are critical, the technique of investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the Company where necessary.
- 8. The samples selected for laboratory test are prepared and tested in accordance with the relevant Clauses and Parts of BS EN ISO 17892 and BS 1377 Parts 1 to 8, where appropriate, in Geotechnics Limited's UKAS accredited Laboratory, where possible. A list of tests is given.
- 9. Tests requiring the use of another laboratory having UKAS accreditation where possible are identified.
- 10. Any unavoidable variations from specified procedures are identified in the report.
- 11. Specimens are cut vertically, where this is relevant and can be identified, unless otherwise stated
- 12. All the data required by the test procedures are recorded on individual test sheets but the results in the report are presented in summary form to aid understanding and assimilation for design purposes. Where all details are required, these can be made available.
- 13. Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes, or on the possible presence of features based on either visual, verbal, written, cartographical, photographic or published evidence, this is for guidance only and no liability can be accepted for its accuracy.

14. The Code of Practice for Ground Investigations – BS 5930:2015 calls for man-made soils to be described as Anthropogenic Ground with soils placed in an un-controlled manner classified as Made Ground and soils placed in a controlled manner as Fill. In view of the difficulty in always accurately determining the origin of manmade soils in exploratory holes, Geotechnics Limited classify such materials as Made Ground. Where soils can be clearly identified as being placed in a controlled manner then further classification of the soils as Fill has been added to the Exploratory Hole Records.

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- 15. Classification of man-made soils is based on the inspection of retrieved samples or exposed excavations. Where it is obvious that foreign matter such as paper, plastic or metal is present, classification is clear. Frequently, however, for man-made soils that arise from the adjacent ground or from the backfilling of excavations, their visual characteristics can closely resemble those of undisturbed ground. Other evidence such as site history, exploratory hole location or other tests may need to be drawn upon to provide clarification. For these reasons, classification of soils on the exploratory hole records as either Made Ground or naturally occurring strata, the boundary between them and any interpretation that this gives rise to should be regarded as provisional and subject to re-evaluation in the light of further data.
- 16. The classification of materials as Topsoil is generally based on visual description and should not be interpreted to mean that the material so described complies with the criteria for Topsoil used in BS 3882:2015. Specific testing would be necessary where such a definition is a requirement.
- 17. Ground conditions should be monitored during the construction of the works and the report should be re-evaluated in the light of these data by the supervising geotechnical engineers.
- 18. Any comments on groundwater conditions are based on observations made at the time of the investigation, unless specifically stated otherwise. It should be noted, however, that the observations are subject to the method and speed of boring, drilling or excavation and that groundwater levels will vary due to seasonal or other effects.
- 19. Any bearing capacities for conventional spread foundations which are given in the report and interpreted from the investigation are for bases at a minimum depth of 1m below finished ground level in naturally occurring strata and at broadly similar levels throughout individual structures, unless otherwise stated. Typically they are based on serviceability criteria taking account of an assessment of the shear strength and/or density data obtained by the investigation. The foundations should be designed in accordance with the good practice embodied in BS 8004:2015 -Foundations, supplemented for housing by NHBC Standards. Foundation design is an iterative process and bearing pressures may need adjustment or other measures may need to be taken in the context of final layouts and levels prior to finalisation of proposals.
- 20. Unless specifically stated, the investigation does not take account of the possible effects of mineral extraction or of gases from fill or natural sources within, below or outside the site.
- 21. The costs or economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to geotechnical or geoenvironmental considerations and hence their evaluation is outside the scope of the report.





## Appendix F with LLFA and Internal Drainage Board

Subject:

**RE: Hemplands Primary School** 

From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: Tuesday, May 30, 2023 12:46 PM To: Jon Shaw <<u>Jon.Shaw @ curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u>; Ewan Mason <<u>Ewan.Mason@curtins.com</u>> Subject: RE: Hemplands Primary School

Hello Jon, good afternoon

I left for the BH weekend at 15:00hrs on Friday and therefore did not get your message but did go straight to site this morning. I found you were carrying out borehole/windows samples which were as useful in the fact up to the point the drilling rig broke down 2.5m had been sunk and the subsoil was found to be predominantly a dark brown medium to dense clay material and therefore we can confirm soakaways will not work on this site and there is no need to carry out the soakaways due to be carried out this coming Thursday.

Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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**ARE YOU AT RISK?** 



From: Jon Shaw <<u>Jon.Shaw@curtins.com</u>> Sent: 26 May 2023 15:30 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Cc: <u>planning@yorkconsort.gov.uk</u>; Ewan Mason <<u>Ewan.Mason@curtins.com</u>> Subject: RE: Hemplands Primary School

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Hi Richard

I have just called and left a message for you but also wanted to follow this up with an email to let you know that unfortunately our contractor has cancelled on us at the last minute for Tuesday and to the soakaway testing will not be happening that day. We are trying to rearrange this for Thursday next week instead but there is no guarantee of this at the moment. I will let you know an update on Tuesday.

Kind regards Jpon

Jon Shaw Associate Curtins т. 0113 274 8509 | м. 07831 154 803 | jon.shaw@curtins.com

From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: Monday, May 22, 2023 9:41 AM To: Jon Shaw <<u>Jon.Shaw @ curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u>; Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>>; Ewan Mason <<u>Ewan.Mason@curtins.com</u>> Subject: RE: Hemplands Primary School

That is booked 🏼

Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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**ARE YOU AT RISK?** 



From: Jon Shaw <<u>Jon.Shaw@curtins.com</u>> Sent: 22 May 2023 09:02 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Cc: planning@yorkconsort.gov.uk; Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>>; Ewan Mason <<u>Ewan.Mason@curtins.com</u>> Subject: RE: Hemplands Primary School

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Hi Richard

Further to my previous email, the soakaway test works are planned in for Tuesday 30 May. If you'd like to come to site for 0900. Our engineer on site will be Ewan Mason.

Kind regards Jon

Jon Shaw Associate Curtins т. 0113 274 8509 | м. 07831 154 803 | jon.shaw@curtins.com

From: Jon Shaw Sent: Tuesday, May 9, 2023 9:07 AM To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Cc: <u>planning@yorkconsort.gov.uk</u>; Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Subject: RE: Hemplands Primary School

Hi Richard

We are planning on the soakaway testing being on Tues 23 May as it stands. If you could contact me nearer the time I can confirm the finer arrangements (i.e. times etc.).

Kind regards Jon

Jon Shaw Associate Curtins T. 0113 274 8509 | M. 07831 154 803 | jon.shaw@curtins.com

From: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Sent: 04 May 2023 09:07 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>>; Jon Shaw <<u>Jon.Shaw@curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

Thanks Richard,

Jon please can you coordinate with Richard to arrange a time on one the dates below when the soakaway tests can be witnessed.

Thanks, Elspeth

Elspeth Fraser (She/her) Civil Engineer Curtins T. 0113 274 8509 | elspeth.fraser@curtins.com

From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: 03 May 2023 16:08 To: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

Tuesday 30<sup>th</sup> May and Thursday 1<sup>st</sup> June are good for me.

#### Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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# **ARE YOU AT RISK?**



From: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Sent: 03 May 2023 15:54 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

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Hi Richard,

Understood. The site investigations are currently planned to be carried out in half term week due to difficulties accessing the site during term time (week commencing 29<sup>th</sup> May). We will propose to carry out the soakaway tests while on site that week.

Please can you confirm your availability to attend site to witness the tests that week?

Kind Regards, Elspeth

Elspeth Fraser (She/her) Civil Engineer Curtins T. 0113 274 8509 | elspeth.fraser@curtins.com

From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: 03 May 2023 15:42 To: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

Extract from our Guidance therefore as advised and per our policy the infiltration testing must be carried out prior to determination of the application, witnessed by us and cannot be conditioned.

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000 with regards to hierarchy for surface water dispersal and the use of Sustainable Drainage Systems (SuDS).

Consideration should be given to discharge to soakaway, infiltration system and watercourse in that priority order. Surface water discharge to the existing public sewer network must only be as a last resort therefore sufficient evidence should be provided i.e. witnessed by CYC infiltration tests to BRE Digest 365 to discount the use of SuDS. Please note, the testing must be site specific (BGS data will not be accepted), carried out prior to determination of the application and the testing cannot be conditioned.

Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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From: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Sent: 03 May 2023 15:16 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Richard,

Thanks for the information, that's really useful.

I have been discussing the infiltration testing with our environmental team that will be carrying out some further site investigations and they do not think that carrying out soakaway tests will be beneficial due to the high groundwater levels encountered in the previous ground investigation (attached).

Section 7.2 of the report shows that the groundwater levels varied across the site from 0.3-7.78m bgl. The area in which the groundwater levels are deeper (CP01 and CP02) are at the higher side of the site so pumping would be required to discharge surface water to soakaways in that area. Pumping is not a preferred solution due sustainability and maintenance risks.

Made ground was encountered in all boreholes up to 0.55m deep (section 7.1.1 of report) which limits the depth of ground between made ground and the groundwater level in which soakaways could work. The report also states (section 7.2) that as no water-bearing granular layers were noted within soils, it is unlikely that the high water levels represent perched water.

Borehole		Groundwat	Remarks	
	Filter Zone	Depth (m bgl)	Level (m OD)	
CP01	Glaciolacustrine Clay and Glacial Till	1.76 - 1.92	11.73 - 11.89	Slight rise over monitoring visits
CP02	Glaciolacustrine Clay and Glacial Till	4.42 - 7.78	5.69 - 9.05	Rising over monitoring visits
CP03	Glaciolacustrine Clay and Glacial Till	0.30 - 5.00	8.01 - 12.71	Varying over monitoring visits
CP04	Glaciolacustrine Clay and Glacial Till	1.10 - 1.38	10.70 - 10.98	Slight fall over monitoring visits, Stopcock cover noted as flooded during visit 3 and 4.
WS02	Glaciolacustrine Clay and Glacial Till	3.58 (Visit 1) DRY (Visits 2 to 4)	10.00 (Visit 1)	Dry during visits 2 to 4



Please could you confirm if the information in the previous ground investigation provides sufficient evidence that infiltration will not be viable due to ground water levels, and therefore soakaway tests will be not be required? Further ground investigation is due to be carried out and will include groundwater monitoring, you or a representative from your team would be welcome to attend site during the ground water monitoring if that would be beneficial.

Kind Regards, Elspeth

Elspeth Fraser (She/her) Civil Engineer Curtins T. 0113 274 8509 | elspeth.fraser@curtins.com From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: 25 April 2023 09:45 To: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Cc: <u>planning@yorkconsort.gov.uk</u> Subject: RE: Hemplands Primary School

Yes it is worth having the conversation with us as early as possible...

Attached below are our Sustainable Drainage Systems Guidance for Developers surface water drainage design considerations with critical points highlighted which must be included within your drainage submission...

Surface water drainage design considerations.

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000 with regards to hierarchy for surface water dispersal and the use of Sustainable Drainage Systems (SuDS). Consideration should be given to discharge to soakaway, infiltration system and watercourse in that priority order. Surface water discharge to the existing public sewer network must only be as a last resort therefore sufficient evidence should be provided *i.e.* witnessed by CYC infiltration tests to BRE Digest 365 to discount the use of SuDS. Please note, the testing must be site specific (BGS data will not be accepted), carried out prior to determination of the application and the testing cannot be conditioned.

If the proposed method of surface water disposal is via soakaways, these should be shown to work through an appropriate assessment carried out under BRE Digest 365, (preferably carried out in winter), to prove that the ground has sufficient capacity to except surface water discharge, and to prevent flooding of the surrounding land and the site itself.

City of York Council's Flood Risk Management Team should witness the BRE Digest 365 test.

If SuDS methods can be proven to be unsuitable then In accordance with City of York Councils City of York Councils Sustainable Drainage Systems Guidance for Developers (August 2018) and in agreement with the Environment Agency and the York Consortium of Internal Drainag Boards, peak run-off from Brownfield developments must be attenuated to 70% of the existing rate (based on 140 l/s/ha of proven by way of CCTV drainage survey connected impermeable areas during the 1 in 1 year event). Storage volume calculations, using computer modelling must accommodate a 1:30 year storm with no surface flooding, along with no internal floodin of buildings or surface run-off from the site in a 1:100-year storm. Proposed areas within the model must also include an additional 30% allowance for climate change. The modelling must use a range of storm durations, with both summer and winter profiles, to find the worst-case volume required. Please note, the CCTV drainage survey must be carried out g determination of the application.

If existing connected impermeable areas not proven, then Greenfield sites are to limit the discharge rate to the pre developed run off rate. The predevelopment run off rate should be calculated using either IOH 124 or FEH methods (depending on catchment size) during a 1 in 1 year event.

Where calculated runoff rates are not available the widely used 1.4l/s/ha rate can be used as a proxy, however, if the developer can demonstrate that the existing site discharges more than 1.4l/s/ha a higher existing runoff rate may be agreed and used as the discharge limit for the

proposed development. If discharge to public sewer is required, and all alternatives have been discounted, the receiving public sewer may not have adequate capacity and it is recommend discussing discharge rate with Yorkshire Water Services Ltd at an early stage.

In some instances, design flows from minor developments may be so small that the restriction of flows may be difficult to achieve. However, through careful selection of source control or SuDS techniques it should be possible to manage or restrict flows from the site to a minimum 0.5 l/sec for individual residential properties, please discuss any design issues with the City of York Council Flood Risk Management Team.

Surface water shall not be connected to any foul / combined sewer, if a suitable surface water sewer is available. Suitability of the watercourse and/or surface water sewer must be proven.

The applicant should provide a topographical survey showing the existing and proposed ground and finished floor levels to ordnance datum for the site and adjacent properties. The development should not be raised above the level of the adjacent land, to prevent runoff from the site affecting nearby properties.

Details of the future management and maintenance of the proposed drainage scheme shall be provided.

Some added notes to the above

You are correct the connection to the Ordinary Watercourse will require consent from the Foss (2008) Internal Drainage (FIDB) Board. Charlotte Gill is the planning officer for the York Consortium of Drainage Boards to include the FIDB, who's email address is CC'd above

If utilising an existing connection and infiltration unsuitable then the permitted surface water discharge rate shall be per the above based on 70% of the existing rate or 70% of the capacity of the existing pipe connection whichever is the lowest. Note, the existing pipe size, length and invert level information shall be surveyed and not estimated.

You should also consider the program of construction. With most schools the existing school remains operational whist the new school is being constructed therefore at some point there will be a temporary overlap where both roofs and car parks will be connected to the watercourse and the drainage scheme will need to accommodate both therefore this period must be kept to a minimum.

As the proposed school will be managed and maintained by our schools drainage team who would not normally adopt a permeable paving, or a dual permeable paving/voided stone sub base attenuation type feature.

Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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# ARE YOU AT RISK?



From: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Sent: 25 April 2023 09:11 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Subject: RE: Hemplands Primary School

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Hi Richard,

The scheme hasn't been submitted to planning yet. I can come back to you when it has but though it would be worth getting any comments before submitting to planning to inform the drainage strategy.

Kind Regards, Elspeth

Elspeth Fraser (She/her) Civil Engineer Curtins T. 0113 274 8509 | elspeth.fraser@curtins.com

From: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Sent: 25 April 2023 08:51 To: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Subject: RE: Hemplands Primary School

Hello Fraser, good morning

Do you have a live planning application reference number please so I can inform the correct planning case officer.?

Regards, Richard

Richard Wells | Senior Flood Risk Engineer t: 01904 553511 | e: <u>richard.wells@york.gov.uk</u>

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From: Elspeth Fraser <<u>Elspeth.Fraser@curtins.com</u>> Sent: 24 April 2023 16:13 To: Wells, Richard <<u>richard.wells@york.gov.uk</u>> Subject: Hemplands Primary School

This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good Afternoon Richard,

I have been instructed as the civil engineer on a new scheme at Hemplands Primary School and would like to discuss the drainage proposals with you at this early stage to ensure the surface water drainage strategy is appropriate. The scheme is still being developed but is understood to include a new school building and the demolition of existing buildings.

The site is adjacent to Tang Hall Beck, which we understand is in the Foss district. We will also consult with the Foss District drainage board.

The majority of the site is in Flood Zone 1, with a small section of the southern border in flood zone 3. The flood risk is away from all proposed and existing school buildings and playing fields so poses a low risk to the development.

There was a preliminary flood risk assessment previously carried out for the site for a similar scheme (see attached). The CCTV survey confirms that the existing surface water discharges unrestricted to Tang Hall Beck. The previous scheme proposed to discharge to the Beck utilising the existing headwall connection at a rate of 30% less than the existing Brownfield rate.

We understand that soakaway tests to BRE 362 are required to confirm if infiltration is viable. Do you have any specific requirements for the tests, for example any specific people required present at the time of testing?

If infiltration is not viable we would propose to discharge surface water to Tang Hall Beck utilising the existing headwall connection at a rate of 30% less than the existing Brownfield rate. Can you confirm that is acceptable?

Please let me know if you have any comments at this stage or if you would like to discuss.

Kind Regards, Elspeth

Elspeth Fraser (She/her) Civil Engineer T. 0113 274 8509 elspeth.fraser@curtins.con

Rose Wharf East Street Leeds LS9 8EE



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SRP1062-CUR-XX-XX-T-C-9211 Hempland Primary School SuDS Strategy & Flood Risk Summary



# Appendix G Drawings





Proiects/0834.38 Hermiland Primary Schmol Vork/04-Production/44-Mindels-Drawinns/C/CA







1.	GENERAL NOTES: THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT
2.	ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS. DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS
2	ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. 4.	ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. FOR GENERAL NOTES REFER TO DRAWING.
P02	PERMEABLE PAVING DETAIL ADDED 13/07/23 EF LB
P01 Rev:	INITIAL ISSUE 05/06/23 AJR LB   Description: Date: By: Chko
	Curtins
	Rose Wharf Ground Floor 78-80 East Street Leeds LS9 8EE 0113 274 8509 leeds@curtins.com
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1	HEMPLAND PRIMARY SCHOOL, YORK
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	Date     Scales @ A0       02/06/23     AS SHOWN       Project No - Originator - Function - Spatial - Form - Discipline - Number     Revision
SF	RP1062 - CUR - XX - XX - D - C - 9202 P02



# Appendix H Surface Water Calculations





# Appendix I Drainage Operation & Maintenance Manual

# Hempland Primary School SuDS Operations and Maintenance Manual

Curtins Ref: SRP1062-CUR-XX-XX-T-C-9290 Project: 083438 Revision: V01 Issue Date: 11 July 2023

Name: ISG Site Address: Hempands Primary School, Whitby Avenue, York





Curtins Rose Wharf East Street, Leeds LS9 8EE Tel: 0113 274 8509

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SuDS Operations and Maintenance Manual



Rev	Description	Issued by	Checked	Date
V01	Initial Issue.	EF	LB	11/07/23

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
Elspeth Fraser Civil Engineer		11/07/23

Reviewed	Signature	Date
Laura Barlow Principal Engineer		11/07/23



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5.0	Permeable Pavements	
6.0	Pipes (Including Oversized) & Manholes	
7.0	Bioretention Systems (Rain Gardens)	



### 1.0 Introduction

#### 1.1 Project Background

Curtins Consulting Limited has been appointed by ISG to prepare a SuDS Operations and Maintenance Manual for the proposed Hemplands Primary School development. Particular reference is paid to the inspection, aftercare and maintenance of SuDS features as part of this manual in order to demonstrate to the Lead Local Flood Authority (LLFA) or adopting authority the effectiveness and longevity of the SuDS features designed within the scheme as opposed to the standard Building Regulations, local and domestic drainage and/or the main discharge drainage connections to 'Sewers for Adoption' standards.

This report is based on current best practice guidance.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

In accordance with the FRA the surface water network has been designed to accommodate the 1 in 100 year storm rainfall event plus an allowance for climate change. It may be that the exceedance flows above the 1 in 30 year storm rainfall event are stored within the site partially above ground, on non-habitable external landscaping, parking or other space. As the flows are generally being attenuated on site and within SuDS features there will be a period after storm events where the network will still be partially or fully surcharged and draining down. Where this surcharging is still present after 48 hours appropriate action should be taken as noted below. As such the responsibility for maintaining the features will be clearly defined, and consistency is carried through from conception to maintenance.

#### 1.2 Scope of O&M Manual

This manual is intended to give an overview of the operation and maintenance for the range of SuDS features included within the drainage strategy and in relation to the typical details only. Where proprietary products are specified the manufacturers' instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.



### 2.0 Attenuation Tank (Geo-cellular Units)

### 2.1 Location and Description

The attenuation tank is located below the proposed school building, as shown on drainage strategy drawings SRP1062-CUR-ZZ-ZZ-D-C9201.

The tank has been designed in accordance with CIRIA C753 and the product specific requirements.

A typical arrangement is shown on drawing SRP1062-CUR-XX-XX-D-C-9202.

Geo-cellular units are proprietary products and therefore manufacturer's recommendations should also be taken into consideration. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken into consideration.

### 2.2 Operation

The attenuation tank is intended to be the surface water storage feature to attenuate the discharge from the site up to and including the 1 in 100 year plus event with an allowance for climate change. As such during rainfall events the basin will fill completely. The tank is intended to be empty between rainfall events.

Access for maintenance has been provided through the central filter drain with the units being effectively sealed laterally preventing the ingress of deleterious material. The main maintenance of this central filter drain should be undertaken in accordance with the filter drain section.

### 2.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of attenuation tanks as designed. As the feature is buried a regularly inspection regime is very important to ensure the correct functionality of the surface water drainage network. Maintenance responsibility for the attenuation tank and its surrounding area should be placed with Hemplands Primary School maintenance team.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.



SuDS Operations and Maintenance Manual

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
aujusteu as requireu)	Check penstocks and other mechanical devices (if present).	Half yearly.
	Inspect ventilation cowl (if present)	Monthly and after large storms.
Regular maintenance\inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance)	Monthly.
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms).
	Remove sediment from pre- treatment structures	Annually (or as required after heavy rainfall events).
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.



### 3.0 Pipes (Including Oversized) & Manholes

### 3.1 Location and Description

Pipes are the main conveyance system across the site with the network as shown on drainage strategy drawings SRP1062-CUR-ZZ-ZZ-D-C-9201.

Typical details for pipe bedding and detailing are shown on drawing SRP1062-CUR-XX-XX-D-C-9202.

Pipes are proprietary products and the materials can vary across the site and as such where used the manufacturer's recommendations should be followed. Regardless of the product used the pipes will be fully compliant with the Curtins' drainage specification.

### 3.2 Operation

Pipes are intended to be the main conveyance system across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleansing where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

### 3.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly, thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with Hemplands Primary School maintenance team.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.



SuDS Operations and Maintenance Manual

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more	Initial inspection should be provided as post construction CCTV survey.	N/A
year of operation and adjusted as required)	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
Occasional maintenance	Check and remove large vegetation growth near pipe runs.	6-monthly.
Remedial actions	Rod through poorly performing runs as initial remediation.	As required.
	If poor performance persists, jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If the above does not improve performance.



### 4.0 Bioretention Systems (Rain Gardens)

#### 4.1 Location and Description

The layout of proposed bioretention systems is shown on drainage strategy drawings SRP1062-CUR-XX-XX-D-C-9201.

Bioretention systems (often called "rain gardens") are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution using engineered soils and vegetation.

Proprietary products and the materials can vary across the site and as such where used the manufacturer's recommendations should be followed. Regardless of the product used will be fully compliant with the Curtins' drainage specification.

#### 4.2 Operation

Runoff collected by the system ponds temporarily on the surface and then filters through the vegetation and underlying soils, which attenuates and treats most of the rainfall from minor events, as well as the first flush from the rest of the possible rainfall events. For higher intensity storms, the runoff can bypass the filter medium using overflow drains, thereby reducing the flood risk on site.

#### 4.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly, thus exposing the development to a greater level of flood risk. Maintenance responsibility for the bioretention systems should be placed with Hemplands Primary School maintenance team.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

It is crucial that the filter medium and vegetation are the correct material and species and that they are properly monitored and maintained. If not, the filter medium can become compacted and blocked. This could result in the vegetation needing full replacement. The below table goes into more detail.



SuDS Operations and Maintenance Manual

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary.	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular Maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly or biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium an replace mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be greater than 20 years


SuDS Operations and Maintenance Manual

## 5.0 Permeable Pavements

### 5.1 Location and Description

The permeable pavements are located as shown on drainage strategy drawings SRP1062-CUR-XX-XX-D-C-9201.

The permeable pavements have/will be designed in accordance with CIRIA C753 and BS7533-13.

A typical arrangement is shown on drawing SRP1062-CUR-XX-XX-D-C-9202.

Permeable pavements contain proprietary products and as such where used the manufacturer's recommendations should be followed.

#### 5.2 Operation

The permeable pavements are intended to be water quality and attenuation storage features. These features are intended to be dry except during rainfall events. The permeable pavements may also be utilised as an infiltration area or soakaway for other areas of the development.

The surface has been designed to be porous or to contain gaps where rain can flow through the upper construction layers into the voided stone which makes up the sub-base. Where these features are intended to be used as infiltration devices or soakaways any capping also needs to be permeable to permit the flows to the formation.

Access for maintenance is not provided as this is a surface feature only.

#### 5.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the pervious pavement. Maintenance responsibility for the pavement and its surrounding area should be placed with Hempland Primary School.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

## Hempland Primary School

## SuDS Operations and Maintenance Manual



Maintenance Schedule	Required Action	Frequency	
Monitoring (to be undertaken more	Initial inspection.	Monthly for three months after installation.	
year of operation and adjusted as required)	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 hours after large storms.	
	Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be profiled to provide a flat area or berm adjacent to the paving.	Annually.	
	Monitor inspection chambers.	Annually.	
Regular maintenance\inspection	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site- specific observations of clogging or manufacturers' recommendations.	
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required and as per Landscape Architect's specification.	
	Removal of weed.	As required.	
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.	
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to	As required.	

## Hempland Primary School



SuDS Operations and Maintenance Manual

the structural performance or a hazard to users.	
Rehabilitation of surface and upper sub-structure. This could include replacement of the jointing and bedding material. The upper geotextiles layer may also need replacing if clogged.	As required (if infiltration performance is reduced as a result of significant clogging). Check manufacturer's product lifespan.

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SRP1062-CUR-XX-XX-T-C-9211 Hempland Primary School SuDS Strategy & Flood Risk Summary



## Appendix J Foul Calculation

Woodside Mews Clayton Wood Close Leeds LS16 6QE T. 0113 274 8509 F. 0113 274 8496 leeds@curtins.com www.curtins.com Job Title:Hemplands Primary SchooSheet Title:Foul Pumping Station calcsJob Number:83438



# 

Appliance	No.	System I	System II	System III	System IV	Total DU	Total DU	Total DU	Total DU
		DU I/s	DU I/s	DU I/s	DU I/s	System I	System II	System III	System IV
Wash Basin	45	0.5	0.3	0.3	0.3	22.5	13.5	13.5	13.5
Bidet		0.5	0.3	0.3	0.3	0	0	0	0
Shower without plug		0.6	0.4	0.4	0.4	0	0	0	0
Shower with plug		0.8	0.5	1.3	0.5	0	0	0	0
Single urinal with cistern		0.8	0.5	0.4	0.5	0	0	0	0
Urinal with flushing valve		0.5	0.3	1.0	0.3	0	0	0	0
Slab Urinal (per person)		0.2	0.2	0.2	0.2	0	0	0	0
Bath		0.8	0.6	1.3	0.5	0	0	0	0
Kitchen Sink	5	0.8	0.6	1.3	0.5	4	3	6.5	2.5
Household Dishwasher		0.8	0.6	0.2	0.5	0	0	0	0
Washing Machine >6kg		0.8	0.6	0.6	0.5	0	0	0	0
Washing Machine >12kg		1.5	1.2	1.2	1.0	0	0	0	0
WC 4.0I cistern		1.0	1.8	1.0	1.0	0	0	0	0
WC 6.0I cistern	29	2.0	1.8	1.2 to 1.7	2.0	58	52.2	34.8 to 49.3	58
WC 7.5I cistern		2.0	1.8	1.4 to 1.8	2.0	0	0	0 to 0	0
WC 9.0I cistern		2.5	2.0	1.6 to 2.0	2.5	0	0	0 to 0	0
Floor Gully DN 50		0.8	0.9	1.0	0.6	0	0	0	0
Floor Gully DN 70	6	1.5	0.9	1.0	1.0	9	5.4	6	6
Floor Gully DN 100		2.0	1.2	1.0	1.3	0	0	0	0

Sum of discharge units

93.5 74.1 60.8 to 75.3 80

Frequency Factor

0.7

Total Foul Flows (I/s)

( 77	( 02		( )(
0.77	0.03	5.46 10 6.07	0.20

SRP1062-CUR-XX-XX-T-C-9211 Hempland Primary School SuDS Strategy & Flood Risk Summary



## Appendix K Outfall Photo



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