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 B Bx C Cx D	100 0 0 0 0 0	4 N/A 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 B Bx C Cx D	100 0 0 0 0 0	4 N/A 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'.

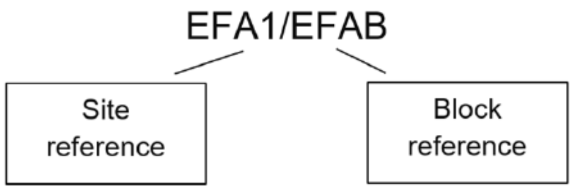


Figure 1: Location field naming convention

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.

The condition grading and priority ratings are defined as follows:

Grade	Condition	Description
A	Good	Performing as intended
B	Satisfactory	Performing as intended, but exhibiting minor deterioration
C	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

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
A	0	N/A
B	60	3
Bx	0	N/A
C	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

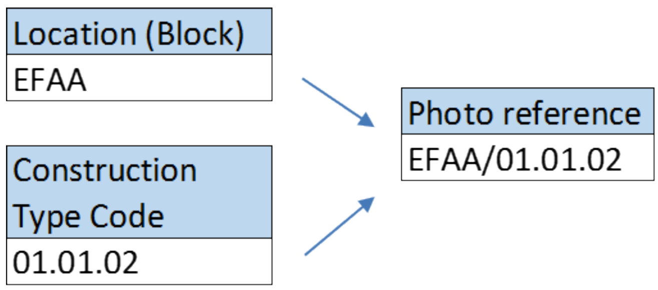


Figure 2: Photo reference example

END OF REPORT

Appendix D Pre-planning Enquiry Response

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

Curtins
Rose Wharf
East Street
Leeds
LS9 8EE
elspeth.fraser@curtins.com

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.

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 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

462416 : 452835	Map Name : SE6252NW	Title	Partial Key	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

Yorkshire Water,
PO Box 500,
Halifax Road,
Bradford BD6 2LZ
Contact Name :
G Mullaney
Contact Tel :

Notes

Foul Sewer = F
Combined Sewer = C
Surface Water Sewer = SW
Trade Sewer = TD
Partially Separate = PS

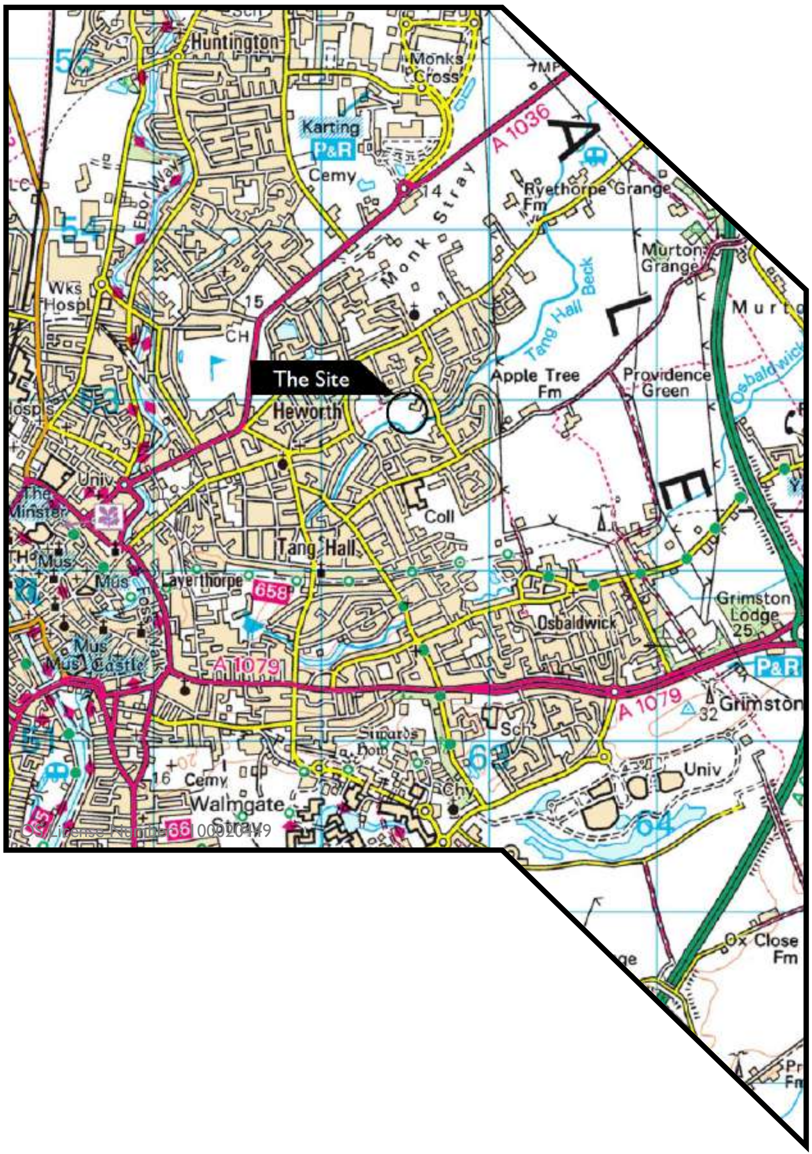
Date Req : 06/07/2023, 11:26:22
Date Gen : 06/07/2023, 11:26:37
Source : Sewer Network Enquiry

UPN: Undefined   Originator: G Mullaney, ,

Appendix E Phase 2 Site Investigation Report (Relevant Pages)

GEOTECHNICS
geotechnical and geoenvironmental specialists

Ground Investigation



www.geotechnics.co.uk

HEMPLAND PRIMARY SCHOOL, YORK

for
Department for Education

Engineer : Mott MacDonald Ltd

Project Number PC218325

April 2022

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Preliminary Ground Investigation Report with Interpretive Chapter
for

HEMPLAND PRIMARY SCHOOL, YORK

for
Department for Education

Engineer :
Mott MacDonald Ltd

Project No:
PC218325
April 2022

DOCUMENT CONTROL

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Client	Department for Education
Engineer	Mott MacDonald Ltd
Document Status	FINAL

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DRAFT	1	Issued for review	Mott MacDonald	PDF
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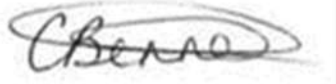
Signatures

	Name	Position	Signature
Author	Chloe Bennett BSc MSc FGS	Engineer	
Authoriser	John Knowles BSc, PGCE, MSc, C.Geol, RoGEP (Advisor)	Principal Engineer	
Authoriser	Trevor Hardie BSc MSc CEng MICE	Chief Geotechnical Engineer	

Please do not print this report unless necessary. If you do have to print this report, please reuse and recycle the paper.

CONFIDENTIALITY AND LIMITATIONS

This report was prepared by Geotechnics (Geotechnics Limited) for the use of the Client, named on the previous page, within the Document Control section. The report has been prepared specifically on the basis of the end use as defined by the Client. Any change of end use would necessitate review of this report and its findings. Use of or reliance on this report by any third party is not permitted without our express written agreement, and where this is given, will be subject to our terms and conditions.

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.

CONTENTS

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APPENDIX 2	Cable Percussion Borehole Records
APPENDIX 3	Dynamic Sample Borehole Records
APPENDIX 4	Dynamic Cone Penetration Tests
APPENDIX 5	Monitoring Results
APPENDIX 6	Ground Model Cross Section
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APPENDIX 8	Laboratory Test Results - Contamination
APPENDIX 9	Ground Parameter Data Plots and Summary Tables
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APPENDIX 11	Proposed Layout Plan
APPENDIX 12	Exploratory Hole Location Plan
APPENDIX 13	Investigation Techniques and General Notes

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

Project No: PC218325
April 2022

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 26th 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".
- BS5930:2015+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.

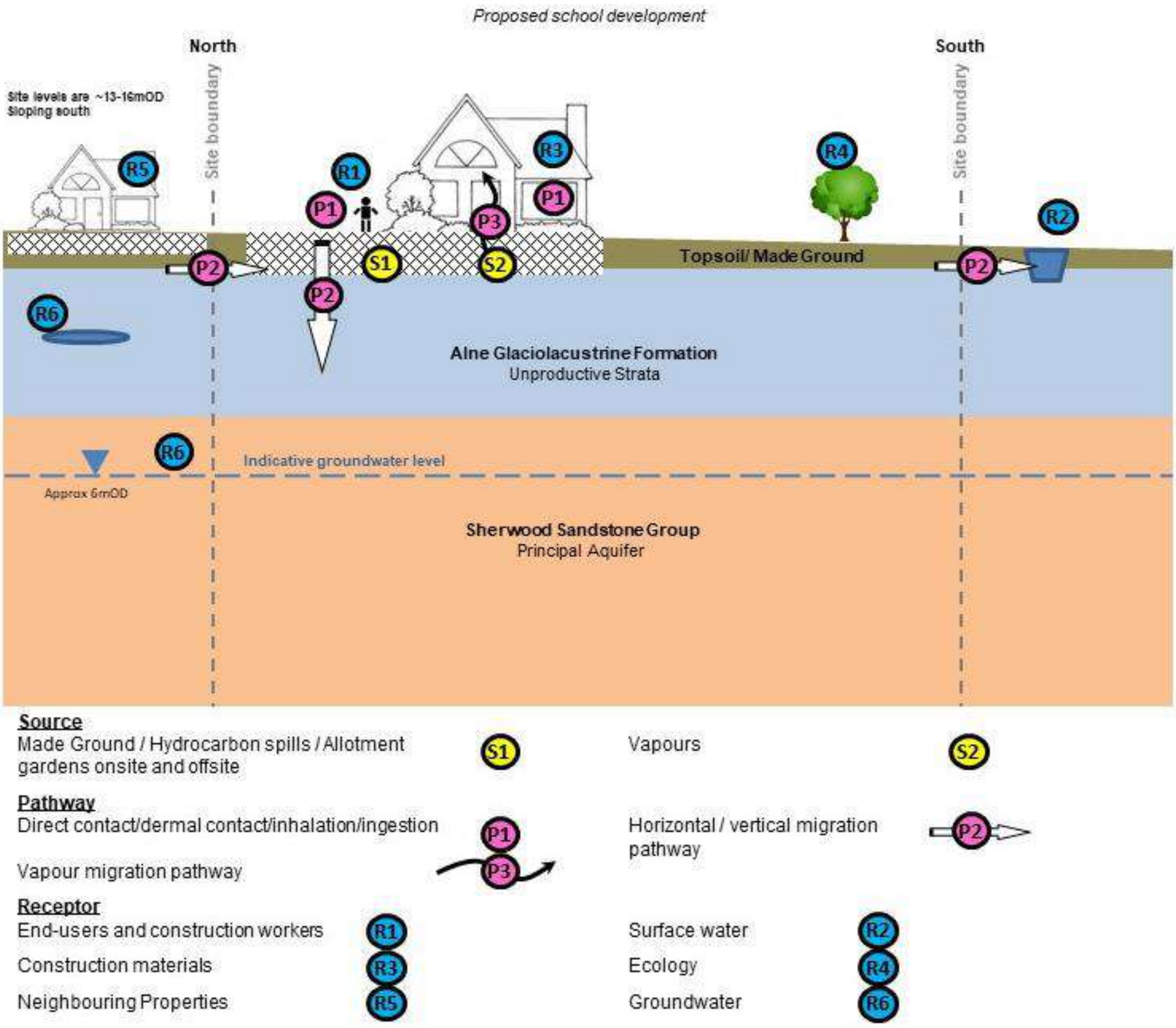
Location	Hempland Primary School, Whitby Ave, Heworth, York
Grid Reference	462581, 452930
Post Code	YO31 1ET
Site Area	Approximately 2.28 Ha
Site Shape	The site is irregular in shape with maximum plan dimensions of 179m by 147m
Topography	The site is generally flat with elevations of approximately 15m 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 → pathway → 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 → Dermal contact, ingestion, inhalation → Construction workers
- Contaminants in soil and groundwater → Dermal contact, ingestion, inhalation → Future site workers, visitors and pupils
- Contaminants in soil and groundwater → Downward / lateral migration → 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 22nd and 25th 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 BS EN 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 26th 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;

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

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 2nd December 2021 with further visits on 9th, 16th and 23rd 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_4, O_2, CO_2, along with (ppm) H_2S, 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 17892-4:2016	Particle Size Distribution Determination – Sieving Method	3
	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 1377:1990 Part 4 - 3.3	Dry Density/Moisture Content relationship determination. Compaction Test – British Standard (2.5 kg Hammer)	2

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
- Beryllium
- Chromium (Hexavalent)
- Lead
- Selenium
- Arsenic
- Boron (Water Soluble)
- Copper
- Molybdenum
- Vanadium
- Barium
- Chromium
- Iron
- Nickel
- Zinc

Inorganics

- pH
- Sulphate (Water Soluble)
- Cyanide (Free)
- Total Sulphur
- Total Organic Carbon

Other

- Petroleum Hydrocarbons (Aliphatic / Aromatic speciated)
- Volatile Organic Compounds (VOC)
- Polyaromatic Hydrocarbons (Speciated)
- MTBE
- Phenols
- Asbestos

The groundwater samples were analysed for the following determinands:

Metals

- Antimony
- Beryllium
- Chromium
- Copper
- Magnesium
- Nickel
- Zinc
- Arsenic
- Boron
- Chromium III
- Iron
- Manganese
- Selenium
- Barium
- Calcium
- Chromium (Hexavalent)
- Lead
- Molybdenum
- Vanadium

Inorganics

- pH
- Sulphate
- Fluoride
- Cyanide (Total & Free)
- Sulphide
- Total Hardness
- Ammoniacal Nitrogen
- Chloride

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
- Arsenic
- Barium
- Beryllium
- Boron
- Calcium
- Chromium
- Chromium III
- Chromium (Hexavalent)
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Selenium
- Vanadium
- Zinc

Inorganics

- pH
- Cyanide (Total & Free)
- Ammonical Nitrogen
- Sulphate (Water Soluble)
- Sulphide
- Chloride
- 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)
Made Ground	Asphalt (Found in CP01, CP04, WS03)	GL	12.08 to 13.65	0.15
Made Ground (Surface covering)	Dark brown slightly gravelly clayey/silty sand with occasional rootlets. The gravel variously composed of brick, sandstone and mudstone. (Found as a topsoil-like surface covering in CP02, CP03, WS01, WS02)	GL	13.01 to 13.58	0.10 to 0.55

Made Ground (Granular)	Reddish brown, light brown, light grey and light greyish brown sandy gravel (with a low cobble content – CP04). The gravel variously composed of brick fragments, concrete, asphalt, sandstone and mudstone. Cobble content is of brick and sandstone. (Found in CP01, CP04, WS03)	0.15	11.93 to 13.50	0.35 to 0.65
Made Ground (Cohesive)	Soft and firm brown, varying to brownish grey, greyish brown and mottled grey slightly sandy slightly gravelly clay (with a low cobble content – CP02). The gravel variously composed of sandstone, mudstone and brick fragments. Cobble content is of sandstone and brick. (All holes except CP03)	0.50 to 0.80	11.28 to 13.15	0.50 to 1.00
Glaciolacustrine Clay	Firm fissured brown mottled grey and light grey slightly sandy CLAY with occasional calcareous inclusions (up to 20mm in size) and occasional sandy pockets (up to 20mm in size). Fissures are extremely closely, varying to closely, spaced, randomly orientated, smooth and dull.	0.10 to 1.50	10.78 to 12.91	0.50 to 1.90
Glacial Till	Firm to stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is composed of mudstone and sandstone.	2.00 to 3.00	10.08 to 11.47	2.00 to 6.45 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 topsoil-like 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^3.

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/m², based on the tentative relationship $c_u = f_1 x$ (kN/m²) 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^2 (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/m². 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^3.

Two (2No.) Particle Size Distribution tests were undertaken on samples of the Glaciolacustrine Clay. These showed the samples to comprise between 81% and 90% fines (<63μm) 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 (1No.) 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^3. 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 0.09m²/MN for the applied pressure range of 100 - 200kN/m². This is indicative of low compressibility clay. Typically, a *fluvio-glacial clay* would be of medium compressibility with an m_v value of 0.10-0.30m²/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/m² to 225kN/m², averaging at 130kN/m², based on the tentative relationship $c_u = f_1.xN$ (kN/m²) proposed by Stroud & Butler, where $f_1 = 5.5$ for clay with a mean PI 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/m² to 167kN/m². 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/m³ to 2.25Mg/m³.

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/m² and 0.14MN/m² for the applied pressure ranges of 50 – 100kN/m² and 100 - 200kN/m², 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.

Borehole	Stratum covered by Filter Zone	Groundwater Level		Remarks
		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 two-storey 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:

$$I'p = Ip \times \frac{\%\ \text{less than } 425\mu m}{100}$$

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:

Sample	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 foundation from Tree (m)	Broad Leaf Tree			Coniferous Tree	
	High Water Demand	Moderate Water Demand	Low Water Demand	High Water Demand	Moderate Water 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.

Type	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 (2No. samples)
Water Soluble Sulphate 56 mg/l and 60 mg/l
pH 7.3 and 7.8

Glaciolacustrine Clay (2No. samples)
Water Soluble Sulphate 68 mg/l and 1100 mg/l
pH 9.1 and 11.6

Glacial Till (4No. samples)
Water Soluble Sulphate 250 to 930 mg/l
pH 8.6 to 11.7

The characteristic water soluble sulphate concentrations for the Glaciolacustrine Clay and the Glacial Till lie within Design Sulphate Class DS-2 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.

PI	Equilibrium CBR (%)	
	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 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.

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 Mitigation	After Control		
				Probability	Impact	Risk		Probability	Impact	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	Made 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 Defra Sewage Sludge Code of Practice. 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	-	N
Copper	12	pH>7 - 200	-	N
Cadmium	-	All pH – 3	Not analysed for	-
Chromium	12	All pH - 400	-	N
Nickel	12	pH>7 – 110	-	N
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.

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

Determinand	Unadjusted EQS GAC (µg/l)	DWS GAC (µg/l)	Results Exceeding EQS (µg/l)	Results Exceeding DWS (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	
Fluroanthene	0.0063	-	CP01 – Groundwater – 0.06 CP04 – Groundwater – 0.02	
Benzo(b) fluoranthene	0.00017 (BaP value)	0.10	CP01 – Groundwater – 0.01	

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.

Hazard Identification				Hazard Assessment			
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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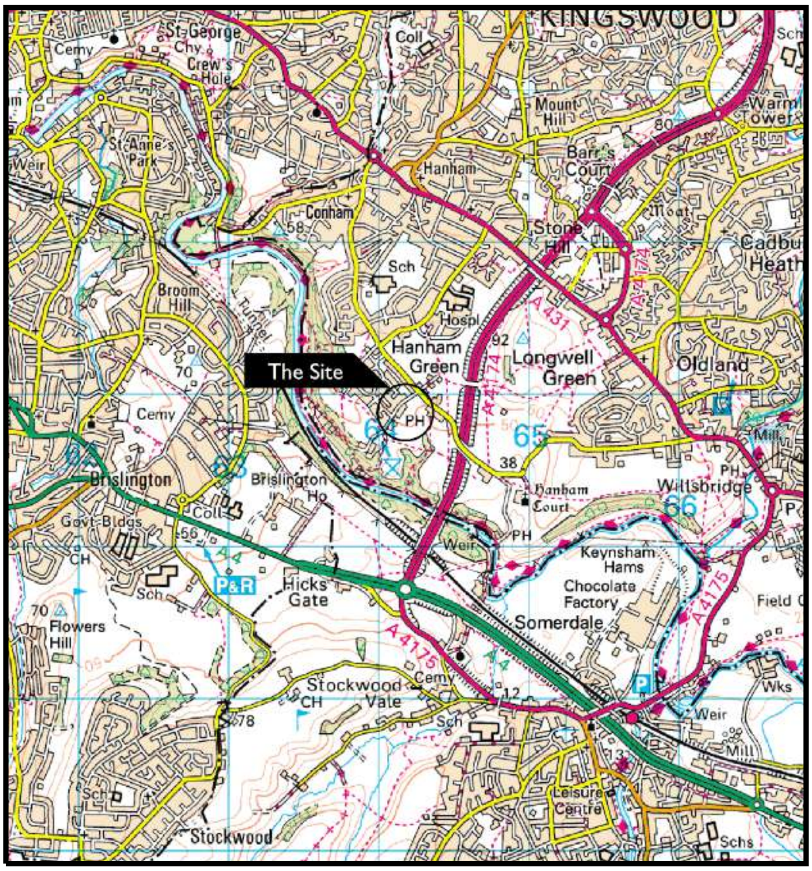
APPENDIX 1

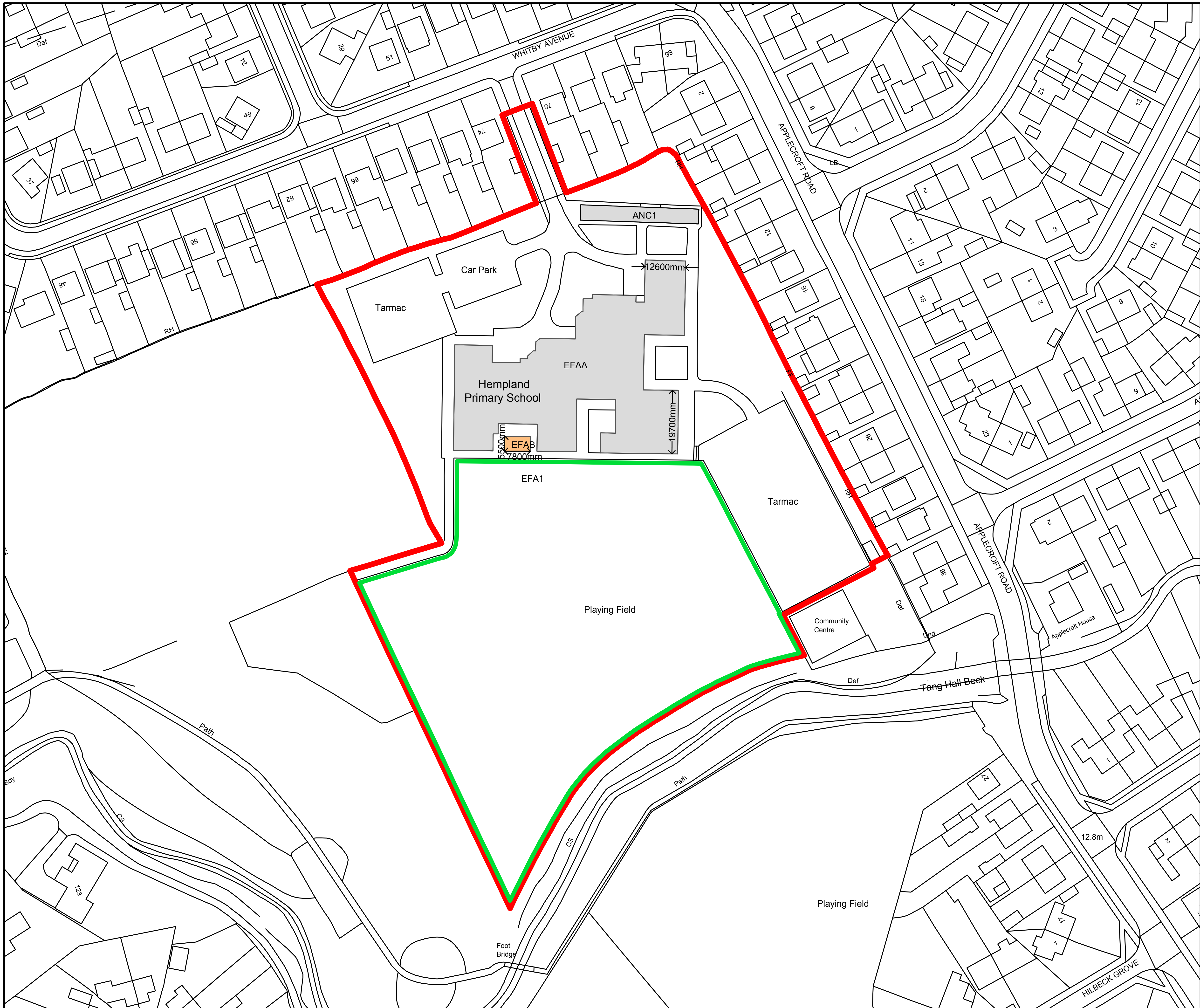
Site Location Plan

SITE LOCATION PLAN



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

GEOTECHNICS
geotechnical and geoenvironmental specialists



NOTES:

School Site Boundary

School Playing Field Boundary

Separation of 2 adjoining blocks

18mm Typical Block dimensions

EFA1 CDC Site Reference

EFAD CDC Block Reference

ANC1 Ancillary Block Reference

Car Park, etc. Annotation to specific areas

Blocks - NEW

Blocks - DEMOLISHED

Blocks - EXISTING

Rev	Date	Description	Drn	Ch

Education & Skills Funding Agency

Education Funding Agency

CDC 17 - 19

SCHOOL:

142844
Hempland Primary Academy

Site Address

Whitby Avenue, Stockton Lane
York, North Yorkshire
YO13 1ET

Survey Organisation	CAPITA		
Drawn	K.TIBBS	Date	16JAN18
Checked	C.STEWART	Date	23JAN18
Scale:	NTS	Original Size:	A3

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APPENDIX 2

Cable Percussion Borehole Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

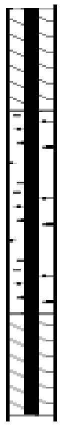
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike ▽

Depth Water Rose To ▼

Instrumentation

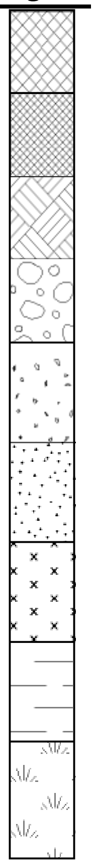


Seal

Filter

Seal

Strata — Legend



Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

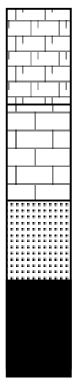
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



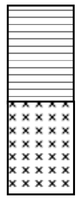
Chalk

Limestone

Sandstone

Coal

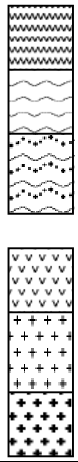
Strata, Continued



Mudstone

Siltstone

Metamorphic Rock



Fine Grained

Medium Grained

Coarse Grained

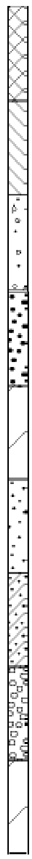
Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials



Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum / Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - Cable Percussion

Project	HEMPLAND PRIMARY SCHOOL, YORK	Engineer	MOTT MACDONALD LIMITED	Borehole	CP01
				Project No	PC218325
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	462516.2 E 452976.5 N	Ground Level	13.65 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N
0.10	ES				
0.30- 0.50	B				
0.30	D				
0.30	ES				
0.50- 1.00	B				
0.80	D			29	
0.80	ES				
1.20- 1.65	D	1.20 (DRY)			S8
1.50- 2.00	B				
1.50	D			27	
2.00- 2.45	UT34	1.70 (DRY)	124	25	
2.50- 3.00	B				
2.50	D				
2.70- 3.15	D				
3.00- 3.45	D	1.70 (DRY)			S13
3.50- 4.00	B				
3.50	D				
4.00- 4.45	UT39	1.70 (DRY)	68	13	
4.50- 5.00	B				
4.50	D				
5.00- 5.45	D	1.70 (DRY)			S20
5.50- 6.00	B				
5.50	D				
6.00- 6.45	UT53	1.70 (DRY)			
6.50- 7.00	B				
6.50	D				
7.00- 7.45	D	1.70 (DRY)			S41
7.50- 8.00	B				
7.50	D				
8.00- 8.45	D	1.70 (DRY)			S41

Strata

Description	Depth	Level m OD
	G.L.	13.65
MADE GROUND: Asphalt.	0.15	13.50
MADE GROUND: Reddish brown and light grey sandy gravel of angular to subangular fine to coarse of mudstone, sandstone, concrete, asphalt and brick fragments (Sub base).	0.50	13.15
MADE GROUND: Soft brown occasionally mottled light grey slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse of mudstone, sandstone and brick fragments.	1.20	12.45
Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are extremely closely spaced, randomly orientated, smooth and dull. At 2.00m, stiff.	3.00	10.65
Firm brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. Below 5.00m, stiff. Below 6.50m, very stiff.	8.45	5.20
End of Borehole		

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
8.45	0.15	Cable Percussion	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			25/11/21	08:00
8.45	1.70	DRY	25/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during boring.

Remarks

Tarmacadam broken out using hydraulic breaker. Inspection pit hand excavated to 1.20m depth and no services were found.
ES 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 8.00m with a geowrapped slotted section from 1.00m to 8.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 1.00m, bentonite up to 0.30m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

geotechnics

BOREHOLE RECORD - *Cable Percussion*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Engineer	MOTT MACDONALD LIMITED	**Borehole**	**CP02**
				Project No	PC218325
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	462617.1 E 452998.7 N	Ground Level	13.47 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Level m OD
							G.L.	13.47
0.10- 0.50	B					**MADE GROUND:** Dark brown slightly gravelly clayey fine to medium sand with occasional roots (up to 3mm diameter). Gravel is angular to subrounded fine to coarse of mudstone, sandstone and brick fragments. Many rootlets to 0.10m depth.		
0.20	D							
0.20	ES							
0.50- 1.00	B					Between 0.20-0.50m, with a low cobble content of brick.	0.50	12.97
0.50	D			29				
0.50	ES							
1.00	ES					**MADE GROUND:** Firm greyish brown mottled grey slightly sandy slightly gravelly clay with a low angular to subangular cobble content of sandstone and brick. Gravel is angular to subangular fine to coarse of mudstone and sandstone.	1.00	12.47
1.20- 1.65	UT31	1.20 (DRY)		28				
1.70- 2.00	B					Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 15mm) and occasional sandy pockets (up to 15mm). Fissures are extremely closely spaced, randomly orientated, smooth and dull.		
1.70	D							
2.00- 2.45	D	1.50 (DRY)			S12		2.00	11.47
2.50- 3.00	B					Firm brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.		
2.50	D			16				
3.00- 3.45	UT43	1.50 (DRY)		12				
3.50- 4.00	B							
3.50	D							
4.00- 4.45	D	1.50 (DRY)			S18	Below 4.00m, stiff.		
4.50- 5.00	B							
4.50	D			15				
5.00	D					At 5.00m, very stiff.		
5.00- 5.45	UT50	1.50 (DRY)	167	11				
5.50- 6.00	B							
5.50	D							
6.00- 6.45	D	1.50 (DRY)			S25			
6.50- 7.00	B							
6.50	D							
7.00- 7.45	UT52	1.50 (DRY)						
7.50- 8.00	B							
7.50	D							
8.00- 8.45	D	1.50 (DRY)			S25			
							8.45	5.02
						End of Borehole		

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
8.45	0.15	Cable Percussion	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			24/11/21	08:00
8.45	1.50	DRY	24/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during boring.

Remarks AGS

Inspection pit hand excavated to 1.20m depth and no services were found.
ES 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 8.00m with a geowrapped slotted section from 1.00m to 8.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 1.00m, bentonite up to 0.30m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

geotechnics

BOREHOLE RECORD - Cable Percussion

Project	HEMPLAND PRIMARY SCHOOL, YORK
Engineer	MOTT MACDONALD LIMITED
Borehole	CP03
Project No	PC218325
Client	DEPARTMENT FOR EDUCATION
National Grid Coordinates	462557.3 E 452917.1 N
Ground Level	13.01 m OD
Scale	1:50

Sampling / Properties

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N
0.10- 0.50	B				
0.20	D				
0.20	ES				
0.50- 1.00	B				
0.50	D			31	
0.50	ES				
1.00	ES				
1.20- 1.65	D	1.50 (DRY)			S14
1.50- 2.00	B				
1.50	D				
2.00- 2.45	UT41	1.50 (DRY)	129	14	
2.50- 3.00	B				
2.50	D				
3.00- 3.45	D	1.50 (DRY)			S19
3.50- 4.00	B				
3.50	D			16	
4.00- 4.45	UT45	1.50 (DRY)		12	
4.50- 5.00	B				
4.50	D				
5.00- 5.45	D	1.50 (DRY)			S21
5.50- 6.00	B				
5.50	D				
6.00- 6.45	UT51	1.50	115	12	
6.50- 7.00	B				
6.50	D				
7.00- 7.45	D	1.50 (DRY)			S21
7.50	D				
7.50- 7.95	UT52	1.50 (DRY)			
8.00- 8.45	D	1.50 (DRY)			S24

Strata

Description	Depth	Level m OD
	G.L.	13.01
MADE GROUND: Light brown slightly gravelly slightly silty sand with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and brick fragments. Many rootlets to 0.10m depth.	0.10	12.91
Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 20mm) and occasional sandy pockets (up to 20mm). Fissures are very closely spaced, randomly orientated, smooth and dull.	1.50	11.51
Firm brown occasionally mottled brownish grey slightly sandy CLAY with occasional calcareous inclusions (up to 15mm) and occasional reddish brown and yellowish brown sandy pockets (up to 20mm). Fissures are closely spaced, randomly orientated, smooth and dull.	2.00	11.01
Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.	8.45	4.56
End of Borehole		

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
8.45	0.15	Cable Percussion	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			23/11/21	08:00
8.45	1.50	DRY	23/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during boring.

Remarks
Inspection pit hand excavated to 1.20m depth and no services were found.
ES 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 8.00m with a geowrapped slotted section from 1.00m to 8.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 1.00m, bentonite up to 0.30m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

geotechnics

BOREHOLE RECORD - Cable Percussion

Project: HEMPLAND PRIMARY SCHOOL, YORK
Engineer: MOTT MACDONALD LIMITED
Borehole: CP04
Project No: PC218325
Client: DEPARTMENT FOR EDUCATION
National Grid Coordinates: 462644.8 E, 452904.8 N
Ground Level: 12.08 m OD
Scale: 1:50

Sampling / Properties

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N
0.10	ES				
0.30- 0.80	B				
0.30	D				
0.30	ES				
0.80- 1.20	B				
0.80	D			20	
0.80	ES				
1.20- 1.65	D	1.20 (DRY)			S12
1.50- 2.00	B				
1.50	D				
1.50	ES				
2.00- 2.45	D	1.70 (DRY)			S19
2.50- 3.00	B				
2.50	D			15	
3.00- 3.45	D	1.70 (DRY)			S21
3.50- 4.00	B				
3.50	D			16	
4.00- 4.45	D	1.70 (DRY)			S23
4.50- 5.00	B				
4.50	D				
5.00- 5.45	D	1.70 (DRY)			S25
5.50- 6.00	B				
5.50	D				
6.00- 6.45	UT41	1.70 (DRY)		12	
6.50- 7.00	B				
6.50	D				
7.00- 7.45	D	1.70 (DRY)			S26
7.50	D				
7.50- 7.95	UT49	1.70 (DRY)			
8.00- 8.45	D	1.70 (DRY)			S24

Strata

Description	Depth	Level m OD
	G.L.	12.08
MADE GROUND: Asphalt.	0.15	11.93
MADE GROUND: Light greyish brown slightly gravelly fine to medium sand. Gravel is angular to subangular fine to coarse of sandstone, asphalt, concrete and brick fragments (Sub base).	0.30	11.78
MADE GROUND: Light reddish brown sandy gravel with a low angular to subangular cobble content of sandstone and brick. Gravel is angular to subangular fine to coarse of mudstone, sandstone, concrete, asphalt and brick fragments.	0.80	11.28
MADE GROUND: Firm dark brownish grey mottled red slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse of mudstone, sandstone and brick fragments (Some ash**).	1.30	10.78
Firm brown occasionally mottled brownish grey slightly sandy CLAY with occasional calcareous inclusions (up to 15mm) and occasional reddish brown and yellowish brown sandy pockets (up to 20mm). Fissures are closely spaced, randomly orientated, smooth and dull.	2.00	10.08
Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.	8.45	3.63
End of Borehole		

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
8.45	0.15	Cable Percussion	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			22/11/21	08:00
8.45	1.70	DRY	22/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during boring.

Remarks

Tarmacadam broken out using hydraulic breaker. Inspection pit hand excavated to 1.20m depth and no services were found.
ES sample = 1 x 1 litre plastic tub, 2 x 258ml amber glass jars and 2 x 60ml VOC vials.
** Drillers description.
A 50mm standpipe was installed to 8.00m with a geowrapped slotted section from 1.50m to 8.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 1.50m, bentonite up to 0.30m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.
All dimensions are in metres.
Logged in accordance with BS5930:2015 + A1:2020

Logged by: CP
Checked by: JK
Figure: 1 of 1
13/04/2022

geotechnics

Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' (10 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	Kris Roebuck
Hammer No.	AR665
Energy Ratio, Er (%)	70.00
Calibration Date	12/03/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' (10 20 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	*
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	*

Driller	Kris Roebuck
Hammer No.	AR665
Energy Ratio, Er (%)	70.00
Calibration Date	12/03/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

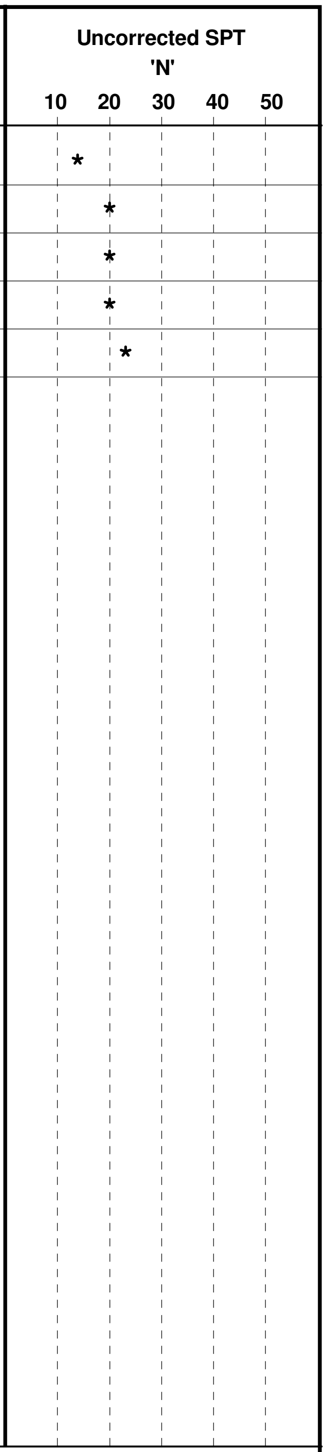
GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value
CP03	1.20	11.81	S	-	2	2	3	3	4	4	14
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	Kris Roebuck
Hammer No.	AR665
Energy Ratio, Er (%)	70.00
Calibration Date	12/03/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

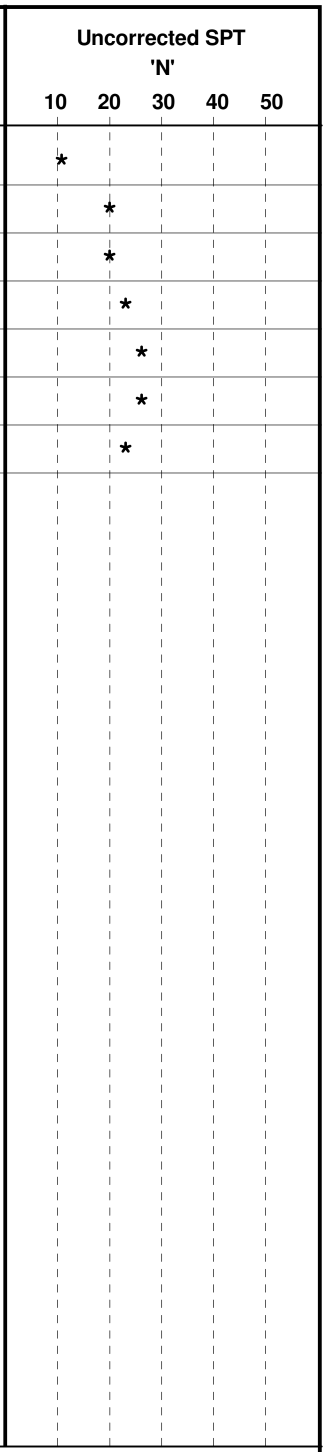
GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value
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
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 Roebuck
Hammer No.	AR665
Energy Ratio, Er (%)	70.00
Calibration Date	12/03/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

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

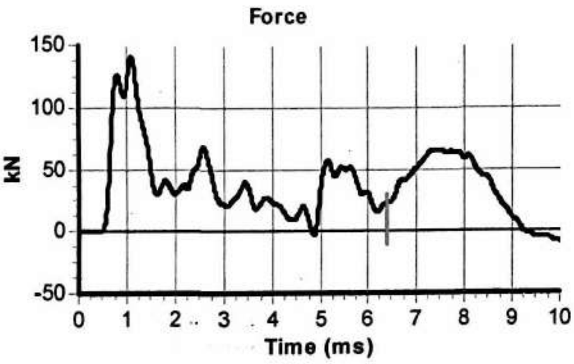
Instrumented Rod Data

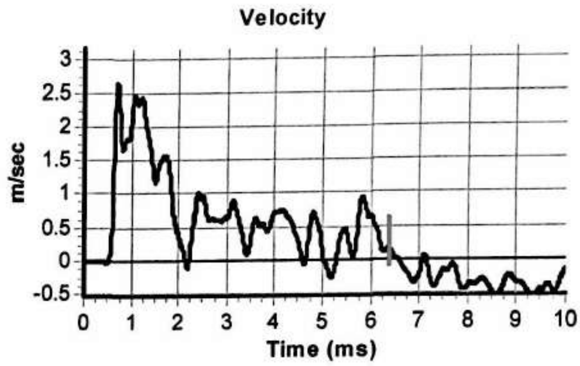
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	7080
Accelerometer No.2:	11609

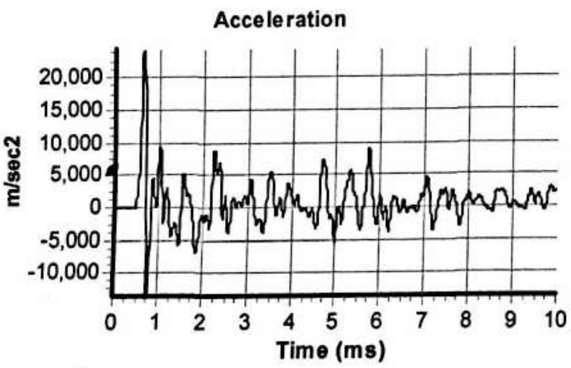
SPT Hammer Information

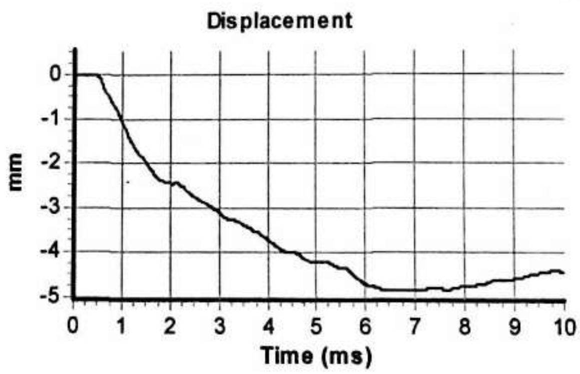
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location









Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	332

Energy Ratio E_r (%): 70

Signed: C.McCLUSKEY
Title: FITTER

The recommended calibration interval is 12 months

APPENDIX 3

Dynamic Sample Borehole Records

3

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike ∇

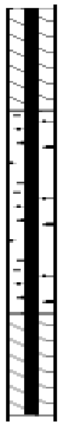
Depth Water Rose To ▼

Instrumentation

Seal

Filter

Seal



Strata — Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

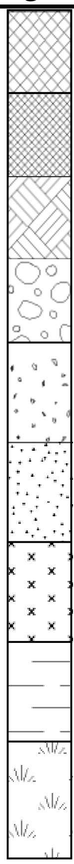
Gravel

Sand

Silt

Clay

Peat



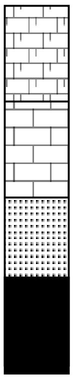
Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

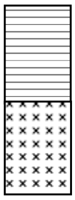
Coal



Strata, Continued

Mudstone

Siltstone

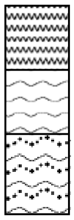


Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

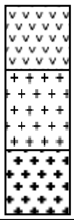


Igneous Rock

Fine Grained

Medium Grained

Coarse Grained



Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

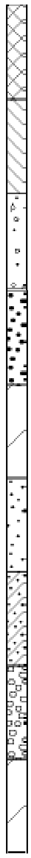
General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam



Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - *Dynamic Sampler*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Engineer	MOTT MACDONALD LIMITED	**Borehole**	**WS01**
				Project No	PC218325
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	462528 E 452937 N	Ground Level	13.37 m OD

Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Level m OD
							G.L.	13.37
0.00- 0.50 0.10 0.10 0.55 0.55	B D ES D ES					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 rootlets to 0.10m depth.	0.55	12.82
1.00- 1.50 1.20- 1.65	B D	1.00 (DRY)			S13	MADE GROUND: Firm light orangish brown slightly sandy slightly gravelly clay. Gravel is angular to subangular fine to coarse of mudstone, sandstone and brick fragments.	1.20	12.17
1.50- 2.00 1.50	B D					Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are extremely closely spaced, randomly orientated, smooth and dull.	1.65	11.72
2.00- 2.50 2.00- 2.45	B D	1.00 (DRY)			S20	Brown slightly gravelly slightly clayey SAND. Gravel is angular to subangular fine to coarse of mudstone and sandstone.	2.00	11.37
2.50- 3.00 2.50 3.00- 3.50 3.00- 3.45	B D B D	1.00 (DRY)		13	S21	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 dull.	2.45	10.92
3.50- 4.00 3.50 4.00- 4.45	B D D	1.00 (DRY)			S25	Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.	4.45	8.92
						End of Borehole		

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
4.00	0.10	Dynamic Sampler	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			26/11/21	08:00
4.45	1.00	DRY	26/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during sampling.

Remarks AGS
Inspection pit hand excavated to 1.20m depth and no services were found.
ES sample = 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.

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

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BOREHOLE RECORD - *Dynamic Sampler*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Engineer	MOTT MACDONALD LIMITED
Borehole	WS02	Project No	PC218325
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	462582.3 E 453006.5 N
Ground Level	13.58 m OD	Scale	1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		13.58
0.30 0.30 0.50- 1.00	D ES B					**MADE GROUND:** Dark brown slightly silty slightly gravelly fine to medium sand with occasional rootlets. Gravel is angular to subangular fine to coarse of mudstone, sandstone and brick fragments. Many rootlets to 0.10m depth.	0.50		13.08
1.00 1.00 1.20- 1.65	D ES D	1.00 (DRY)			S13	**MADE GROUND:** Soft light greyish brown slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse of mudstone, sandstone and brick fragments.	1.00		12.58
1.50- 2.00 1.50 2.00- 2.45	B D D	1.00 (DRY)			S20	Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are very closely to extremely closely spaced, randomly orientated, smooth and dull.	2.20		11.38
2.50- 3.00 2.50	B D			17		Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.			
3.00- 3.45	D	1.00 (DRY)			S23				
3.50- 4.00 3.50	B D								
4.00- 4.45	D	1.00 (DRY)			S25		4.45		9.13
						End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
4.00	0.10	Dynamic Sampler	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			26/11/21	08:00
4.45	1.00	DRY	26/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during sampling.

Remarks AGS

Inspection pit hand excavated to 1.20m depth and no services were found.
ES 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 filter up to 2.00m, bentonite up to 0.30m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

geotechnics

BOREHOLE RECORD - *Dynamic Sampler*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Engineer	MOTT MACDONALD LIMITED
Borehole	WS03	Project No	PC218325
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	462616.6 E 452943.1 N
Ground Level	13.00 m OD	Scale	1:50

Sampling / Properties / Strata

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N
0.10	ES				
0.30- 0.50	B				
0.30	ES				
0.50- 1.00	B				
0.50	D				
0.80	D				
0.80	ES				
1.20- 1.65	D	1.00 (DRY)			S12
1.50- 2.00	B				
1.50	D				
2.00- 2.45	D	1.00 (DRY)			S24
2.50- 3.00	B				
2.50	D			13	
2.50- 3.00	D				
3.00- 3.45	D	1.00 (DRY)			S27
3.50- 4.00	B			13	
3.50	D				
4.00- 4.45	D	1.00 (DRY)			S29

Description	Depth	Legend	Level m OD
	G.L.		13.00
MADE GROUND: Asphalt.	0.15		12.85
MADE GROUND: Light brownish grey mottled red slightly sandy gravel of angular to subangular fine to coarse of mudstone, sandstone, concrete, asphalt and brick fragments.	0.50		12.50
POSSIBLE MADE GROUND: Firm light greyish brown slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse of mudstone, sandstone and brick fragments.	1.50		11.50
Firm fissured brown mottled grey and light grey slightly sandy CLAY with some calcareous inclusions (up to 20mm) and occasional sandy pockets (up to 15mm). Fissures are extremely closely spaced, randomly orientated, smooth and dull.	2.00		11.00
Stiff brown slightly sandy slightly gravelly calcareous CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.	4.45		8.55
End of Borehole			

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.40	Inspection Pit	KR/SR
4.00	0.10	Dynamic Sampler	KR/SR

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			26/11/21	08:00
4.45	1.00	DRY	26/11/21	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					None encountered during sampling.

Remarks

Tarmacadam broken out using hydraulic breaker. Inspection pit hand excavated to 1.20m depth and no services were found.
ES sample = 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, concrete up to 0.15m, asphalt up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by CP
Checked by JK
Figure 1 of 1
13/04/2022

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Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N' (10 20 30 40 50)
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		
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 Roebuck
Hammer No.	AR2475
Energy Ratio, Er (%)	66.00
Calibration Date	08/11/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' (10 20 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	*
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	*

Driller	Kris Roebuck
Hammer No.	AR2475
Energy Ratio, Er (%)	66.00
Calibration Date	08/11/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

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Fieldwork Results - *SPT Results Summary*

Project HEMPLAND PRIMARY SCHOOL, YORK **Project No** PC218325

Client Department for Education

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' (10 20 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	*
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 Roebuck
Hammer No.	AR2475
Energy Ratio, Er (%)	66.00
Calibration Date	08/11/2021

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

CRAIG'S RIG
SYD 06

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

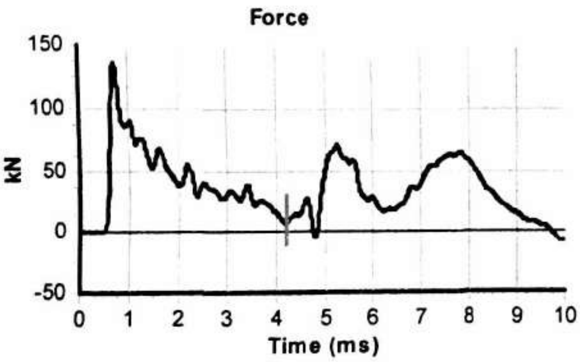
Instrumented Rod Data

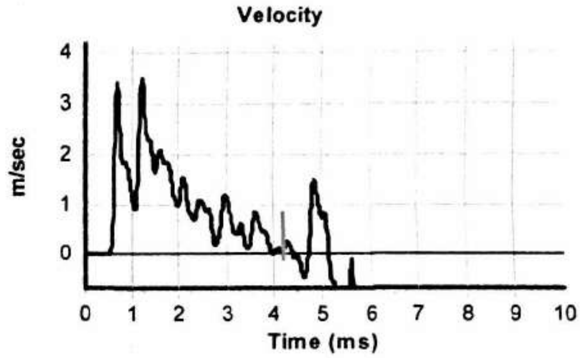
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	7080
Accelerometer No.2:	11609

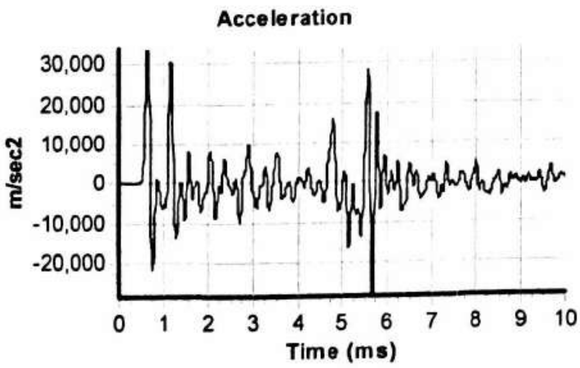
SPT Hammer Information

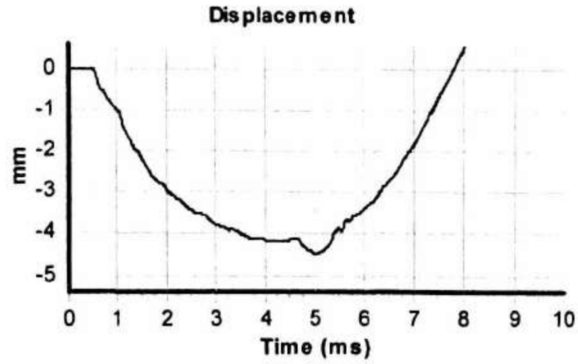
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	12.0

Comments / Location









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	310

Energy Ratio E_r (%): 66

Signed: K.McDONALD
Title: SALES

The recommended calibration interval is 12 months

APPENDIX 5

Monitoring Results

FIELDWORK – *Water Level Monitoring*

Project HEMPLAND PRIMARY SCHOOL, YORK

Project No PC218325

Client Department for Education

Sheet No 1

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			
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
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		1.87	*11.78*	5.02	*8.45*	0.30	*12.71*	1.12	*10.96*	DRY			
16 Dec 2021		1.82	*11.83*	5.02	*8.45*	0.75	*12.26*	1.38	*10.70*	DRY			
23 Dec 2021		1.76	*11.89*	4.42	*9.05*	0.80	*12.21*	1.35	*10.73*	DRY			

Remarks Note 1 - Installation cover flooded prior to monitoring during rounds 3 and 4.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

GEOTECHNICS
geotechnical and geoenvironmental specialists

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**
Date **02/12/2021**
Sheet No. **1 (1 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind: Still [ ] Light [x] Moderate [ ] Strong [ ]

Cloud Cover: None [ ] Slight [ ] Cloudy [ ] Overcast [x]

Precipitation: Dry [x] Slight [ ] Moderate [ ] Heavy [ ]

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Electrical Conductivity (uS/cm)	pH (pH Units)	Redox (mV)	Dissolved Oxygen (mg/l)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Remarks
CP01	8.00						<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00						<0.1	<0.1	
CP04	8.00						<0.1	<0.1	
WS02	4.00						<0.1	<0.1	

Remarks

Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325

Date 02/12/2021

Sheet No. 1 (2 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	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	0.6	0.6	19.8	19.8	<1	<1	1015	
CP02	8.00	1.4	1.4	17.8	17.8	<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

geotechnics

Form 002/3

***FIELDWORK** - Insitu Gas Monitoring - Daily Record*

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325
Date 02/12/2021
Sheet No. 1 (3 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
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	8.00	<1	<0.1	<0.1				Light	
WS02	4.00	<1	<0.1	<0.1				Light	

Remarks

geotechnics

Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**
Date **02/12/2021**
Sheet No. **1 (4 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 ☐ MK2 ☐ GA2000 ☐

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind	Still ☐	Light ☒	Moderate ☐	Strong ☐
Cloud Cover	None ☐	Slight ☐	Cloudy ☐	Overcast ☒
Precipitation	Dry ☒	Slight ☐	Moderate ☐	Heavy ☐

Borehole	Depth to Base (m)	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
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

geotechnics

Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325
Date 09/12/2021
Sheet No. 1 (1 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [x]	Light [ ]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Electrical Conductivity (uS/cm)	pH (pH Units)	Redox (mV)	Dissolved Oxygen (mg/l)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Remarks
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	
WS02	4.00						<0.1	<0.1	

Remarks

geotechnics

Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Project No	PC218325
		Date	09/12/2021
Client	Department for Education	Sheet No.	1 (2 of 4)

Equipment Used

GI Infra Red Gas Analyser — MK1 ☐ MK2 ☐ GA2000 ☐

Other: Gas Data GFM435;

Weather / Site Conditions

Wind	Still [x]	Light ☐	Moderate ☐	Strong ☐
Cloud Cover	None ☐	Slight ☐	Cloudy ☐	Overcast [x]
Precipitation	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	3.0	3.0	16.9	16.9	<1	<1	996	
CP02	8.00	0.9	0.9	18.0	18.0	<1	<1	996	
CP03	8.00	0.6	0.6	15.7	15.7	<1	<1	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

geotechnics

Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325
Date 09/12/2021
Sheet No. 1 (3 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [x]	Light [ ]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
CP01	8.00	<1	<0.1	<0.1		None	1000	Still	
CP02	8.00	<1	<0.1	<0.1				Still	
CP03	8.00	<1	<0.1	<0.1		None	1000	Still	
CP04	8.00	<1	<0.1	<0.1		None	1000	Still	
WS02	4.00	<1	<0.1	<0.1				Still	

Remarks

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Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Project No	PC218325
		Date	09/12/2021
Client	Department for Education	Sheet No.	1 (4 of 4)

Equipment Used

GI Infra Red Gas Analyser — MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [x]	Light [ ]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
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

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Form 002/3

FIELDWORK *- Insitu Gas Monitoring - Daily Record*

Project	HEMPLAND PRIMARY SCHOOL, YORK	Project No	PC218325
		Date	16/12/2021
Client	Department for Education	Sheet No.	1 (1 of 4)

Equipment Used

GI Infra Red Gas Analyser — MK1 [ ] MK2 [ ] GA2000 [ ]

Other — Gas Data GFM435;

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Electrical Conductivity (uS/cm)	pH (pH Units)	Redox (mV)	Dissolved Oxygen (mg/l)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Remarks
CP01	8.00						<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00						<0.1	<0.1	
CP04	8.00						<0.1	<0.1	
WS02	4.00						<0.1	<0.1	

Remarks

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Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**

Date **16/12/2021**

Sheet No. **1 (2 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	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	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	
WS02	4.00	1.0	1.0	19.1	19.1	<1	<1	997	

Remarks

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FIELDWORK - Insitu Gas Monitoring - Daily Record

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325

Date 16/12/2021

Sheet No. 1 (3 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [ ]	Overcast [x]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
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	8.00	<1	<0.1	<0.1				Light	
WS02	4.00	<1	<0.1	<0.1				Light	

Remarks

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Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**
Date **16/12/2021**
Sheet No. **1 (4 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind: Still [ ] Light [x] Moderate [ ] Strong [ ]

Cloud Cover: None [ ] Slight [ ] Cloudy [ ] Overcast [x]

Precipitation: Dry [x] Slight [ ] Moderate [ ] Heavy [ ]

Borehole	Depth to Base (m)	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
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

Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project HEMPLAND PRIMARY SCHOOL, YORK

Project No PC218325
Date 23/12/2021
Sheet No. 1 (1 of 4)

Client Department for Education

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind	Still [ ]	Light [x]	Moderate [ ]	Strong [ ]
Cloud Cover	None [ ]	Slight [ ]	Cloudy [x]	Overcast [ ]
Precipitation	Dry [x]	Slight [ ]	Moderate [ ]	Heavy [ ]

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Electrical Conductivity (uS/cm)	pH (pH Units)	Redox (mV)	Dissolved Oxygen (mg/l)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Remarks
CP01	8.00						<0.1	<0.1	
CP02	8.00						<0.1	<0.1	
CP03	8.00						<0.1	<0.1	
CP04	8.00						<0.1	<0.1	
WS02	4.00						<0.1	<0.1	

Remarks

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Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**

Date **23/12/2021**

Sheet No. **1 (2 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind: Still [ ] Light [x] Moderate [ ] Strong [ ]

Cloud Cover: None [ ] Slight [ ] Cloudy [x] Overcast [ ]

Precipitation: 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

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project **HEMPLAND PRIMARY SCHOOL, YORK**

Client **Department for Education**

Project No **PC218325**
Date **23/12/2021**
Sheet No. **1 (3 of 4)**

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other **Gas Data GFM435;**

Weather / Site Conditions

Wind: Still [ ] Light [x] Moderate [ ] Strong [ ]

Cloud Cover: None [ ] Slight [ ] Cloudy [x] Overcast [ ]

Precipitation: Dry [x] Slight [ ] Moderate [ ] Heavy [ ]

Borehole	Depth to Base (m)	Diff. Pressure (Pa)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	PID Reading (ppm)	Odour (-)	Turbidity (FTU)	Wind ()	Remarks
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	8.00	<1	<0.1	<0.1				Light	
WS02	4.00	<1	<0.1	<0.1				Light	

Remarks

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Form 002/3

FIELDWORK - *Insitu Gas Monitoring - Daily Record*

Project HEMPLAND PRIMARY SCHOOL, YORK

Client Department for Education

Project No PC218325

Date 23/12/2021

Sheet No. 1 (4 of 4)

Equipment Used

GI Infra Red Gas Analyser MK1 [ ] MK2 [ ] GA2000 [ ]

Other Gas Data GFM435;

Weather / Site Conditions

Wind: Still [ ] Light [x] Moderate [ ] Strong [ ]

Cloud Cover: None [ ] Slight [ ] Cloudy [x] Overcast [ ]

Precipitation: Dry [x] Slight [ ] Moderate [ ] Heavy [ ]

Borehole	Depth to Base (m)	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
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	
CP04	8.00	Cloudy	Dry	Gas Data GFM435	AVM	
WS02	4.00	Cloudy	Dry	Gas Data GFM435	AVM	

Remarks

6

APPENDIX 6

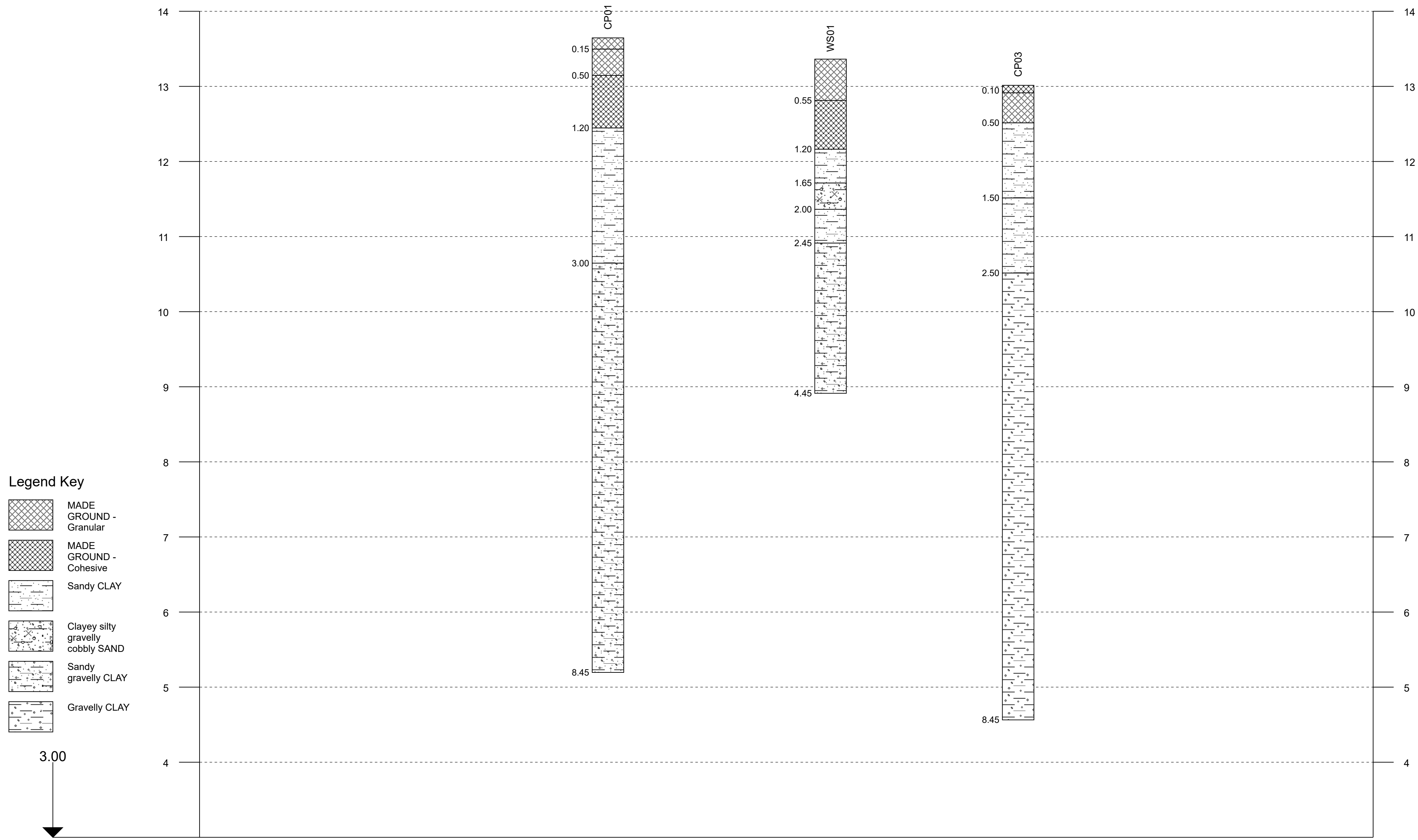
Ground Model Cross Section

Project:	**HEMPLAND PRIMARY**	Title:	**Section Line A - A'**
		Vertical Scale:	**1:70**
Project No.:	**PC218325**	Horizontal Scale:	**1:926**
Client:	**Department for Education**	Engineer:	**Mott MacDonald Limited**

203 Torrington Avenue
Tile Hill
Coventry
CV4 9AP

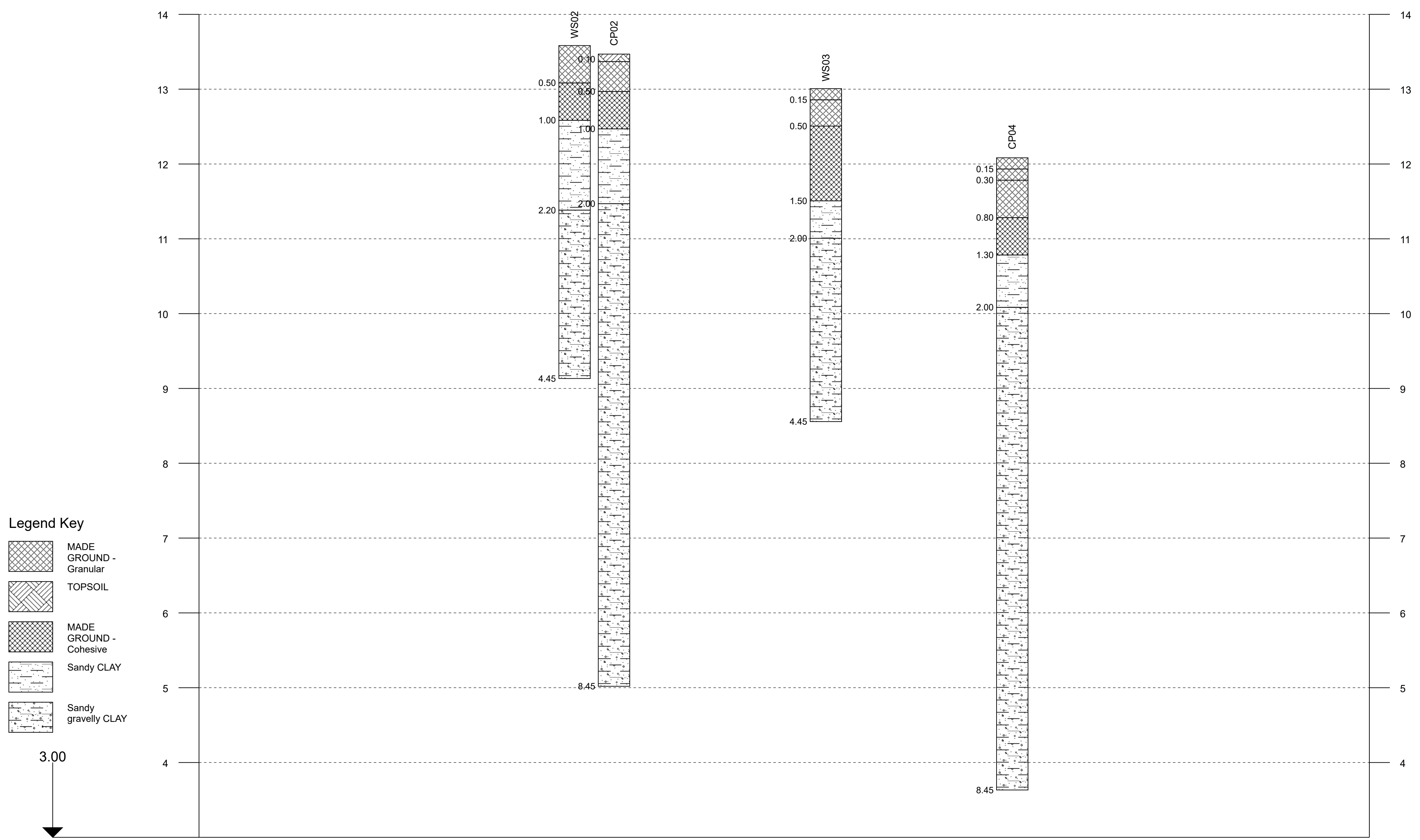
Phone: 024 7669 4664
Email: mail@geotechnics.co.uk
www.geotechnics.co.uk

GEOTECHNICS geotechnical and geoenvironmental specialists



Project:	**HEMPLAND PRIMARY**	Title:	**Section Line B - B'**	203 Torrington Avenue Tile Hill Coventry CV4 9AP	Phone: 024 7669 4664 Email: mail@geotechnics.co.uk www.geotechnics.co.uk
		Vertical Scale:	**1:70**		
Project No.:	**PC218325**	Horizontal Scale:	**1:1286**		
Client:	**Department for Education**	Engineer:	**Mott MacDonald Limited**		

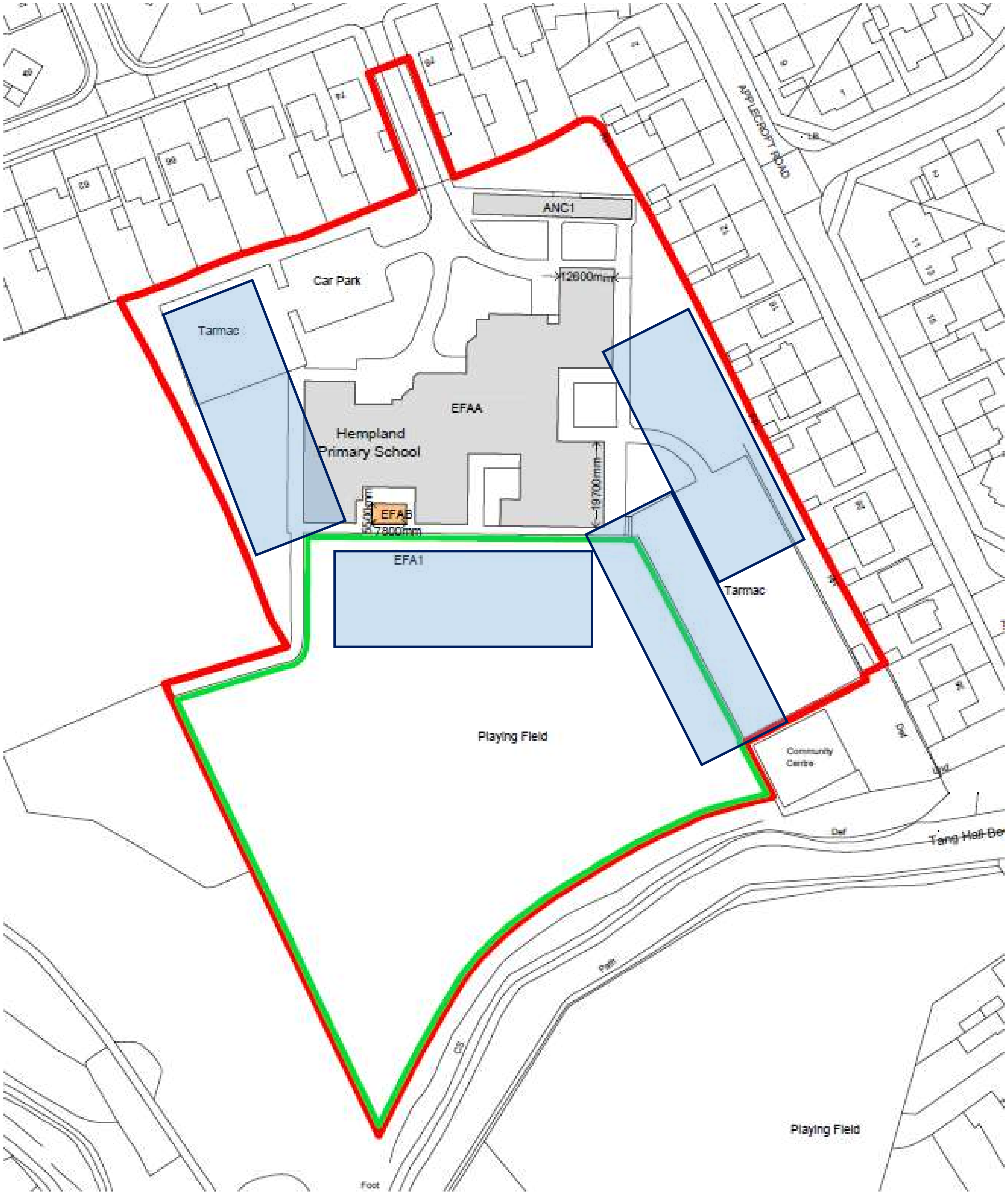
geotechnical and geoenvironmental specialists



APPENDIX 11

Proposed Layout Plan

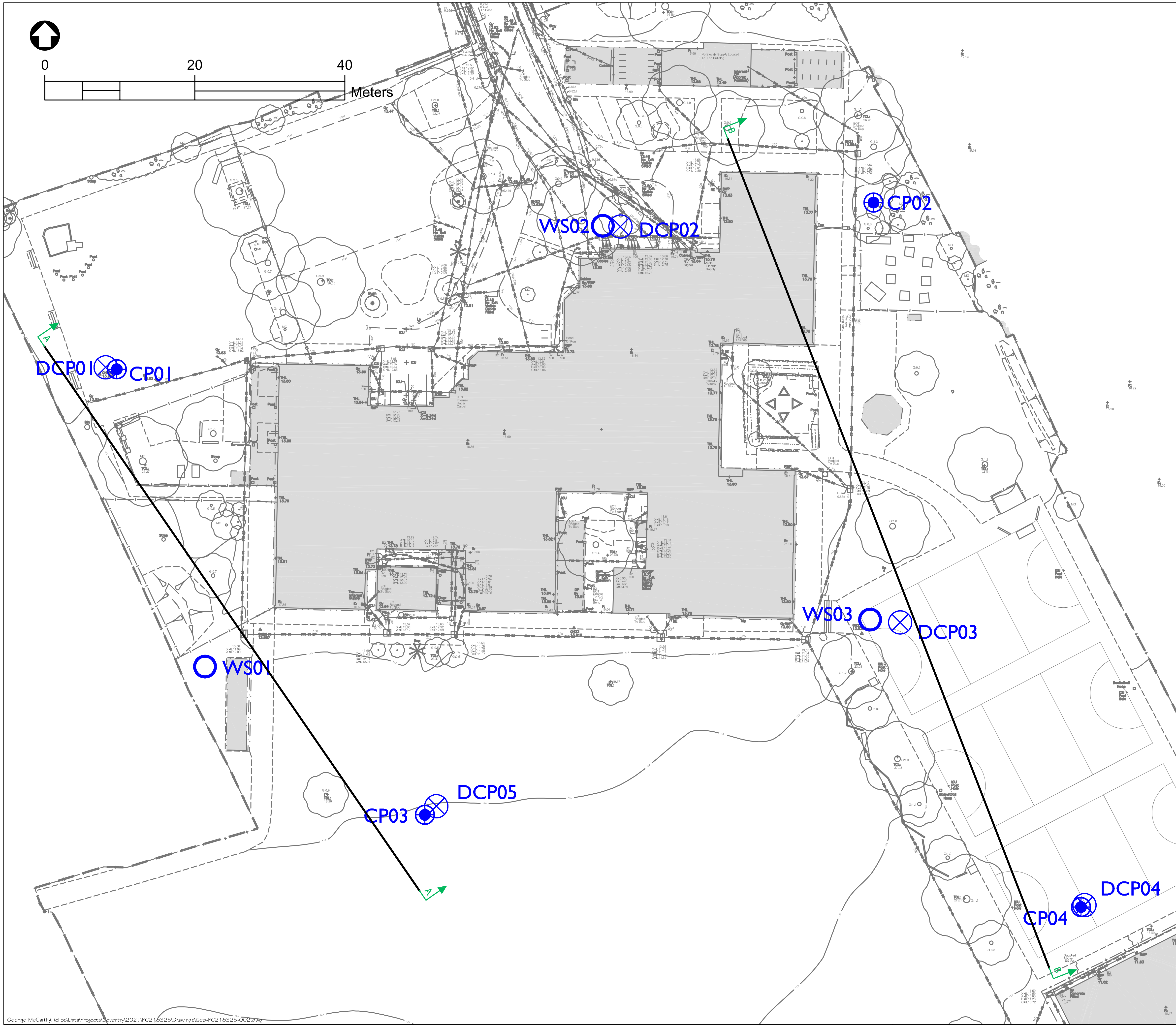
11



Possible location of redevelopment

APPENDIX 12

Exploratory Hole Location Plan



Key

- Cable Percussive Borehole
- 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

GEOTECHNICS
geotechnical and geoenvironmental specialists

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

Engineer:
Mott MacDonald Ltd

Client:
Department for Education

Project:
Hempland Primary School

Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

Scale: 1:500@A3

Date:
February 2022

Project No:
PC218325

File Name:
Geo-PC218325-002(1)

APPENDIX 13

Investigation Techniques and General Notes

13

INVESTIGATION TECHNIQUES

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.

DYNAMIC SAMPLING

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 tool 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 loose 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 tidal 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.

GENERAL NOTES

1. *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 man-made 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.*

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

Elspeth Fraser

Subject: RE: Hemplands Primary School

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

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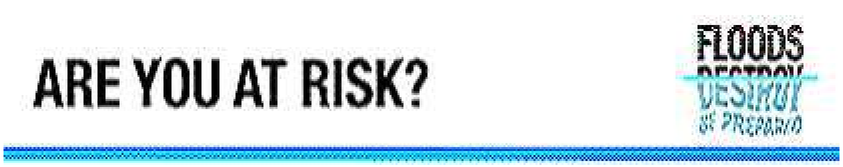

From: Jon Shaw <Jon.Shaw@curtins.com>
Sent: 26 May 2023 15:30
To: Wells, Richard <richard.wells@york.gov.uk>
Cc: planning@yorkconsort.gov.uk; Ewan Mason <Ewan.Mason@curtins.com>
Subject: RE: Hemplands Primary School

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
T. 0113 274 8509 | M. 07831 154 803 | jon.shaw@curtins.com

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

That is booked 😊

Regards, Richard

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

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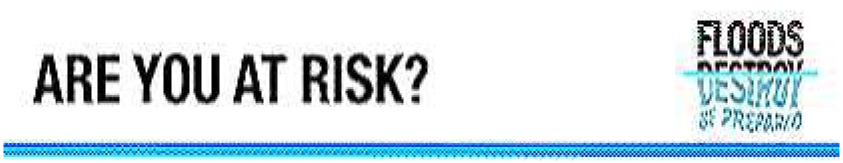

From: Jon Shaw <Jon.Shaw@curtins.com>
Sent: 22 May 2023 09:02
To: Wells, Richard <richard.wells@york.gov.uk>
Cc: planning@yorkconsort.gov.uk; Elspeth Fraser <Elspeth.Fraser@curtins.com>; Ewan Mason <Ewan.Mason@curtins.com>
Subject: RE: Hemplands Primary School

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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
T. 0113 274 8509 | M. 07831 154 803 | jon.shaw@curtins.com

From: Jon Shaw
Sent: Tuesday, May 9, 2023 9:07 AM
To: Wells, Richard <richard.wells@york.gov.uk>
Cc: planning@yorkconsort.gov.uk; Elspeth Fraser <Elspeth.Fraser@curtins.com>
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 <Elspeth.Fraser@curtins.com>
Sent: 04 May 2023 09:07
To: Wells, Richard <richard.wells@york.gov.uk>; Jon Shaw <Jon.Shaw@curtins.com>
Cc: planning@yorkconsort.gov.uk
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 <richard.wells@york.gov.uk>
Sent: 03 May 2023 16:08
To: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Cc: planning@yorkconsort.gov.uk
Subject: RE: Hemplands Primary School

Tuesday 30th May and Thursday 1st June are good for me.

Regards, Richard

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

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ARE YOU AT RISK? FLOODS DESTROY

From: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Sent: 03 May 2023 15:54
To: Wells, Richard <richard.wells@york.gov.uk>
Cc: planning@yorkconsort.gov.uk
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 29th 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 <richard.wells@york.gov.uk>
Sent: 03 May 2023 15:42
To: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Cc: planning@yorkconsort.gov.uk
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: richard.wells@york.gov.uk

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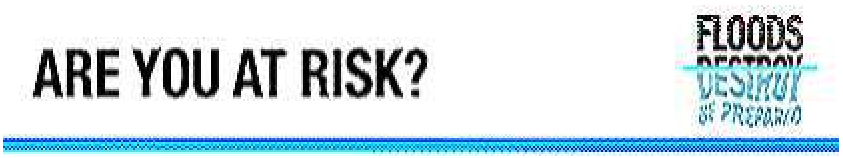


From: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Sent: 03 May 2023 15:16
To: Wells, Richard <richard.wells@york.gov.uk>
Cc: planning@yorkconsort.gov.uk
Subject: RE: Hemplands Primary School

Hi Richard,

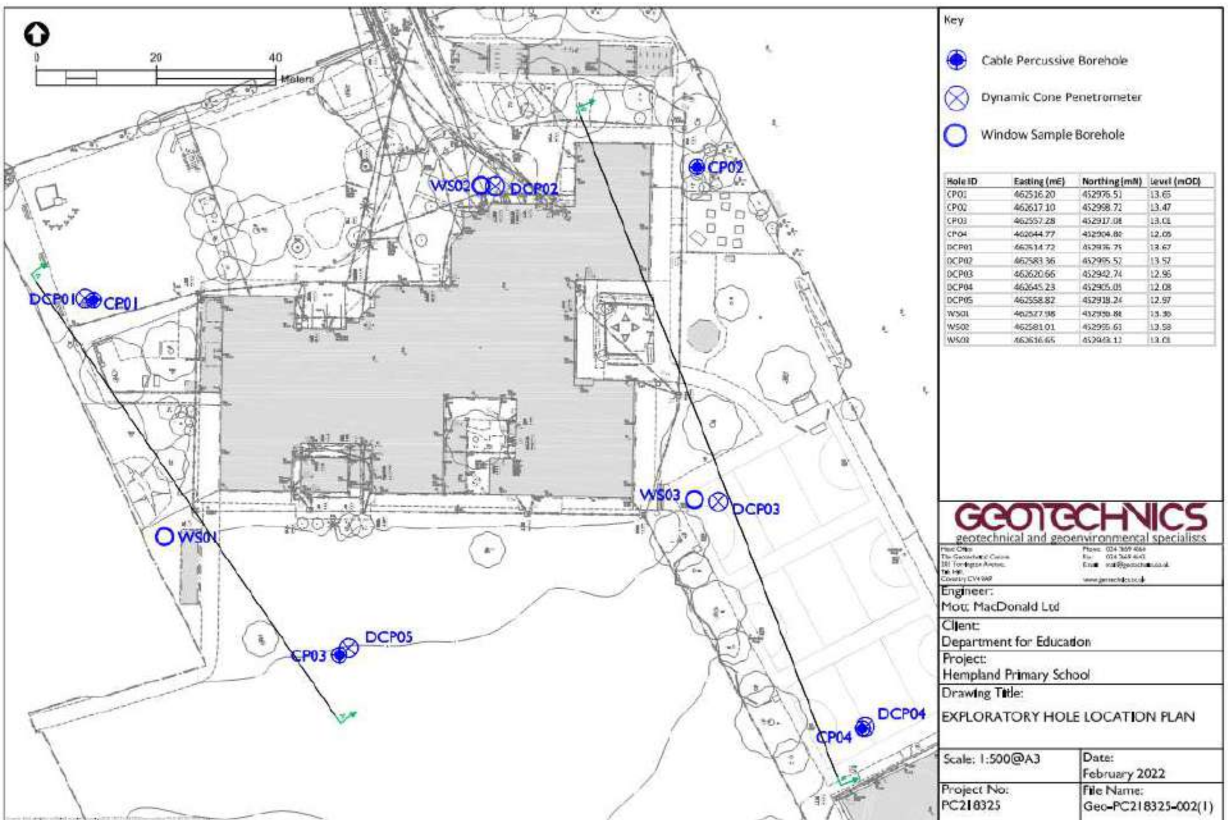
Thanks for the information, that’s really useful.

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	Stratum covered by Filter Zone	Groundwater Level		Remarks
		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 <richard.wells@york.gov.uk>
Sent: 25 April 2023 09:45
To: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Cc: planning@yorkconsort.gov.uk
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 Drainage 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 flooding 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 prior to 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: richard.wells@york.gov.uk

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Directorate of Place | West Offices Station Rise | York YO1 6GA
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From: Elspeth Fraser <Elspeth.Fraser@curtins.com>
Sent: 25 April 2023 09:11
To: Wells, Richard <richard.wells@york.gov.uk>
Subject: RE: Hemplands Primary School

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 <richard.wells@york.gov.uk>
Sent: 25 April 2023 08:51
To: Elspeth Fraser <Elspeth.Fraser@curtins.com>
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: richard.wells@york.gov.uk

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ARE YOU AT RISK?
FLOODS DESTROY

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

Rose Wharf
East Street
Leeds LS9 8EE

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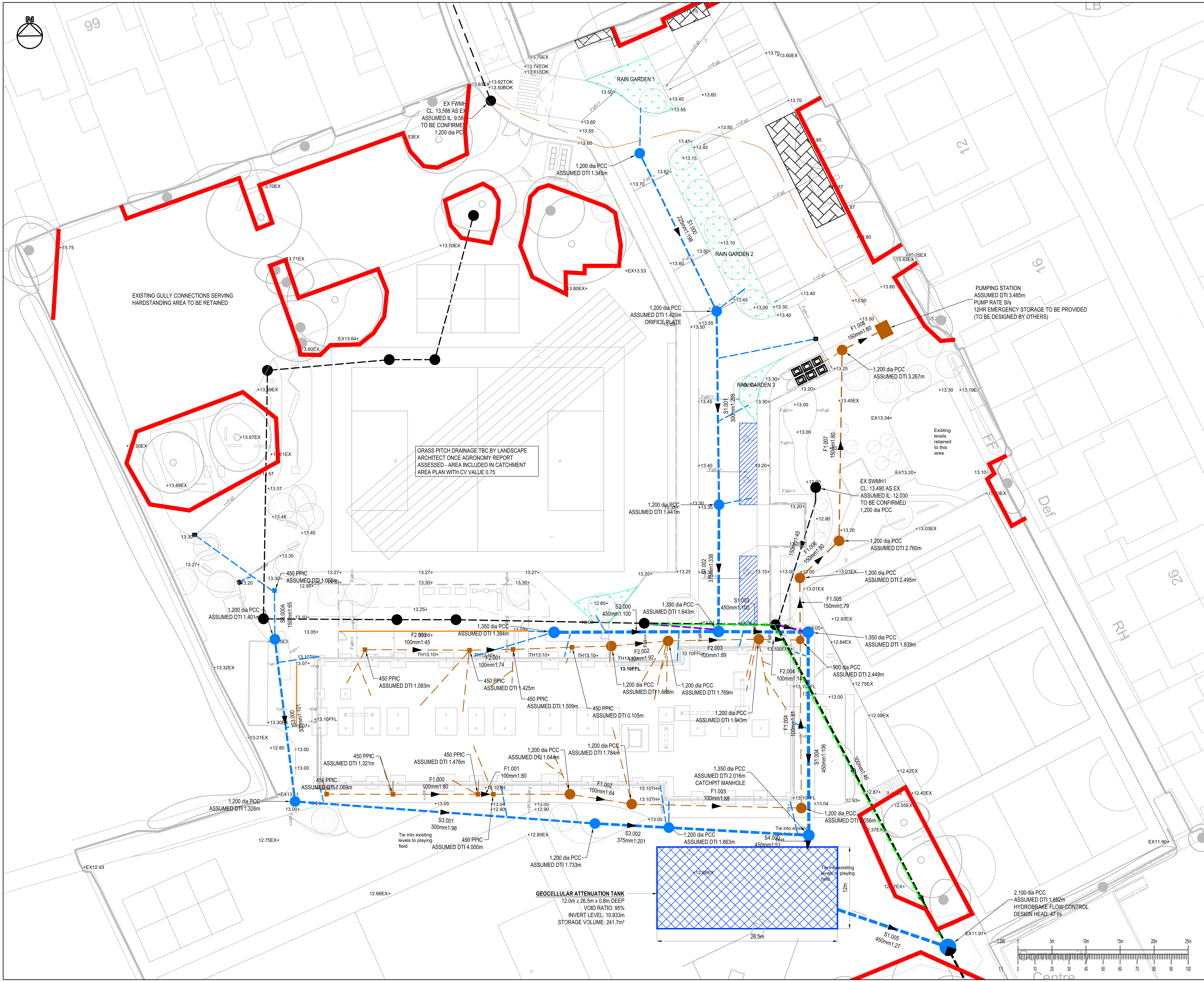
Appendix G Drawings



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4. FOR GENERAL NOTES REFER TO DRAWING.

KEY:

- PROPOSED SURFACE WATER
- PROPOSED FOUL WATER
- PROPOSED SURFACE WATER DIVERSION
- EXISTING SURFACE WATER
- EXISTING FOUL WATER
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED ABANDONED DRAINAGE
- PROPOSED RAIN GARDEN
- PROPOSED ATTENUATION TANK
- PROPOSED CHANNEL DRAIN
- PROPOSED GULLY
- PROPOSED PERMEABLE PAVING
- TREE ROOT PROTECTION FENCING
- NO-DIG HARD SURFACING

Rev:	Description:	Date:	By:	Chkd:
P03	REVISED TO COMMENTS	13/07/23	EF	LB
P02	REVISED TO COMMENTS	30/06/23	EF	LB
P01	INITIAL ISSUE	06/06/23	AJR	LB

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Status: SUITABLE FOR INFORMATION S2

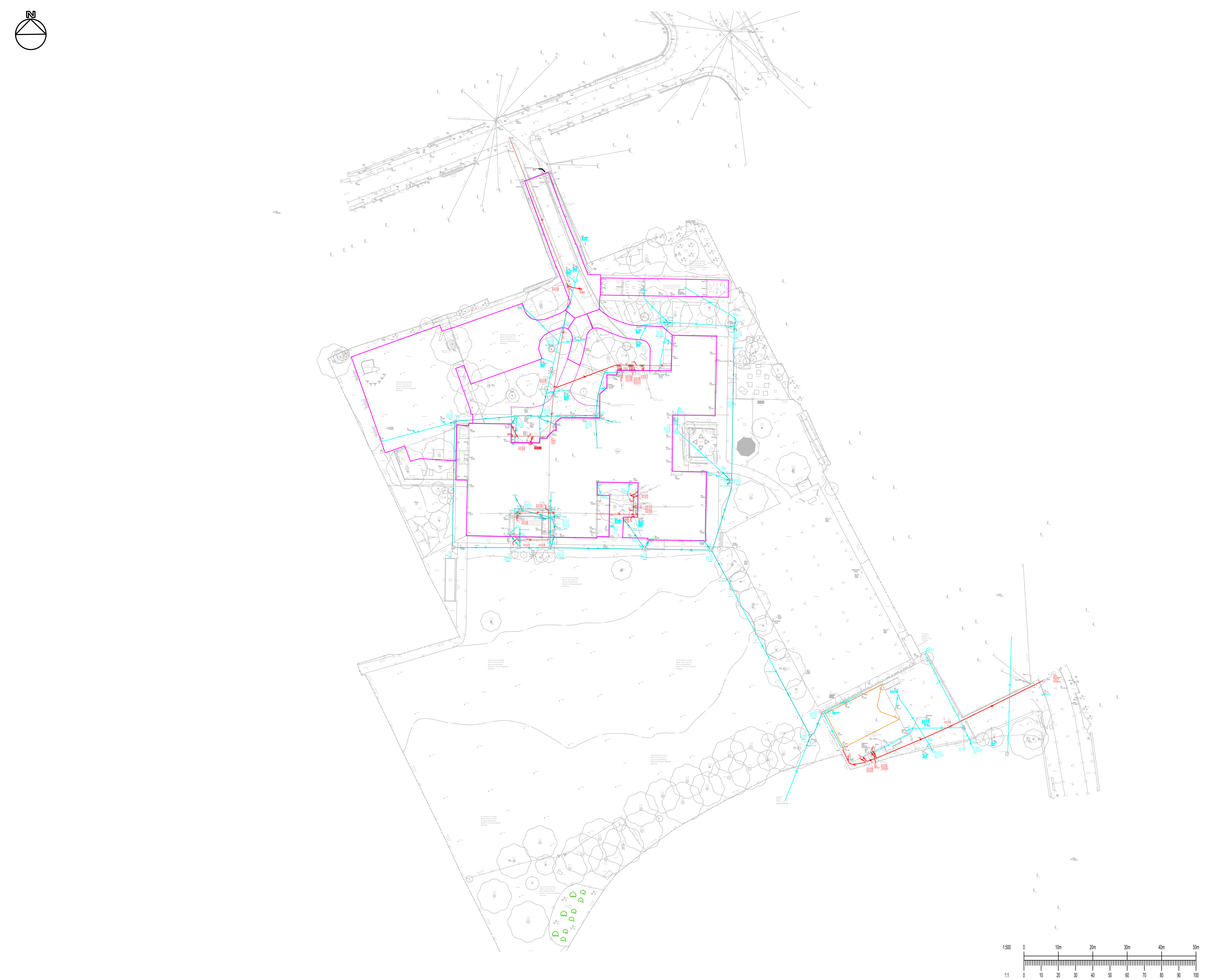
Project: HEMPLAND PRIMARY SCHOOL, YORK

Drg Title:

DRAINAGE LAYOUT

Drawn By	Designed By	Checked By
AJR	EF	LB
	Date 02/06/23	Scales @ A1 1:250

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
SRP1062 - CUR - ZZ - ZZ - D - C - 9201	P03



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KEY

- EXISTING CONTRIBUTING IMPERMEABLE AREA FROM SCHOOL (0.48Ha)
- EXISTING CONTRIBUTING IMPERMEABLE AREA COMMUNITY CENTRE (0.018Ha)
- EXISTING SURFACE WATER DRAINAGE
- EXISTING FOUL WATER DRAINAGE

Rev:	Description:	Date:	By:	Chkd:
P01	INITIAL ISSUE	12/07/23	EF	LB

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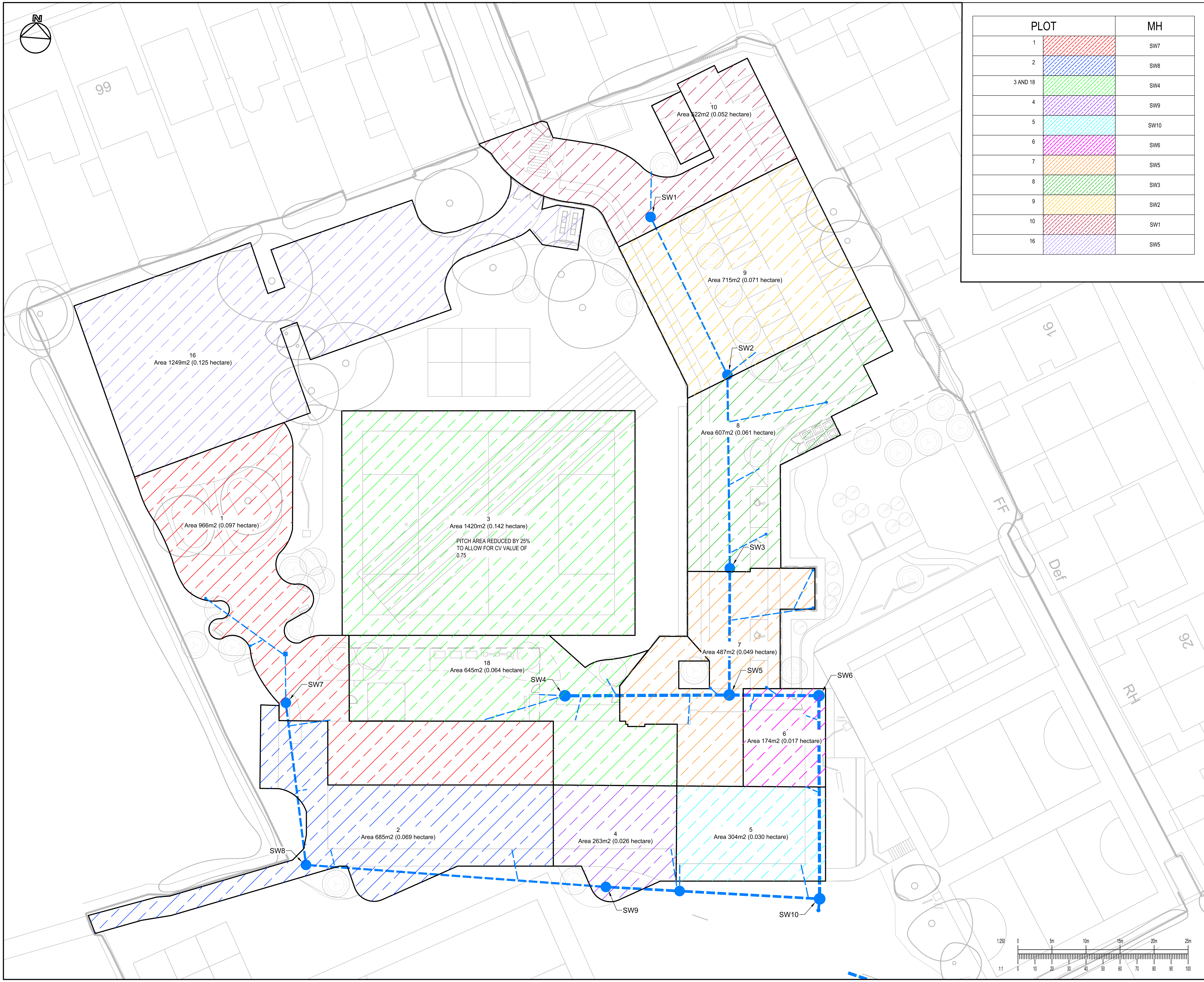
Status: SUITABLE FOR INFORMATION S2

Project: HEMPLAND PRIMARY SCHOOL, YORK

Drg Title: CATCHMENT AREA PLAN

Drawn By	Designed By	Checked By
AJR	AJR	LB
	Date: 01/06/23	Scales @ A1: 1:500

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
SRP1062 - CUR - ZZ - ZZ - D - C - 9203	P01



PLOT		MH
1		SW7
2		SW8
3 AND 18		SW4
4		SW9
5		SW10
6		SW6
7		SW5
8		SW3
9		SW2
10		SW1
16		SW5

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Rev:	Description:	Date:	By:	Chkd:
P02	KEY ADDED	30/06/23	ZR	LB
P01	INITIAL ISSUE	06/06/23	AJR	LB

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Status: SUITABLE FOR INFORMATION S2

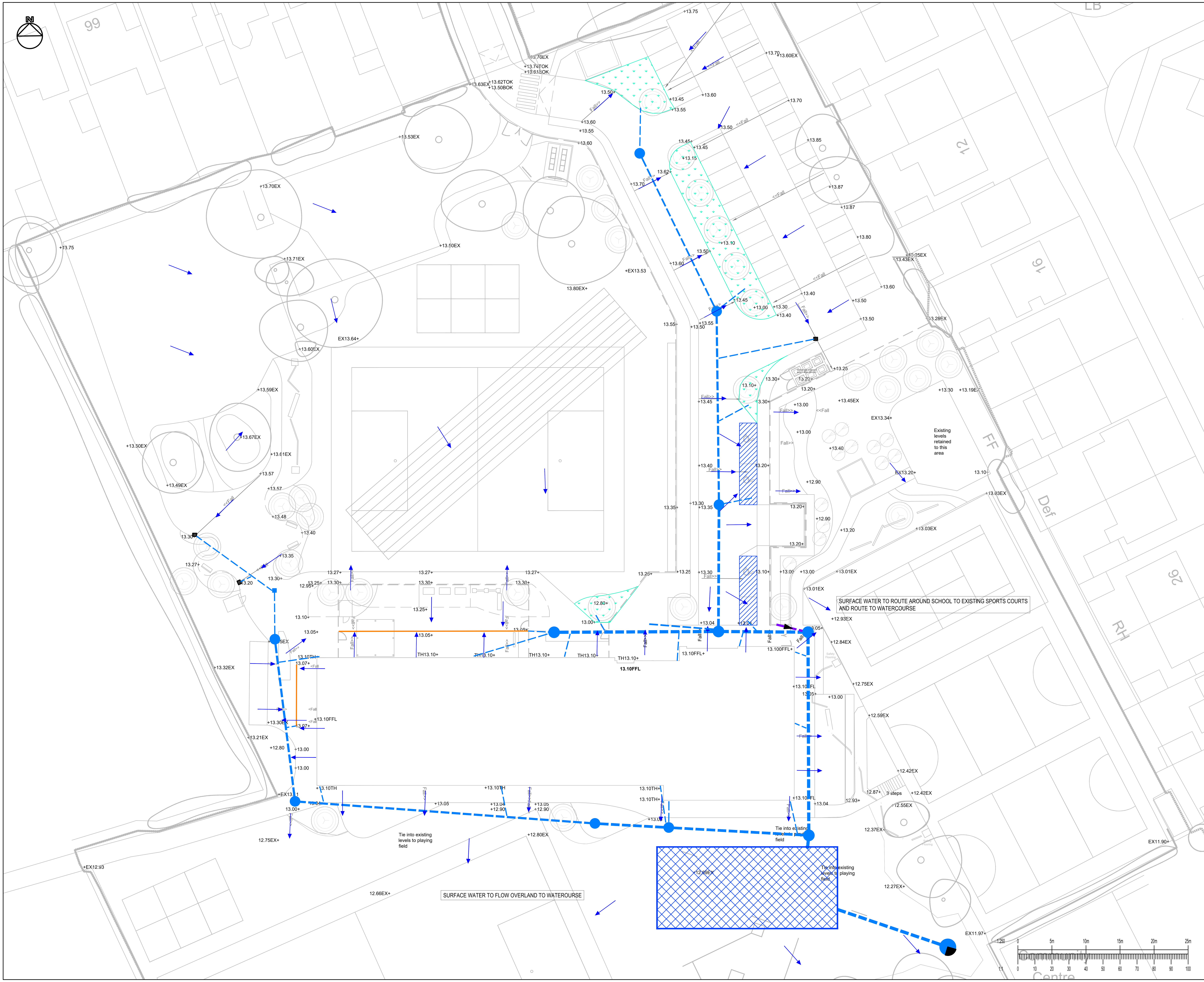
Project: HEMPLAND PRIMARY SCHOOL, YORK

Drg Title: CATCHMENT AREA PLAN

Drawn By	Designed By	Checked By
AJR	AJR	LB
	Date 01/06/23	Scales @ A1 1:250

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
SRP1062 - CUR - ZZ - ZZ - D - C - 9203	P02

\\lefs02\Projects\083438 Hempland Primary School, York\Q4-Production\4A-Models-Drawings\C\CAD\92\



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4. FOR GENERAL NOTES REFER TO DRAWING.

KEY:

- SURFACE WATER EXCEEDANCE ROUTING ARROW
- PROPOSED SURFACE WATER
- PROPOSED SURFACE WATER DIVERSION
- EXISTING SURFACE WATER
- PROPOSED ABANDONED DRAINAGE
- PROPOSED RAIN GARDEN
- PROPOSED ATTENUATION TANK
- PROPOSED CHANNEL DRAIN
- PROPOSED GULLY
- PROPOSED PERMEABLE PAVING

Rev:	Description:	Date:	By:	Chkd:
P02	REVISED TO LATEST DESIGN	13/07/23	EF	LB
P01	INITIAL ISSUE	30/06/23	EF	LB

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Status: SUITABLE FOR INFORMATION S2

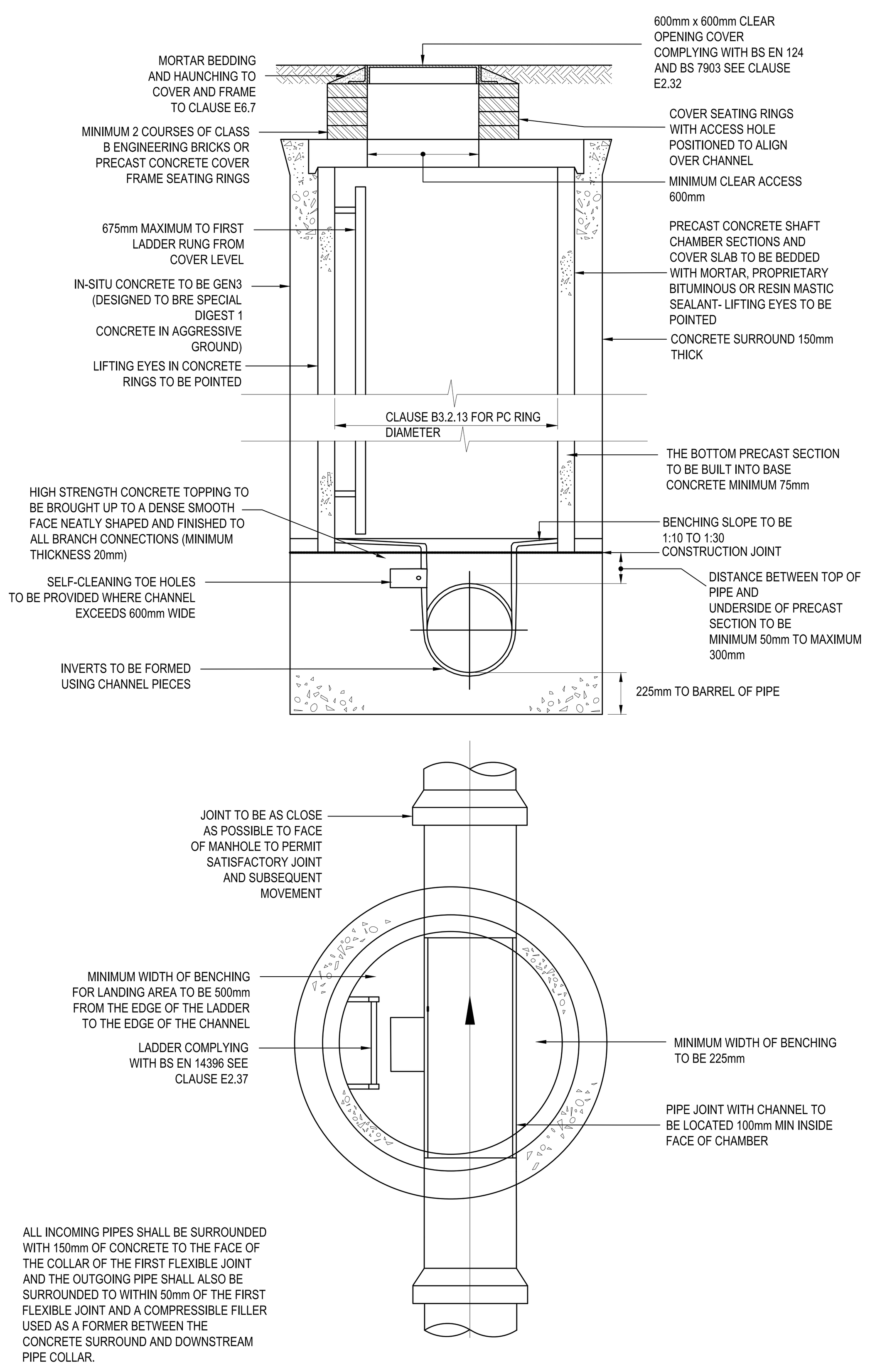
Project: HEMPLAND PRIMARY SCHOOL, YORK

Drg Title: FLOOD EXCEEDANCE ROUTING

Drawn By	Designed By	Checked By
EF	EF	LB
	Date 30/06/23	Scales @ A1 1:250

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
SRP1062 - CUR - ZZ - ZZ - D - C - 9211	P02

\\lefs02\Projects\083438 Hempland Primary School, York\Q4-Production\4A-Models-Drawings\C\CAD\92\

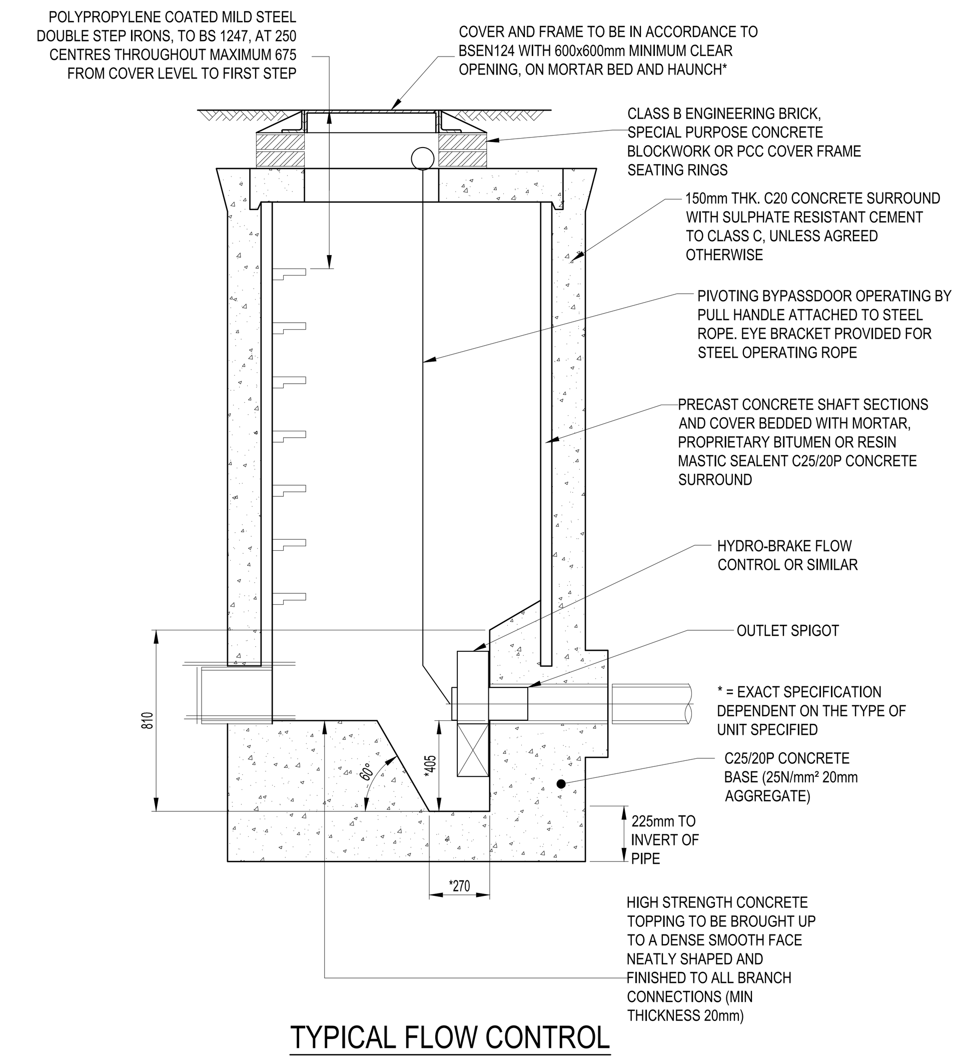


ALL INCOMING PIPES SHALL BE SURROUNDED WITH 150mm OF CONCRETE TO THE FACE OF THE COLLAR OF THE FIRST FLEXIBLE JOINT AND THE OUTGOING PIPE SHALL ALSO BE SURROUNDED TO WITHIN 50mm OF THE FIRST FLEXIBLE JOINT AND A COMPRESSIBLE FILLER USED AS A FORMER BETWEEN THE CONCRETE SURROUND AND DOWNSTREAM PIPE COLLAR.

TYPICAL MANHOLE DETAIL TYPE B

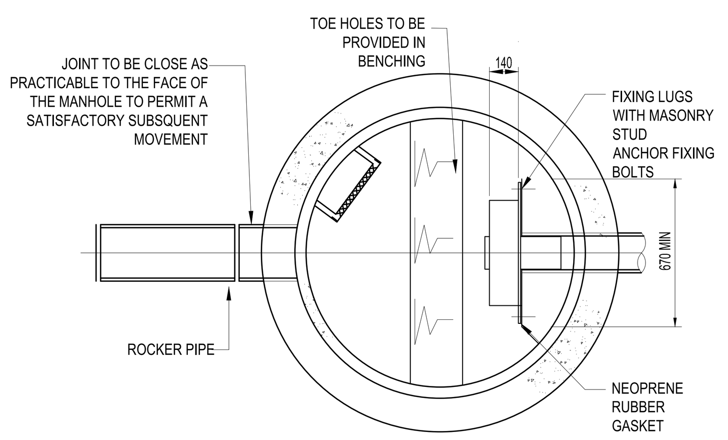
DEPTH TO SOFFIT < 3m

SCALE 1:20



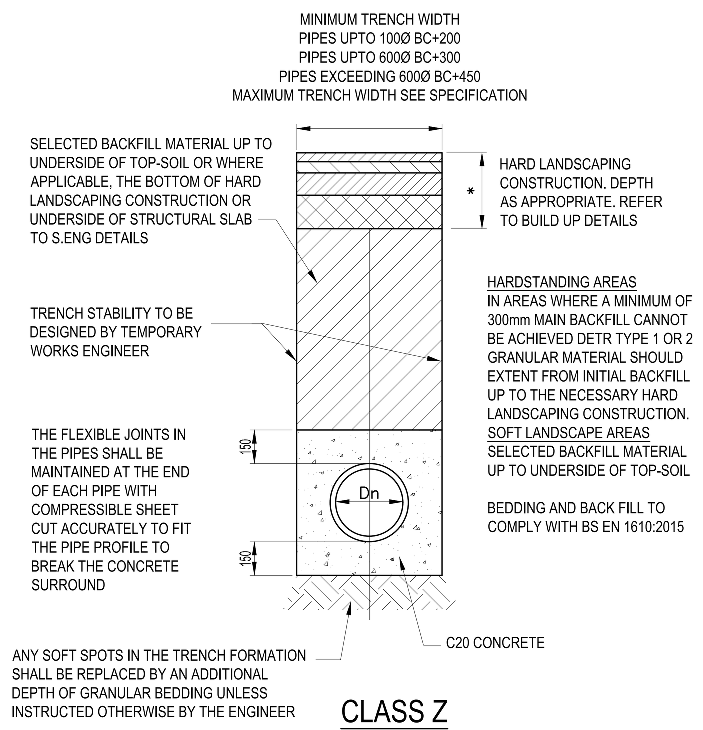
TYPICAL FLOW CONTROL MANHOLE

(SCALE 1:20)



TYPICAL SECTION AT BENCHING LEVEL

(SCALE 1:20)

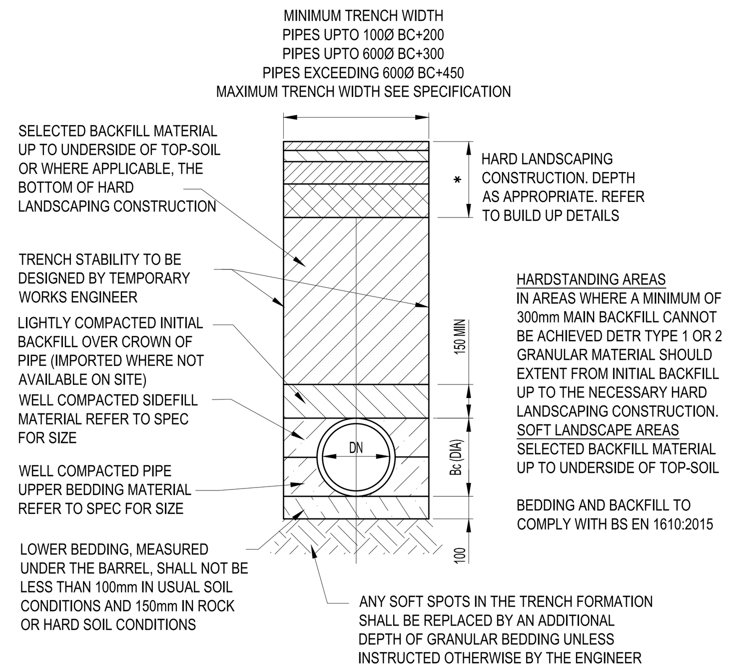


CLASS Z

CONCRETE BED AND SURROUND

PIPE BEDDING DETAIL

(SCALE 1:20)



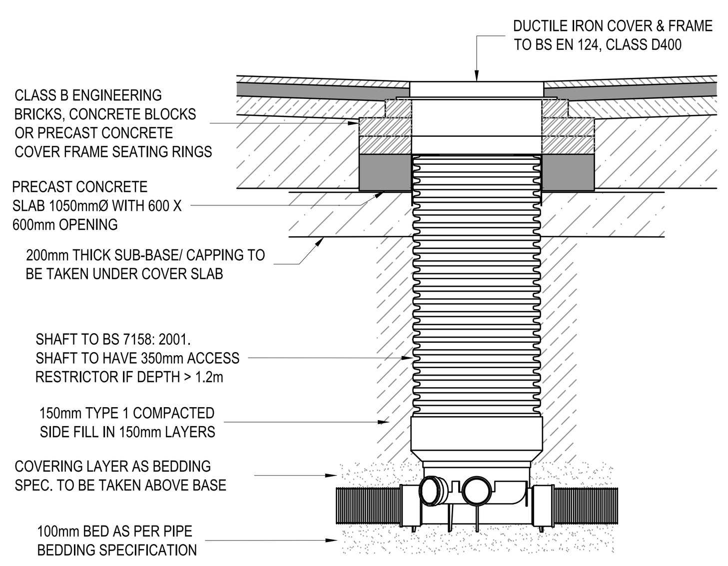
CLASS S

360° GRANULAR SURROUND

PIPE BEDDING DETAIL

(SCALE 1:20)

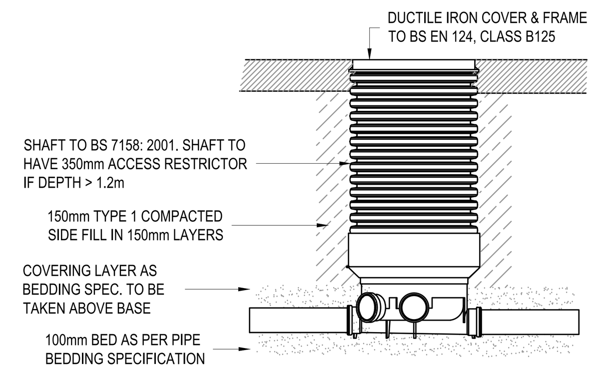
CLASS 'Z'
(TO BE USED WHERE CLASS 'S' BEDDING IS NOT SUITABLE OR COVER IS LESS LESS 0.6m IN PEDESTRIAN OR 1.2m IN TRAFFICKED AREAS)



PPIC INSPECTION CHAMBER

(VEHICULAR LOADED AREAS)

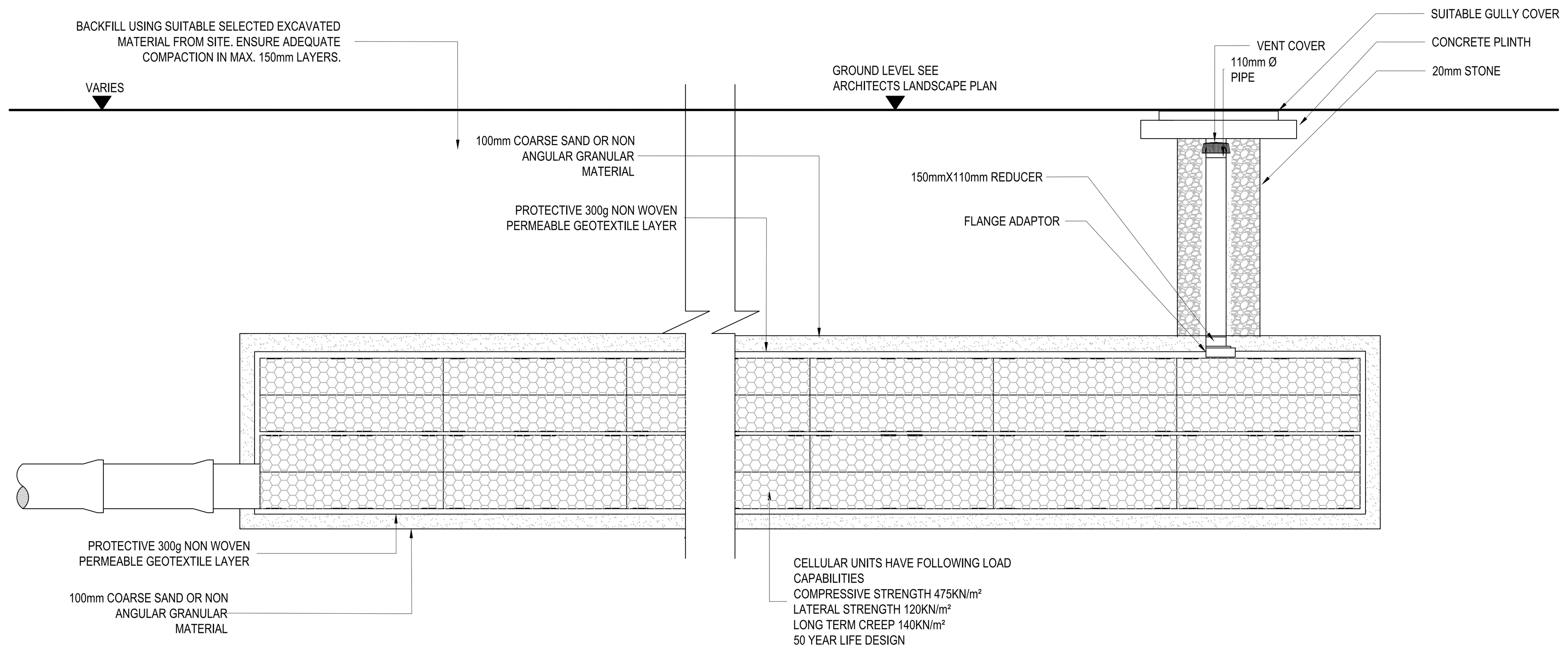
SCALE 1:20



PPIC INSPECTION CHAMBER

(NON-TRAFFICKED AREAS)

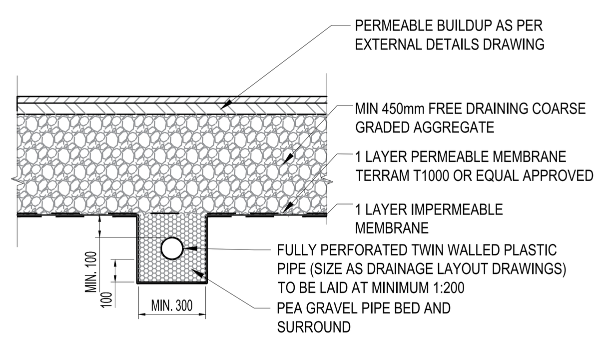
SCALE 1:20



TYPICAL CELLULAR STORAGE TANK

(TO BE CONSTRUCTED AND INSTALLED TO MANUFACTURERS SPECIFICATION)

(SCALE 1:20)



PERMEABLE PAVEMENT DRAINAGE DETAIL

(SCALE 1:20)

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Rev.	Description	Date	By	Chkd
P02	PERMEABLE PAVING DETAIL ADDED	13/07/23	EF	LB
P01	INITIAL ISSUE	05/06/23	AJR	LB

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Status: SUITABLE FOR INFORMATION S2

Project: HEMPLAND PRIMARY SCHOOL, YORK

Drg Title: DRAINAGE DETAILS

Drawn By	Designed By	Checked By
AJR	AJR	LB
	Date: 02/06/23	Scales @ A0: AS SHOWN

Project No - Originator - Function - Spatial - Form - Discipline - Number: SRP1062 - CUR - XX - XX - D - C - 9202

Revision: P02

Appendix H Surface Water Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW9	0.026	5.00	12.971	1200	462581.631	452911.229	1.733
SW6	0.017	5.00	13.054	1350	462612.925	452939.316	1.764
SW8	0.069	5.00	13.014	1200	462537.597	452914.468	1.326
SW1	0.052	5.00	13.595	1200	462588.209	453009.636	1.445
SW2	0.071	5.00	13.465	1200	462599.499	452986.439	1.560
SW3	0.061	5.00	13.316	1200	462599.848	452958.032	1.591
SW5	0.174	5.00	13.064	1350	462599.767	452939.382	1.643
SW7	0.097	5.00	13.401	1200	462534.632	452938.281	1.401
SW4	0.171	5.00	13.047	1350	462575.630	452939.302	1.384
SW10	0.030	5.00	12.949	1350	462613.040	452909.446	2.016
SW11			12.060	2100	462633.449	452893.084	1.236
TANK			12.921	1	462612.970	452907.784	1.988
MH44			13.047	1200	462592.471	452910.626	1.863

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S3.000	SW7	SW8	23.996	0.600	12.000	11.763	0.237	101.2	300	5.37	50.0
S3.001	SW8	SW9	44.153	0.600	11.688	11.238	0.450	98.1	375	6.38	50.0
S3.002	SW9	MH44	10.856	0.600	11.238	11.184	0.054	201.0	375	6.34	49.1
S1.005	TANK	SW11	12.581	0.600	10.933	10.824	0.109	115.4	450	6.88	47.2
S1.000	SW1	SW2	25.799	0.600	12.150	11.980	0.170	151.8	225	5.43	50.0
S1.001	SW2	SW3	28.409	0.600	11.905	11.800	0.105	270.6	300	5.90	50.0
S1.002	SW3	SW5	18.612	0.600	11.725	11.650	0.075	248.2	375	6.21	49.6
S1.003	SW5	SW6	13.158	0.600	11.421	11.290	0.131	100.4	450	6.38	48.9
S1.004	SW6	SW10	29.835	0.600	11.290	10.933	0.357	83.6	450	6.74	47.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S3.000	1.562	110.4	17.5	1.101	0.951	0.097	0.0	81	1.153
S3.001	1.829	202.0	30.0	0.951	1.358	0.166	0.0	97	1.326
S3.002	1.274	140.7	34.1	1.358	1.488	0.192	0.0	125	1.055
S1.005	1.891	300.8	131.0	1.538	0.786	0.768	0.0	208	1.830
S1.000	1.059	42.1	9.4	1.220	1.260	0.052	0.0	72	0.853
S1.001	0.951	67.2	22.2	1.260	1.216	0.123	0.0	119	0.856
S1.002	1.145	126.5	33.0	1.216	1.039	0.184	0.0	130	0.968
S1.003	2.028	322.6	93.5	1.193	1.314	0.529	0.0	165	1.764
S1.004	2.225	353.8	93.9	1.314	1.566	0.546	0.0	158	1.894

Links

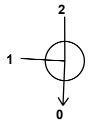
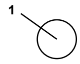
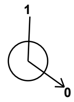
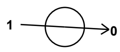
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S2.000	SW4	SW5	24.137	0.600	11.663	11.421	0.242	99.7	450	5.40	50.0
S4.000	SW10	TANK	1.691	0.600	11.041	11.008	0.033	51.2	450	5.04	50.0
S3.002 (1)	MH44	SW10	20.602	0.600	11.184	11.083	0.101	204.0	375	6.65	47.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S2.000	2.035	323.7	30.9	0.934	1.193	0.171	0.0	93	1.301
S4.000	2.845	452.4	138.8	1.458	1.463	0.768	0.0	170	2.512
S3.002 (1)	1.265	139.7	33.2	1.488	1.491	0.192	0.0	124	1.044

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW9	462581.631	452911.229	12.971	1.733	1200	1	S3.001	11.238	375
						0	S3.002	11.238	375
SW6	462612.925	452939.316	13.054	1.764	1350	1	S1.003	11.290	450
						0	S1.004	11.290	450
SW8	462537.597	452914.468	13.014	1.326	1200	1	S3.000	11.763	300
						0	S3.001	11.688	375
SW1	462588.209	453009.636	13.595	1.445	1200	0	S1.000	12.150	225
SW2	462599.499	452986.439	13.465	1.560	1200	1	S1.000	11.980	225
						0	S1.001	11.905	300
SW3	462599.848	452958.032	13.316	1.591	1200	1	S1.001	11.800	300
						0	S1.002	11.725	375
SW5	462599.767	452939.382	13.064	1.643	1350	1	S2.000	11.421	450
						2	S1.002	11.650	375
						0	S1.003	11.421	450
SW7	462534.632	452938.281	13.401	1.401	1200	0	S3.000	12.000	300
SW4	462575.630	452939.302	13.047	1.384	1350	0	S2.000	11.663	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW10	462613.040	452909.446	12.949	2.016	1350		1	S3.002 (1)	11.083	375
							2	S1.004	10.933	450
							0	S4.000	11.041	450
SW11	462633.449	452893.084	12.060	1.236	2100		1	S1.005	10.824	450
TANK	462612.970	452907.784	12.921	1.988	1		1	S4.000	11.008	450
							0	S1.005	10.933	450
MH44	462592.471	452910.626	13.047	1.863	1200		1	S3.002	11.184	375
							0	S3.002 (1)	11.184	375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	30	0	0

Node SW11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	10.824	Product Number	CTL-SHE-0284-4700-1240-4700
Design Depth (m)	1.240	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	47.0	Min Node Diameter (mm)	1800

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	10.933
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	74

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	318.0	0.0	0.800	318.0	0.0	0.801	0.0	0.0

Node SW2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	87.7	0.0	0.200	124.4	0.0	0.201	0.0	0.0

Node SW1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.250
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	33.3	0.0	0.200	51.0	0.0	0.201	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	30 year 240 minute summer	41.604	10.995
1 year 15 minute winter	76.857	30.991	30 year 240 minute winter	27.641	10.995
1 year 30 minute summer	71.439	20.215	30 year 360 minute summer	31.221	8.034
1 year 30 minute winter	50.133	20.215	30 year 360 minute winter	20.295	8.034
1 year 60 minute summer	48.435	12.800	30 year 480 minute summer	24.324	6.428
1 year 60 minute winter	32.179	12.800	30 year 480 minute winter	16.160	6.428
1 year 120 minute summer	30.053	7.942	30 year 600 minute summer	19.756	5.404
1 year 120 minute winter	19.966	7.942	30 year 600 minute winter	13.498	5.404
1 year 180 minute summer	23.233	5.979	30 year 720 minute summer	17.490	4.687
1 year 180 minute winter	15.102	5.979	30 year 720 minute winter	11.754	4.687
1 year 240 minute summer	18.475	4.882	30 year 960 minute summer	14.215	3.743
1 year 240 minute winter	12.274	4.882	30 year 960 minute winter	9.416	3.743
1 year 360 minute summer	14.169	3.646	30 year 1440 minute summer	10.161	2.723
1 year 360 minute winter	9.210	3.646	30 year 1440 minute winter	6.829	2.723
1 year 480 minute summer	11.185	2.956	100 year +30% CC 15 minute summer	453.359	128.285
1 year 480 minute winter	7.431	2.956	100 year +30% CC 15 minute winter	318.147	128.285
1 year 600 minute summer	9.182	2.511	100 year +30% CC 30 minute summer	297.655	84.226
1 year 600 minute winter	6.274	2.511	100 year +30% CC 30 minute winter	208.881	84.226
1 year 720 minute summer	8.203	2.199	100 year +30% CC 60 minute summer	199.275	52.662
1 year 720 minute winter	5.513	2.199	100 year +30% CC 60 minute winter	132.393	52.662
1 year 960 minute summer	6.768	1.782	100 year +30% CC 120 minute summer	120.330	31.800
1 year 960 minute winter	4.483	1.782	100 year +30% CC 120 minute winter	79.945	31.800
1 year 1440 minute summer	4.949	1.326	100 year +30% CC 180 minute summer	90.748	23.353
1 year 1440 minute winter	3.326	1.326	100 year +30% CC 180 minute winter	58.989	23.353
30 year 15 minute summer	268.706	76.035	100 year +30% CC 240 minute summer	70.550	18.644
30 year 15 minute winter	188.566	76.035	100 year +30% CC 240 minute winter	46.872	18.644
30 year 30 minute summer	174.929	49.499	100 year +30% CC 360 minute summer	52.629	13.543
30 year 30 minute winter	122.757	49.499	100 year +30% CC 360 minute winter	34.210	13.543
30 year 60 minute summer	116.589	30.811	100 year +30% CC 480 minute summer	40.838	10.792
30 year 60 minute winter	77.459	30.811	100 year +30% CC 480 minute winter	27.132	10.792
30 year 120 minute summer	70.438	18.615	100 year +30% CC 600 minute summer	33.061	9.043
30 year 120 minute winter	46.797	18.615	100 year +30% CC 600 minute winter	22.589	9.043
30 year 180 minute summer	53.298	13.715	100 year +30% CC 720 minute summer	29.188	7.823
30 year 180 minute winter	34.645	13.715	100 year +30% CC 720 minute winter	19.616	7.823

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +30% CC 960 minute summer	23.616	6.219	100 year +30% CC 1440 minute summer	16.765	4.493
100 year +30% CC 960 minute winter	15.643	6.219	100 year +30% CC 1440 minute winter	11.267	4.493

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW9	11	11.375	0.137	33.6	0.1953	0.0000	OK
15 minute summer	SW6	11	11.447	0.157	94.8	0.2544	0.0000	OK
15 minute summer	SW8	11	11.783	0.095	29.4	0.2057	0.0000	OK
15 minute summer	SW1	10	12.223	0.073	9.3	0.1345	0.0000	OK
15 minute summer	SW2	11	12.025	0.120	21.7	0.2453	0.0000	OK
15 minute summer	SW3	11	11.860	0.135	31.9	0.2567	0.0000	OK
15 minute summer	SW5	11	11.604	0.183	92.1	0.6480	0.0000	OK
15 minute summer	SW7	10	12.082	0.082	17.4	0.2074	0.0000	OK
15 minute summer	SW4	10	11.755	0.092	30.6	0.3575	0.0000	OK
15 minute summer	SW10	11	11.272	0.339	133.6	0.5855	0.0000	OK
60 minute summer	SW11	41	11.089	0.265	42.3	0.9170	0.0000	OK
60 minute summer	TANK	40	11.085	0.152	91.4	45.8196	0.0000	OK
15 minute summer	MH44	11	11.315	0.131	33.5	0.1479	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW9	S3.002	MH44	33.5	0.957	0.238	0.3820	
15 minute summer	SW6	S1.004	SW10	95.1	1.064	0.269	2.6409	
15 minute summer	SW8	S3.001	SW9	29.0	1.024	0.143	1.2811	
15 minute summer	SW1	S1.000	SW2	9.1	0.840	0.216	0.2790	
15 minute summer	SW2	S1.001	SW3	21.5	0.857	0.320	0.7130	
15 minute summer	SW3	S1.002	SW5	32.1	0.938	0.254	0.6375	
15 minute summer	SW5	S1.003	SW6	91.9	1.682	0.285	0.7195	
15 minute summer	SW7	S3.000	SW8	17.1	1.121	0.155	0.3660	
15 minute summer	SW4	S2.000	SW5	30.3	0.751	0.094	1.0039	
15 minute summer	SW10	S4.000	TANK	133.5	1.992	0.295	0.1135	
60 minute summer	SW11	Hydro-Brake®		42.3				95.3
60 minute summer	TANK	S1.005	SW11	42.3	0.684	0.141	0.9048	
15 minute summer	MH44	S3.002 (1)	SW10	33.4	0.757	0.239	0.9235	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW9	11	11.517	0.279	83.2	0.3997	0.0000	OK
15 minute summer	SW6	11	11.608	0.318	232.2	0.5169	0.0000	OK
15 minute summer	SW8	10	11.840	0.152	72.3	0.3305	0.0000	OK
15 minute summer	SW1	10	12.273	0.123	22.8	0.2271	0.0000	OK
15 minute summer	SW2	11	12.114	0.209	53.8	0.4260	0.0000	OK
15 minute summer	SW3	11	11.955	0.230	78.6	0.4367	0.0000	OK
15 minute summer	SW5	11	11.761	0.340	228.0	1.2071	0.0000	OK
15 minute summer	SW7	10	12.136	0.136	42.6	0.3417	0.0000	OK
15 minute summer	SW4	10	11.807	0.144	75.0	0.5635	0.0000	OK
15 minute summer	SW10	11	11.448	0.515	325.8	0.8906	0.0000	OK
60 minute summer	SW11	45	11.363	0.539	55.2	1.8659	0.0000	OK
60 minute summer	TANK	45	11.367	0.434	220.4	131.2144	0.0000	OK
15 minute summer	MH44	11	11.484	0.300	81.0	0.3390	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW9	S3.002	MH44	81.0	1.030	0.575	0.9905	
15 minute summer	SW6	S1.004	SW10	232.6	1.543	0.657	4.1519	
15 minute summer	SW8	S3.001	SW9	71.8	1.205	0.356	2.8589	
15 minute summer	SW1	S1.000	SW2	22.6	0.994	0.536	0.6001	
15 minute summer	SW2	S1.001	SW3	52.9	1.100	0.787	1.3640	
15 minute summer	SW3	S1.002	SW5	79.0	1.190	0.624	1.2348	
15 minute summer	SW5	S1.003	SW6	225.1	1.889	0.698	1.6344	
15 minute summer	SW7	S3.000	SW8	42.0	1.417	0.380	0.7116	
15 minute summer	SW4	S2.000	SW5	74.5	0.896	0.230	2.0683	
15 minute summer	SW10	S4.000	TANK	325.6	2.520	0.720	0.2140	
60 minute summer	SW11	Hydro-Brake®		47.0				233.3
60 minute summer	TANK	S1.005	SW11	55.2	0.675	0.183	1.9829	
15 minute summer	MH44	S3.002 (1)	SW10	80.6	0.838	0.577	2.1005	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	SW9	57	12.049	0.811	68.9	1.1603	0.0000	SURCHARGED
15 minute summer	SW6	11	12.252	0.962	360.1	1.5616	0.0000	SURCHARGED
15 minute summer	SW8	12	12.079	0.391	122.0	0.8500	0.0000	SURCHARGED
15 minute summer	SW1	12	12.928	0.778	38.5	1.4395	0.0000	SURCHARGED
15 minute summer	SW2	11	12.804	0.899	85.1	1.8356	0.0000	SURCHARGED
15 minute summer	SW3	11	12.628	0.903	119.8	1.7138	0.0000	SURCHARGED
15 minute summer	SW5	11	12.532	1.111	353.7	3.9440	0.0000	SURCHARGED
15 minute summer	SW7	10	12.189	0.189	71.8	0.4758	0.0000	OK
15 minute summer	SW4	11	12.577	0.914	126.6	3.5681	0.0000	SURCHARGED
60 minute winter	SW10	57	12.047	1.114	261.4	1.9258	0.0000	SURCHARGED
60 minute winter	SW11	58	12.040	1.216	69.3	4.2119	0.0000	OK
60 minute winter	TANK	57	12.044	1.111	259.7	241.8311	0.0000	SURCHARGED
60 minute winter	MH44	58	12.048	0.864	63.7	0.9771	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	SW9	S3.002	MH44	63.7	0.981	0.453	1.1974	
15 minute summer	SW6	S1.004	SW10	358.1	2.260	1.012	4.7272	
15 minute summer	SW8	S3.001	SW9	110.5	1.270	0.547	4.8699	
15 minute summer	SW1	S1.000	SW2	35.0	1.007	0.833	1.0261	
15 minute summer	SW2	S1.001	SW3	81.4	1.156	1.211	2.0005	
15 minute summer	SW3	S1.002	SW5	121.7	1.156	0.962	2.0528	
15 minute summer	SW5	S1.003	SW6	348.1	2.197	1.079	2.0848	
15 minute summer	SW7	S3.000	SW8	71.6	1.598	0.648	1.3845	
15 minute summer	SW4	S2.000	SW5	114.8	0.963	0.355	3.8243	
60 minute winter	SW10	S4.000	TANK	259.7	2.259	0.574	0.2679	
60 minute winter	SW11	Hydro-Brake®		47.0				400.7
60 minute winter	TANK	S1.005	SW11	69.3	0.675	0.231	1.9934	
60 minute winter	MH44	S3.002 (1)	SW10	62.3	0.755	0.446	2.2723	

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW9	0.026	5.00	12.971	1200	462581.631	452911.229	1.733
SW6	0.017	5.00	13.054	1350	462612.925	452939.316	1.764
SW8	0.069	5.00	13.014	1200	462537.597	452914.468	1.326
SW1	0.052	5.00	13.595	1200	462588.209	453009.636	1.445
SW2	0.071	5.00	13.465	1200	462599.499	452986.439	1.560
SW3	0.061	5.00	13.316	1200	462599.848	452958.032	1.591
SW5	0.174	5.00	13.064	1350	462599.767	452939.382	1.643
SW7	0.097	5.00	13.401	1200	462534.632	452938.281	1.401
SW4	0.171	5.00	13.047	1350	462575.630	452939.302	1.384
SW10	0.030	5.00	12.949	1350	462613.040	452909.446	2.016
SW11			12.060	2100	462633.449	452893.084	1.236
TANK			12.921	1	462612.970	452907.784	1.988
MH44			13.047	1200	462592.471	452910.626	1.863

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S3.000	SW7	SW8	23.996	0.600	12.000	11.763	0.237	101.2	300	5.37	50.0
S3.001	SW8	SW9	44.153	0.600	11.688	11.238	0.450	98.1	375	6.38	50.0
S3.002	SW9	MH44	10.856	0.600	11.238	11.184	0.054	201.0	375	6.34	49.1
S1.005	TANK	SW11	12.581	0.600	10.933	10.824	0.109	115.4	450	6.88	47.2
S1.000	SW1	SW2	25.799	0.600	12.150	11.980	0.170	151.8	225	5.43	50.0
S1.001	SW2	SW3	28.409	0.600	11.905	11.800	0.105	270.6	300	5.90	50.0
S1.002	SW3	SW5	18.612	0.600	11.725	11.650	0.075	248.2	375	6.21	49.6
S1.003	SW5	SW6	13.158	0.600	11.421	11.290	0.131	100.4	450	6.38	48.9
S1.004	SW6	SW10	29.835	0.600	11.290	10.933	0.357	83.6	450	6.74	47.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S3.000	1.562	110.4	17.5	1.101	0.951	0.097	0.0	81	1.153
S3.001	1.829	202.0	30.0	0.951	1.358	0.166	0.0	97	1.326
S3.002	1.274	140.7	34.1	1.358	1.488	0.192	0.0	125	1.055
S1.005	1.891	300.8	131.0	1.538	0.786	0.768	0.0	208	1.830
S1.000	1.059	42.1	9.4	1.220	1.260	0.052	0.0	72	0.853
S1.001	0.951	67.2	22.2	1.260	1.216	0.123	0.0	119	0.856
S1.002	1.145	126.5	33.0	1.216	1.039	0.184	0.0	130	0.968
S1.003	2.028	322.6	93.5	1.193	1.314	0.529	0.0	165	1.764
S1.004	2.225	353.8	93.9	1.314	1.566	0.546	0.0	158	1.894

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S2.000	SW4	SW5	24.137	0.600	11.663	11.421	0.242	99.7	450	5.40	50.0
S4.000	SW10	TANK	1.691	0.600	11.041	11.008	0.033	51.2	450	5.04	50.0
S3.002 (1)	MH44	SW10	20.602	0.600	11.184	11.083	0.101	204.0	375	6.65	47.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S2.000	2.035	323.7	30.9	0.934	1.193	0.171	0.0	93	1.301
S4.000	2.845	452.4	138.8	1.458	1.463	0.768	0.0	170	2.512
S3.002 (1)	1.265	139.7	33.2	1.488	1.491	0.192	0.0	124	1.044

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW9	462581.631	452911.229	12.971	1.733	1200	1	S3.001	11.238	375
						0	S3.002	11.238	375
SW6	462612.925	452939.316	13.054	1.764	1350	1	S1.003	11.290	450
						0	S1.004	11.290	450
SW8	462537.597	452914.468	13.014	1.326	1200	1	S3.000	11.763	300
						0	S3.001	11.688	375
SW1	462588.209	453009.636	13.595	1.445	1200	0	S1.000	12.150	225
SW2	462599.499	452986.439	13.465	1.560	1200	1	S1.000	11.980	225
						0	S1.001	11.905	300
SW3	462599.848	452958.032	13.316	1.591	1200	1	S1.001	11.800	300
						0	S1.002	11.725	375
SW5	462599.767	452939.382	13.064	1.643	1350	1	S2.000	11.421	450
						2	S1.002	11.650	375
						0	S1.003	11.421	450
SW7	462534.632	452938.281	13.401	1.401	1200	0	S3.000	12.000	300
SW4	462575.630	452939.302	13.047	1.384	1350	0	S2.000	11.663	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW10	462613.040	452909.446	12.949	2.016	1350	1	S3.002 (1)	11.083	375
						2	S1.004	10.933	450
						0	S4.000	11.041	450
SW11	462633.449	452893.084	12.060	1.236	2100	1	S1.005	10.824	450
TANK	462612.970	452907.784	12.921	1.988	1	1	S4.000	11.008	450
						0	S1.005	10.933	450
MH44	462592.471	452910.626	13.047	1.863	1200	1	S3.002	11.184	375
						0	S3.002 (1)	11.184	375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	10	0
30	0	10	0
100	30	10	0

Node SW11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	10.824	Product Number	CTL-SHE-0284-4700-1240-4700
Design Depth (m)	1.240	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	47.0	Min Node Diameter (mm)	1800

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	10.933
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	79

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	378.0	0.0	0.800	378.0	0.0	0.801	0.0	0.0

Node SW2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	87.7	0.0	0.200	124.4	0.0	0.201	0.0	0.0

Node SW1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.250
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	33.3	0.0	0.200	51.0	0.0	0.201	0.0	0.0

Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW9	11	11.383	0.145	37.0	0.2117	0.0000	OK
15 minute summer	SW6	11	11.455	0.165	104.3	0.2708	0.0000	OK
15 minute summer	SW8	10	11.787	0.099	32.4	0.2263	0.0000	OK
15 minute summer	SW1	10	12.226	0.076	10.2	0.1470	0.0000	OK
15 minute summer	SW2	11	12.032	0.127	23.9	0.2703	0.0000	OK
15 minute summer	SW3	11	11.868	0.143	35.1	0.2814	0.0000	OK
15 minute summer	SW5	11	11.614	0.193	101.3	0.7260	0.0000	OK
15 minute summer	SW7	10	12.087	0.087	19.1	0.2298	0.0000	OK
15 minute summer	SW4	10	11.759	0.096	33.6	0.3983	0.0000	OK
15 minute summer	SW10	11	11.285	0.352	146.9	0.6190	0.0000	OK
60 minute summer	SW11	41	11.089	0.265	42.4	0.9167	0.0000	OK
60 minute summer	TANK	41	11.084	0.151	100.6	54.2423	0.0000	OK
15 minute summer	MH44	11	11.324	0.140	36.8	0.1579	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW9	S3.002	MH44	36.8	0.968	0.262	0.4158	
15 minute summer	SW6	S1.004	SW10	104.6	1.112	0.296	2.7679	
15 minute summer	SW8	S3.001	SW9	31.9	1.048	0.158	1.3817	
15 minute summer	SW1	S1.000	SW2	10.0	0.861	0.237	0.2991	
15 minute summer	SW2	S1.001	SW3	23.7	0.879	0.352	0.7645	
15 minute summer	SW3	S1.002	SW5	35.3	0.962	0.279	0.6838	
15 minute summer	SW5	S1.003	SW6	101.1	1.723	0.313	0.7730	
15 minute summer	SW7	S3.000	SW8	18.8	1.150	0.170	0.3916	
15 minute summer	SW4	S2.000	SW5	33.3	0.767	0.103	1.0786	
15 minute summer	SW10	S4.000	TANK	146.8	2.042	0.324	0.1217	
60 minute summer	SW11	Hydro-Brake®		42.3				104.3
60 minute summer	TANK	S1.005	SW11	42.4	0.688	0.141	0.9032	
15 minute summer	MH44	S3.002 (1)	SW10	36.7	0.766	0.263	1.0073	

Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW9	11	11.556	0.318	91.4	0.4650	0.0000	OK
15 minute summer	SW6	11	11.669	0.379	253.8	0.6228	0.0000	OK
15 minute summer	SW8	10	11.848	0.160	79.5	0.3646	0.0000	OK
15 minute summer	SW1	10	12.280	0.130	25.1	0.2501	0.0000	OK
15 minute summer	SW2	11	12.129	0.224	59.1	0.4771	0.0000	OK
15 minute summer	SW3	11	11.970	0.245	86.2	0.4830	0.0000	OK
15 minute summer	SW5	11	11.811	0.390	250.5	1.4665	0.0000	OK
15 minute summer	SW7	10	12.144	0.144	46.8	0.3814	0.0000	OK
15 minute summer	SW4	10	11.815	0.152	82.5	0.6299	0.0000	OK
15 minute summer	SW10	11	11.477	0.544	353.4	0.9562	0.0000	OK
60 minute summer	SW11	46	11.354	0.530	56.0	1.8352	0.0000	OK
60 minute summer	TANK	46	11.358	0.425	242.3	152.7627	0.0000	OK
15 minute summer	MH44	11	11.524	0.340	87.9	0.3844	0.0000	OK

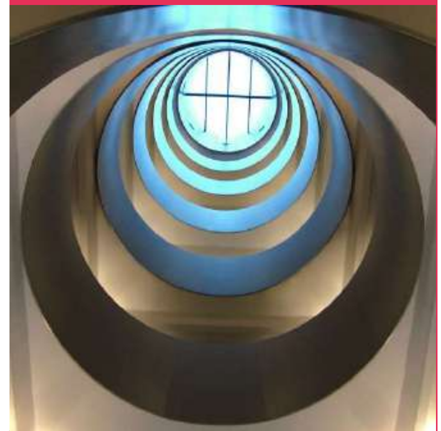
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW9	S3.002	MH44	87.9	1.033	0.625	1.1116	
15 minute summer	SW6	S1.004	SW10	252.5	1.607	0.714	4.4893	
15 minute summer	SW8	S3.001	SW9	78.8	1.218	0.390	3.1833	
15 minute summer	SW1	S1.000	SW2	24.9	0.988	0.590	0.6622	
15 minute summer	SW2	S1.001	SW3	58.1	1.129	0.865	1.4591	
15 minute summer	SW3	S1.002	SW5	86.8	1.223	0.686	1.3205	
15 minute summer	SW5	S1.003	SW6	246.0	1.890	0.763	1.8975	
15 minute summer	SW7	S3.000	SW8	46.2	1.450	0.418	0.7644	
15 minute summer	SW4	S2.000	SW5	81.9	0.909	0.253	2.3144	
15 minute summer	SW10	S4.000	TANK	353.1	2.571	0.780	0.2249	
60 minute summer	SW11	Hydro-Brake®		47.0				255.9
60 minute summer	TANK	S1.005	SW11	56.0	0.678	0.186	1.9727	
15 minute summer	MH44	S3.002 (1)	SW10	87.5	0.837	0.627	2.2183	

Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW9	12	12.033	0.795	136.5	1.1609	0.0000	SURCHARGED
15 minute summer	SW6	11	12.410	1.120	391.6	1.8396	0.0000	SURCHARGED
15 minute summer	SW8	11	12.222	0.534	134.4	1.2159	0.0000	SURCHARGED
15 minute summer	SW1	12	13.228	1.078	42.4	2.0731	0.0000	SURCHARGED
15 minute summer	SW2	11	13.061	1.156	89.2	2.4644	0.0000	SURCHARGED
15 minute summer	SW3	11	12.854	1.129	130.4	2.2287	0.0000	SURCHARGED
15 minute summer	SW5	11	12.741	1.320	385.7	4.9663	0.0000	SURCHARGED
15 minute summer	SW7	11	12.357	0.357	79.0	0.9476	0.0000	SURCHARGED
15 minute summer	SW4	11	12.795	1.132	139.3	4.6997	0.0000	FLOOD RISK
60 minute winter	SW10	59	11.967	1.034	289.0	1.8190	0.0000	SURCHARGED
60 minute winter	SW11	59	11.961	1.137	54.5	3.9369	0.0000	OK
60 minute winter	TANK	59	11.965	1.032	286.1	287.4596	0.0000	SURCHARGED
60 minute winter	MH44	59	11.969	0.785	71.6	0.8876	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW9	S3.002	MH44	136.1	1.234	0.967	1.1974	
15 minute summer	SW6	S1.004	SW10	389.3	2.457	1.100	4.7272	
15 minute summer	SW8	S3.001	SW9	117.5	1.293	0.581	4.8699	
15 minute summer	SW1	S1.000	SW2	38.6	1.010	0.917	1.0261	
15 minute summer	SW2	S1.001	SW3	88.4	1.256	1.316	2.0005	
15 minute summer	SW3	S1.002	SW5	132.4	1.200	1.046	2.0528	
15 minute summer	SW5	S1.003	SW6	378.4	2.389	1.173	2.0848	
15 minute summer	SW7	S3.000	SW8	78.2	1.589	0.708	1.6898	
15 minute summer	SW4	S2.000	SW5	124.4	0.957	0.384	3.8243	
60 minute winter	SW10	S4.000	TANK	286.1	2.359	0.632	0.2679	
60 minute winter	SW11	Hydro-Brake®		47.0				439.5
60 minute winter	TANK	S1.005	SW11	54.5	0.678	0.181	1.9934	
60 minute winter	MH44	S3.002 (1)	SW10	70.3	0.756	0.503	2.2723	

Appendix I Drainage Operation & Maintenance Manual



Hempland Primary School

SuDS Operations and Maintenance Manual

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

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Author	Signature	Date
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Reviewed	Signature	Date
Laura Barlow Principal Engineer	L.Barlow	11/07/23

Table of Contents

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.

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.
	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.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection should be provided as post construction CCTV survey.	N/A
	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.

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

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.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection.	Monthly for three months after installation.
	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.

	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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Job Title: **Hemplands Primary School**
Sheet Title: **Foul Pumping Station calcs**
Job Number: **83438**

Foul Water Flow Calculations

Appliance	No.	System I DU l/s	System II DU l/s	System III DU l/s	System IV DU l/s	Total DU System I	Total DU System II	Total DU System III	Total DU 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 4.0l cistern		1.0	1.8	1.0	1.0	0	0	0	0
WC 6.0l cistern	29	2.0	1.8	1.2 to 1.7	2.0	58	52.2	34.8 to 49.3	58
WC 7.5l cistern		2.0	1.8	1.4 to 1.8	2.0	0	0	0 to 0	0
WC 9.0l 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 (l/s)		6.77	6.03	5.46 to 6.07	6.26

Appendix K Outfall Photo

Our Locations

Birmingham
2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
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Bristol
Quayside
40-58 Hotwell Road
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K Village
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