

Built Development Ltd.

Bury Old Road, Heywood

Sustainable Drainage Strategy

November 2024



Revision Schedule

Bury Old Road, Heywood

Drainage Strategy

November 2024

Doc Ref: BDL-1763-01-DS-001

REV	DATE	STATUS	PREPARED BY	REVIEWED BY	APPROVED BY
-	28 th June 2024	First Issue	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT
P1	19 th July 2024	First Revision	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT
P2	30 th August 2024	Second Revision	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT
P3	18 th November 2024	Third Revision	Calum Reford, BSc (Hons), MSc.	Lee Barnes, BSc (Hons), MCIHT	Lee Barnes, BSc (Hons), MCIHT

REVISION NOTES	
P1	Revised to include references to BDL-1763-01-FRA-001 – Flood Risk Assessment
P2	Revised to remove permeable paving and replacement with attenuation crates.
P3	Revised following infiltration testing to address LLFA and UU comments. Site 1 now includes infiltration to ground.

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Inspire Design & Development Ltd
Unit 2A
Church View Business Park
Coney Green Road
Chesterfield
Derbyshire
S45 9HA

Tel: 01246 864467

www.inspiredesigngroup.co.uk

CONTENTS

1.0	INTRODUCTION	3
2.0	SITE INFORMATION	4
3.0	FLOOD RISK	5
4.0	DRAINAGE STRATEGY	6
5.0	CONCLUSIONS.....	10

APPENDICES

APPENDIX A	LOCATION PLAN	11
APPENDIX B	SEWER RECORDS	12
APPENDIX C	DRAINAGE STRATEGY DRAWING	13
APPENDIX D	HYDRAULIC CALCULATIONS	14
APPENDIX E	SIMPLE INDEX APPROACH	15
APPENDIX F	FLOOD MAP FOR PLANNING.....	16
APPENDIX G	INFILTRATION TEST RESULTS	17

1.0 INTRODUCTION

1.1 Instructions

1.1.1 This Drainage Strategy report has been prepared in accordance with instructions from Bernard Taylor Partnership Architects, on behalf of Build Developments Ltd, to support a planning application to Rochdale Borough Council for a residential development of 28no. dwellings over two sites. Site 1 is located to the south of Bury Old Road, and to the east of Sutherland Road, Heywood. Site 2 is located to the north of Argyle Street, Heywood. Both sites are located within the curtilage of Our Lady's and St Paul's Roman Catholic Primary School, OL10 3PD.

1.1.2 The purpose of this report is to assess flood risk and determine a drainage strategy for the proposed development. It does not purport to be a detailed design for approval or construction purposes.

1.2 Planning History

1.2.1 Rochdale Borough Council have provided pre-application advice concerning flood risk as follows:

The site is within Flood Zone 1, having a less than a 1 in 1,000 annual probability of flooding, however, does fall in the Heywood Critical Drainage Area. Given the proposals would comprise of major development, a Flood Risk Assessment and a Sustainable Drainage Strategy will be required with any future application.

1.2.2 Inspire Design and Development have prepared a Site-Specific Flood Risk Assessment (doc ref: BDL-1763-01-FRA-001) which should be read in conjunction with this Sustainable Drainage Strategy.

1.2.3 Comments on the planning application were received from the Lead Local Flood Authority (LLFA) on 12th September 2024, and can be summarised as below:

- The current proposals (to combined sewer) are not acceptable in principle.
- Infiltration to ground should be comprehensively assessed by an on-site investigation to establish the feasibility of soakaways.

1.2.4 In accordance with these comments, BRE365 soakaway testing was conducted by Humberside Laboratories. The on-site surveys concluded that infiltration is feasible at Site 1. However, no soakage was observed on part of Site 2, and therefore, this Drainage Strategy (P3) has been updated to reflect the findings of this assessment.

2.0 SITE INFORMATION

2.1 Existing Site

- 2.1.1 The site comprises of two sites (Site 1 (0.5ha) and Site 2 (0.1ha)), with a total site area of 0.6ha. Both sites comprise of unused land which forms part of the curtilage to Our Lady's and St Paul's Roman Catholic Primary School, off Sutherland Road, Heywood, OL10 3PD. A Location Plan (BDL-1763-01-GA-001) is available within Appendix A of this report.
- 2.1.2 Site 1 is bound to the north by Old Bury Road, and to the west by Sutherland Road, and is relatively rectangular in shape. Levels on the site are generally sloping, with +135.7m AOD along the east boundary down to +132.2m AOD.
- 2.1.3 Site 2 is bound to the south by Argyle Street, and to the west and north by the curtilage of Our Lady's and St Paul's Roman Catholic Primary School. Levels on Site 2 is relatively flat, with +133.1m AOD in the north, and +132.5m AOD in the south.
- 2.1.4 The nearest watercourse in the River Roch, 660m to the northwest of the site. The River Roch is a main river, a tributary of the River Irwell, running east to west. The River Roch joins the River Irwell, 4.5km to the southwest of the site.
- 2.1.5 According to sewer records from United Utilities (Appendix B), there is a 225mm diameter public combined sewer located under Sutherland Road, and a 225mm diameter public combined sewer under Argyle Street.
- 2.1.6 According to BGS data, the site is located within the Pennine Lower Coal Measures formation comprising of mudstone, siltstone and sandstone. Superficial deposits of Glaciofluvial Deposits are also present with sand and gravel.

2.2 Development Proposals

- 2.2.1 The proposed development is to construct 28no. residential dwellings over two plots of land, complete with access, driveways, and associated landscaping. The total impermeable area of the development is considered to be approximately 60% of the total site area, with the remaining 40% to consist of public open space and private gardens.

3.0 FLOOD RISK

3.1.1 This section provides a brief overview of Flood Risk. However, full flood risk information is available within the Inspire Design & Development Report BDL-1763-01-FRA-001 *Flood Risk Assessment*, which has been submitted in support of this planning application.

3.2 Potential for Fluvial Flood Risk

3.2.1 The Environment Agency's *Flood Map for Planning* shows the site is located within Flood Zone 1 (low probability), see Appendix F. Consequently, there is no significant risk of fluvial flooding and therefore no need to consider the NPPF Sequential and Exception Tests.

3.2.2 As the site is located within Flood Zone 1, and has an area of less than 1ha, there is no requirements in the NPPF for a site-specific flood risk assessment to accompany a planning application.

3.3 Potential for Surface Water Flooding

3.3.1 According to the EA's *Flood Risk from Surface Water* shows a small area of low risk surface water flooding in the centre of Site 1. However, the remainder of Site 1, and all of Site 2, shows no risk of surface water flooding.

3.3.2 The proposed drainage system, described within Section 4, will utilise sustainable drainage techniques to attenuate runoff to a low discharge rate, thereby reducing any potential for surface water flooding at the site.

3.4 Potential for Reservoir Flooding

3.4.1 The EA's *Flood Risk from Reservoirs* map shows no risk of reservoir flooding at or in the vicinity of the site.

3.5 Potential for Groundwater Flooding

3.5.1 In view of the geological data from BGS, which identifies the site to be within coal measure geology, flood risk from groundwater is considered to be low.

4.0 DRAINAGE STRATEGY

4.1 Existing Drainage

4.1.1 There is no known positive drainage from the site at present.

4.2 Sustainable Urban Drainage Systems (SUDS)

4.2.1 The proposed drainage system will be based on SUDS principles for the attenuation and treatment of the surface water runoff, as shown on the drawing BDL-1763-01-DS-001 *Drainage Strategy Site 1* and BDL-1763-01-DR-002 *Drainage Strategy Site 2*, and described below.

4.2.2 The first consideration in the SUDS hierarchy is infiltration to ground. According to BGS data, there is relatively impermeable Coal Measure geology present at or near the surface of the site. There is also the possibility of Made Ground in some areas of the site. BRE365 soakaway testing was commissioned by Inspire Design and Development to further assess the feasibility of infiltration at the application sites. Full results from Humberside Laboratories can be found in Appendix G of this report. The report concluded that infiltration was feasible at Site 1, with infiltration rates of between 1×10^{-5} and 1×10^{-6} . However, no soakage was observed at trial pit 6 within Site 2.

4.2.3 Consequently, as infiltration is feasible at Site 1, the proposed drainage strategy will incorporate infiltration to ground. The runoff from roofs and private driveways will be conveyed to private soakaways located under the private driveways as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

4.2.4 As infiltration to ground at Site 2 is not feasible, the second consideration in the SUDS hierarchy is disposal to watercourse. As the nearest watercourse is approximately 650m to the northwest of the site, and crossing third-party land, discharge to watercourse is not considered to be a feasible option.

4.2.5 The third consideration in the SUDS hierarchy is disposal to the sewer. The nearest public sewer is the 225mm diameter public surface water sewer which flows under Argyle Street. Discharge to the public sewer is therefore considered to be feasible, and the only option available based on current information. Consequently, surface water runoff from Site 2 will be drained to the public surface water sewer.

4.3 Site 1 Proposed Drainage

Surface Water Drainage

- 4.3.1 The proposed surface water drainage for Site 1 will collect future surface water runoff from roofs and private driveways, and will be conveyed to one of three soakaways, with a total volume of 335m³, as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*, with hydraulic calculations within Appendix D.
- 4.3.2 In order to protect groundwater, treatment of surface water runoff prior to infiltration will be given particular attention. Runoff from the dwelling roofs will be clean enough to discharge directly, and will be conveyed by a series of pipes to the soakaways shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.
- 4.3.3 Runoff from private driveways and parking areas will be conveyed via series of filter drains with catchpits to the soakaway. The soakaway itself will provide a second level of treatment. Therefore, this 2-stage treatment train will be sufficient to adequately protect ground water, and thereby permit discharge to the ground.
- 4.3.4 The areas of open space and private gardens will be soft landscaped and offer a measure of bioretention through shallow infiltration into topsoil and the evapotranspiration of the vegetation.
- 4.3.5 The proposed drainage system will ensure that there will be no significant flooding caused either within the site, or in the surrounding area by future site surface water runoff.

Foul Sewerage

- 4.3.6 Foul sewerage for Site 1 will collect sewerage from various sanitary facilities and convey the sewerage via a new foul sewer under the proposed access road before discharging to the existing combined sewer under Sutherland Road, as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

4.4 Site 2 Proposed Drainage

Surface Water Drainage

- 4.4.1 The proposed surface water drainage system will collect future runoff from the site and discharge the attenuated flow to the 225mm diameter public combined sewer under

Argyle Street. A total surface water storage volume of 40m³ is provided by the attenuation crates located underneath each driveway of the 6no. plots as shown in the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

- 4.4.2 The proposed attenuation will be sufficient to cater for the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, May 2022. Hydraulic calculations are available within Appendix D. Surface water will be discharged at the greenfield runoff rate of 2.43l/s.
- 4.4.3 The areas of open space and private gardens will be soft landscaped and offer a measure of bioretention through shallow infiltration into topsoil and the evapotranspiration of the vegetation.
- 4.4.4 The proposed drainage system will ensure that there will be no significant flooding caused either within the site, or in the surrounding area by future site surface water runoff.

Foul Sewerage

- 4.4.5 Foul sewerage for Site 2 will collect sewerage from various sanitary facilities and convey the sewerage via a new foul sewer under the proposed access road before discharging to the existing combined sewer under Argyle Street, as shown on the drawing BDL-1763-01-DR-001 *Drainage Strategy*.

4.5 Management and Maintenance

Treatment

- 4.5.1 Surface water will be collected via trapped gullies and conveyed to attenuation crates which will provide adequate treatment prior to discharge, together with roof water, to the combined sewer. Areas of soft landscaping will provide a significant degree of bioretention and amenity value.
- 4.5.2 To ensure the appropriate SUDS measures used to treat surface water and prevent the risk of pollution from the discharging runoff, the CIRIA SUDS Manual's *Simple Index Approach* has been used. A summary of the *Simple Index Approach Tool* by HR Wallingford is supplied within Appendix E of this report.

Surface Water Approvals

- 4.5.3 At the detailed design stage, an application will be made to United Utilities under Section 106 of the Water Industry Act 1991 for consent to discharge surface water from the site to the public sewer system.
- 4.5.4 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed surface water drainage design to be subject to the approval of the Local Planning Authority subsequent to the granting of planning permission, and this will be sought from Rochdale Borough Council at the appropriate time.

Foul Sewerage Approvals

- 4.5.5 At the detailed design stage, an application will be made to United Utilities under Section 106 of the Water Industry Act 1991 for consent to discharge foul sewerage from the site to the public sewer system.
- 4.5.6 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed foul water drainage design to be the subject of approval by the Local Planning Authority subsequent to the grant of planning permission. This will be sought from Rochdale Borough Council at the appropriate time.

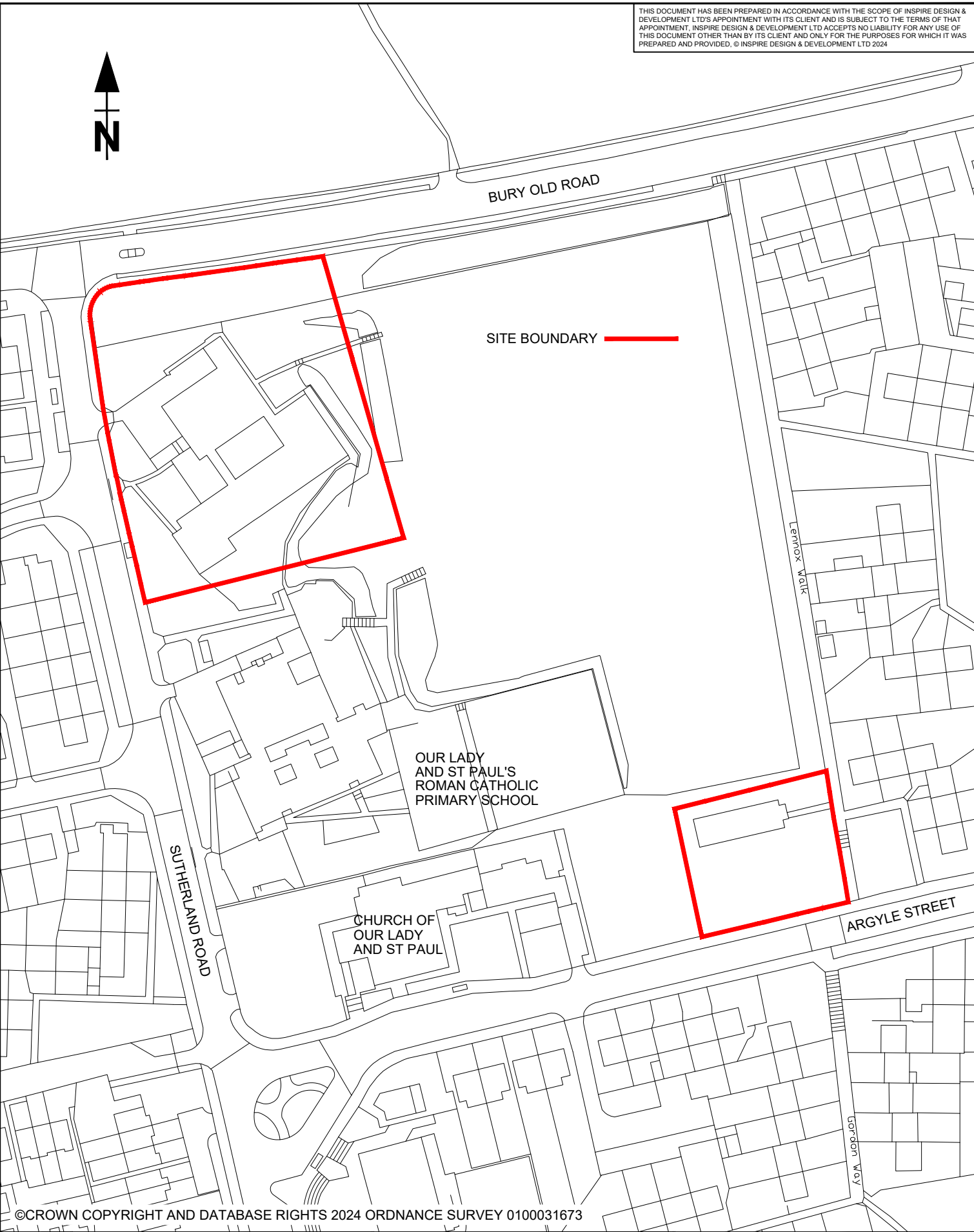
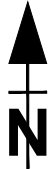
Maintenance

- 4.5.7 The completed development will be operated by the landowner, who may employ an operation and maintenance team to maintain the proposed drainage system to a standardised procedure and ensure that all features of the drainage system are regularly and adequately managed and maintained.
- 4.5.8 In the event that the properties are transferred to private ownership, the properties will be similarly managed and maintained by the owners.
- 4.5.9 A detailed Management and Maintenance Plan may be provided at the detailed design stage, as and when required.

5.0 CONCLUSIONS

- 5.1.1 The site is not at risk of flooding from any source and there is no need to consider the NPPF Sequential or Exception Tests.
- 5.1.2 The site will be drained via two surface water systems. Site 1 will be drained via a soakaway following results from Humberside Laboratories' BRE365 soakaway testing exercise. Site 2, where soakaway is not feasible, will be drained via a new connection to the public sewer system using SUDS techniques, which will provide flow attenuation to a greenfield runoff rate and provide sufficient treatment of surface water runoff.
- 5.1.3 The proposed drainage system will be sufficient to cater for the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, May 2022.
- 5.1.4 Following implementation of the surface water drainage system, there will be no significant risk of surface water flooding at the site.
- 5.1.5 Foul sewerage will be disposed of the public combined sewer in Sutherland Road (Site 1), and Argyle Street (Site 2).
- 5.1.6 With regard to flood risk and drainage, therefore, the site is suitable for the proposed use. Subject to the implementation of this Drainage Strategy, the development may be occupied safely and adequately drained while reducing flood risk overall.

APPENDIX A LOCATION PLAN



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DATE: 26/06/2024	DRAWING TITLE: LOCATION PLAN		REV	DATE	NAME	CHK	NOTES
DRAWN: NGP			DRAWING STATUS: FOR APPROVAL				
CHECKED: CGR	PROJECT:	CLIENT:	DRAWING No:		REVISION No:		
APPROVED: CR	BURY OLD ROAD, HEYWOOD	BUILT DEVELOPMENTS LTD	BDL-1763-01-GA-001				
SCALE @ A4: 1:1250							

APPENDIX B SEWER RECORDS

Inspire Design And Development

Unit 2a, Church View Business Park
Coney Green Rd, Inspire Design And Development
Clay Cross, Chesterfield,
S45 9HA

FAO:

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: 1763
Our Ref: UUPS-ORD-580703
Date: 24/06/2024

Dear Sirs**Location: 105 SUTHERLAND ROAD, HEYWOOD, OL10 3PD**

I acknowledge with thanks your request dated 20/06/2024 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

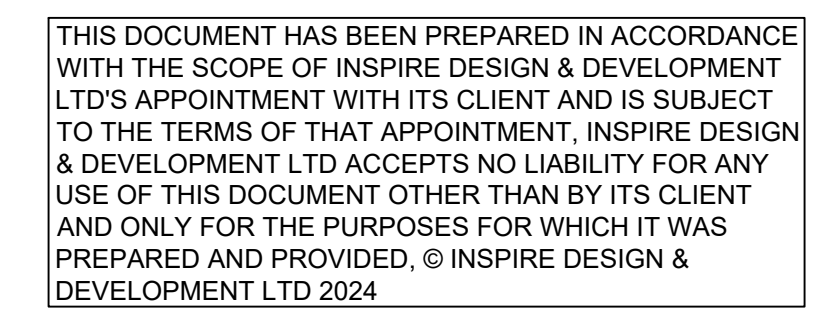
APPENDIX C DRAINAGE STRATEGY DRAWING



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
2313	CO	CO	122.84	225		VC	1.481851	1 in 33	
5204	VC	VC	122.84	225		VC	6.047706	1 in 33	
5102	125.97	CO	122.84	225		VC	62.02697	1 in 33	
5201	130.73	SW	128.63	225		VC	84.43379	1 in 33	
3104	123.82	CO	122.14	450		VC	53.41125	1 in 281	
6401	140.25	VC	137.22	225		VC	83.55747	1 in 31	
3314	CO	CO	150			VC	11.28187	1 in 31	
6214	CO	CO	150			VC	9.225163	1 in 24	
4112	128.57	SW	127.22	225		UN	34.54596	1 in 24	
3304	128.52	CO	123.13	300		CO	38.62966	1 in 180	
5101	127.21	SW	124.63	225		VC	28.16026	1 in 83	
6311	FO	FO	100			VC	22.84217	1 in 31	
6210	VC	VC	150			VC	15.57762	1 in 31	
6106	CO	CO	100			PF	18.53318	1 in 166	
7406	CO	CO	150			VC	20.37769	1 in 206	
2304	125.48	CO	123.31	200		VC	57.47657	1 in 171	
3101	124.72	CO	122.44	450		CO	41.45466	1 in 206	
4202	132.38	SW	129.55	225		VC	52.88667	1 in 171	
6302	CO	CO	0	225		VC	18.88154	1 in 31	
3202	125.09	CO	123.9	150		VC	12.20656	1 in 31	
4115	128.87	SW	0			UN	0.3689208	1 in 166	
6402	142.07	CO	140.21	225		VC	26.29477	1 in 166	
6407	CO	CO	150			VC	39.8257	1 in 280	
6217	CO	CO	150			VC	10.38363	1 in 280	
3103	123.67	CO	122.17	450		CO	8.494541	1 in 280	
5001	124.16	CO	121.04	600		CO	89.28666	1 in 280	
4107	128.89	CO	121.69	450		CO	12.707	1 in 254	
3304	129.71	CO	127.61	225		VC	49.65884	1 in 69	
7403	CO	CO	150			VC	38.18105	1 in 201	
4105	128.83	CO	121.72	450		CO	9.035317	1 in 720	
4114	129.21	SW	127.02	525		UN	7.159987	1 in 71	
3311	125.22	CO	124.36	150		VC	30.91666	1 in 71	
8401	CO	CO	150			VC	16.40287	1 in 71	
6001	CO	CO	0	600		VC	50.9902	1 in 71	
7318	FO	FO	100			VC	31.715	1 in 179	
3209	CO	CO	100			VC	6.794676	1 in 30	
6501	142.59	CO	139.6	300		VC	49.47727	1 in 206	
3205	124.12	CO	122.71	375		VC	31.84403	1 in 246	
7316	CO	CO	100			VC	19.77962	1 in 9	
3010	126.36	SW	120.69	150		UN	40.32331	1 in 9	
3404	122.66	CO	120.37	225		VC	34	1 in 179	
6111	CO	CO	150			VC	8.358182	1 in 30	
3401	126.36	SW	125.63	300		VC	91.23595	1 in 130	
6213	CO	CO	100			VC	20.47199	1 in 138	
7502	142.25	FO	141.12	150		PVC	33.25555	1 in 138	
6306	CO	CO	150			VC	22.50286	1 in 71	
7405	CO	CO	150			VC	12.42427	1 in 71	
4302	130.87	CO	125.86	225		VC	89.91656	1 in 71	
4402	132.04	SW	128.89	225		VC	28.15476	1 in 265	
3107	123.46	SW	122.22	300		UN	9.587879	1 in 137	
3307	126.45	CO	124.88	150		VC	8.468633	1 in 10	
4204	131.84	SW	127.15	525		UN	41.05666	1 in 513	
3106	123.57	SW	0			UN	0.2702629	1 in 513	
4304	CO	CO	0	225		VC	69.2315	1 in 89	
4201	CO	CO	127.62	300		VC	80.59266	1 in 89	
7314	CO	CO	150			VC	12.20593	1 in 34	
6201	135.59	FO	133.25	225		VC	18.78289	1 in 175	
6202	135.63	CO	134.25	225		VC	10.44021	1 in 175	
7303	139.37	CO	133.93	450		VC	49.0408	1 in 175	
3405	CO	CO	100			PVC	10.57144	1 in 191	
6105	CO	CO	150			VC	8.113223	1 in 117	
3105	124.65	SW	122.39	600		VC	83.42997	1 in 521	
6230	CO	CO	150			VC	7.166772	1 in 155	
4303	130.81	CO	129.11	150		VC	11.18034	1 in 155	
3305	129.09	CO	126.66	300		VC	17.02039	1 in 30	
2301	124.41	SW	121.02	300		VC	47.42362	1 in 137	
3201	126.32	CO	124.53	300		VC	23.5372	1 in 137	
4103	126.06	CO	121.95	450		VC	29.97428	1 in 300	
6104	CO	CO	100			VC	22.12554	1 in 117	
6110	CO	CO	150			VC	25.49229	1 in 117	
6204	134.57	CO	132.15	300		VC	77.12076	1 in 117	
4108	128.02	CO	121.49	300		VC	21.0302	1 in 117	
6219	CO	CO	150			VC	11.40588	1 in 118	
6305	CO	CO	150			VC	35.35233	1 in 118	
3302	131.13	CO	129.36	150		VC	6.703054	1 in 118	
4109	128.94	CO	0			UN	6.401344	1 in 118	
6207	CO	CO	100			VC	10.00156	1 in 226	
5111	CO	CO	150			VC	8.261626	1 in 226	
7501	142.41	CO	139.31	300		VC	106.3203	1 in 226	
6103	CO	CO	150			VC	17.11239	1 in 118	
7410	CO	CO	150			VC	10.48514	1 in 118	
7401	142.79	CO	140.82	225		VC	60.40685	1 in 118	
6206	CO	CO	100			VC	15.75202	1 in 118	
7306	CO	CO	150			VC	20.83036	1 in 118	
3306	126.55	CO	125.05	150		VC	7.610773	1 in 118	
6301	141.02	CO	138.78	300		VC	113	1 in 231	
5011	CO	CO	150			VC	23.67817	1 in 37	
7404	CO	CO	150			VC	13.2453	1 in 37	
5401	136.02	SW	133.16	225		VC	72.43038	1 in 37	
6305	CO	CO	100			VC	21.95093	1 in 37	
3310	126.73	CO	125.1	150		VC	14.14214	1 in 37	
4305	136.18	CO	128	150		VC	2.236066	1 in 37	
6218	CO	CO	150			VC	15.589	1 in 37	
6228	CO	CO	100			VC	11.57888	1 in 37	
7002	CO	CO	0	225		VC	57.31462	1 in 148	
7302	140.03	CO	138.29	300		VC	17.72005	1 in 148	
7202	135.29	CO	130.08	450		VC	38.20995	1 in 212	
7301	141.02	SW	139.29	225		VC	35.12834	1 in 39	
7207	CO	CO	150			VC	27.76678	1 in 25	
4101	131.11	CO	127.46	225		VC	2.236068	1 in 25	
3216	127.82	SW	128.47	150		UN	58.9927	1 in 25	
6309	CO	CO	225			VC	21.72583	1 in 25	
6224	FO	FO	100			VC	18.4165	1 in 817	
4113	131.32	SW	127.07	525		UN	40.85127	1 in 817	
5202	127.34	CO	125.27	225		VC	56.88885	1 in 55	
4110	126.44	SW	124.11	600		UN	20.22145	1 in 506	
3102	124.27	CO	122.3	450		VC	40.32373	1 in 310	
6403	140.67	CO	139.55	225		VC	30.35445	1 in 607	
6404	140.36	SW	139.61	225		VC	5.656854	1 in 94	
4401	132.52	SW	129.92	300		VC	106.3015	1 in 31	
6205	CO	CO	150			VC	20.18107	1 in 64	
6204	133.19	SW	129.73	225		VC	57.48913	1 in 177	
7003	124.07	CO	120.13	600		CO	46.64346	1 in 177	
4301	131.88	CO	128.72	225		VC	26.83282	1 in 113	
6405	143.38	CO	139.39	225		VC	57.87054	1 in 113	
7305	CO	CO	100			VC	9.379339	1 in 5	
4102	129.74	CO	126.69	300		CO	24.1921	1 in 5	
6007	CO	CO	100			PF	7.220846	1 in 217	
6220	CO	CO	121.38	600		VC	13.62927	1 in 217	
5103	126.77	CO	121.38	600		VC	71.67468	1 in 33	
6307	CO	CO	123.1	150		VC	13.23467	1 in 195	
5002	CO	CO	0	225		VC	4.123106	1 in 195	
5105	126.82	CO	124.77	300		VC	45.35416	1 in 33	
6203	CO	CO	150			VC	35.1141	1 in 195	
6208	132.16	CO	130.21	225		VC	38.33984	1 in 193	
4009	125.24	SW	123.89	150		VC	34.78955	1 in 193	
3309	126.2	CO	124.64	150		VC	63.3173	1 in 19	
6303	CO	CO	0	225		VC	4	1 in 33	
4104	127.32	CO	121.85	450		VC	13.18255	1 in 275	
6205	127.46	CO	125.54	150		VC	35.7648	1 in 32	
6107	CO	CO	100			PF	8.413028	1 in 289	
6101	124.96	SW	122.83	225		VC	43.41659	1 in 63	
3402	131.19	SW	129.69	150		UN	13.92839	1 in 66	
4111	127.11	SW	125.76	225		UN	87.73544	1 in 28	
6212	CO	CO	225			VC	5.517274	1 in 28	
2303	125.47	CO	123.47	150		VC	4.472136	1 in 289	
3206	123.81	CO	122.58	450		CO	40.42694	1 in 289	
3301	131.16	CO	128.47	150		VC	3.162278	1 in 130	
7402	142.85	CO	139.03	300		CO	39.21734	1 in 157	
7001	126.25	CO	124.64	225		VC	69.27216	1 in 155	
7203	131.39	SW	129.97	225		VC	35.05709	1 in 185	
7409	CO	CO	150			VC	11.55051	1 in 185	
8504	CO	CO	0			UN	6.843242	1 in 130	
7408	CO	CO	150			VC	16.97377	1 in 130	
7201	134	CO	129.71	300		VC	61.0062	1 in 130	
5104									



1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METERS UNLESS OTHERWISE STATED.
3. DRAWING NOT ISSUED FOR CONSTRUCTION.
4. SITE LAYOUT PROVIDED BY BTP ARCHITECTS DWG No. BR-BTP-00-SP-A-4299-107.2
5. LOCATION OF SVPS TO BE CONFIRMED BY THE ARCHITECT
6. PROPOSED EXTERNAL WORKS LEVELS TO BE CONFIRMED AT DETAILED DESIGN
7. OUTFALL INVERT LEVELS TO BE CONFIRMED & REPORTED BACK TO INSPIRE DESIGN & DEVELOPMENT

FFL 134.40	PROPOSED FINISH FLOOR LEVEL
132.06 +	EXISTING SPOT LEVEL

LEGEND

	PUBLIC COMBINED DRAINAGE
	PUBLIC FOUL DRAINAGE
	PUBLIC SURFACE WATER DRAINAGE
PROPOSED	
	PRIVATE SURFACE WATER DRAINAGE
	PRIVATE FOUL DRAINAGE
	PRIVATE FOUL RISING MAIN
	PRIVATE COMBINED DRAINAGE
	CHANNEL DRAIN
	GULLY
	SOAKAWAY CRATES

DRAWING STATUS:

CLIENT



DRAWING TITLE

DRAWN	CHECKED	APPROVED
NGP	CGR	CR

DATE	SCALE @ A1
26/06/24	1:250
DRAWING No.	REVISION No.
BDL-1763-01-DR-001	P2

APPENDIX D HYDRAULIC CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	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)	2.000
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	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
P18	0.009	5.00	133.800	450	383622.218	410284.373	0.560
P19	0.007	5.00	133.400	450	383616.659	410284.403	0.760
P20	0.007	5.00	133.200	450	383609.013	410282.708	0.760
P21	0.008	5.00	132.890	450	383606.049	410281.717	0.760
P22	0.009	5.00	132.500	450	383596.473	410279.450	0.660
P23	0.009	5.00	132.200	450	383590.826	410278.369	0.910
6	0.000		133.500	450	383617.044	410283.090	1.000
7	0.000		133.000	450	383606.345	410280.486	1.350
8	0.000		132.300	1200	383592.246	410277.056	1.600
OUTFALL			132.000		383595.540	410262.640	2.506

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)
1.000	P18	6	5.331	0.600	133.240	132.500	0.740	7.2	100	5.09	50.0
2.000	P19	6	1.368	0.600	132.640	132.500	0.140	9.8	100	5.01	50.0
3.000	P20	7	3.472	0.600	132.440	132.000	0.440	7.9	100	5.03	50.0
4.000	P21	7	1.266	0.600	132.130	132.000	0.130	9.7	100	5.01	50.0
5.000	P22	8	4.858	0.600	131.840	131.050	0.790	6.1	100	5.03	50.0
6.000	P23	8	1.934	0.600	131.290	131.050	0.240	8.1	100	5.01	50.0
1.001	6	7	11.011	0.600	132.500	132.000	0.500	22.0	100	5.27	50.0
1.002	7	8	14.510	0.600	131.650	130.750	0.900	16.1	450	5.51	50.0
1.003	8	OUTFALL	14.788	0.600	130.700	129.494	1.206	12.3	150	5.76	50.0

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)
1.000	2.898	22.8	1.6	0.460	0.900	0.009	0.0	18	1.689
2.000	2.487	19.5	1.3	0.660	0.900	0.007	0.0	18	1.410
3.000	2.769	21.7	1.3	0.660	0.900	0.007	0.0	16	1.481
4.000	2.491	19.6	1.4	0.660	0.900	0.008	0.0	18	1.451
5.000	3.138	24.6	1.6	0.560	1.150	0.009	0.0	18	1.780
6.000	2.740	21.5	1.6	0.810	1.150	0.009	0.0	18	1.596
1.001	1.652	13.0	2.9	0.900	0.900	0.016	0.0	32	1.338
1.002	5.082	808.2	5.6	0.900	1.100	0.031	0.0	26	1.485
1.003	2.892	51.1	8.9	1.450	2.356	0.049	0.0	42	2.169

Pipeline Schedule

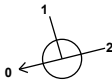
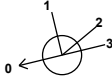
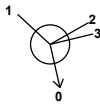
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.331	7.2	100	Circular	133.800	133.240	0.460	133.500	132.500	0.900
2.000	1.368	9.8	100	Circular	133.400	132.640	0.660	133.500	132.500	0.900
3.000	3.472	7.9	100	Circular	133.200	132.440	0.660	133.000	132.000	0.900
4.000	1.266	9.7	100	Circular	132.890	132.130	0.660	133.000	132.000	0.900
5.000	4.858	6.1	100	Circular	132.500	131.840	0.560	132.300	131.050	1.150
6.000	1.934	8.1	100	Circular	132.200	131.290	0.810	132.300	131.050	1.150
1.001	11.011	22.0	100	Circular	133.500	132.500	0.900	133.000	132.000	0.900
1.002	14.510	16.1	450	Circular	133.000	131.650	0.900	132.300	130.750	1.100
1.003	14.788	12.3	150	Circular	132.300	130.700	1.450	132.000	129.494	2.356

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	P18	450	Manhole	Adoptable	6	450	Manhole	Adoptable
2.000	P19	450	Manhole	Adoptable	6	450	Manhole	Adoptable
3.000	P20	450	Manhole	Adoptable	7	450	Manhole	Adoptable
4.000	P21	450	Manhole	Adoptable	7	450	Manhole	Adoptable
5.000	P22	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
6.000	P23	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.001	6	450	Manhole	Adoptable	7	450	Manhole	Adoptable
1.002	7	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.003	8	1200	Manhole	Adoptable	OUTFALL		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
P18	383622.218	410284.373	133.800	0.560	450				
						0	1.000	133.240	100
P19	383616.659	410284.403	133.400	0.760	450				
						0	2.000	132.640	100
P20	383609.013	410282.708	133.200	0.760	450				
						0	3.000	132.440	100
P21	383606.049	410281.717	132.890	0.760	450				
						0	4.000	132.130	100
P22	383596.473	410279.450	132.500	0.660	450				
						0	5.000	131.840	100
P23	383590.826	410278.369	132.200	0.910	450				
						0	6.000	131.290	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
6	383617.044	410283.090	133.500	1.000	450		1	2.000	132.500	100
							2	1.000	132.500	100
							0	1.001	132.500	100
7	383606.345	410280.486	133.000	1.350	450		1	4.000	132.000	100
							2	3.000	132.000	100
							3	1.001	132.000	100
							0	1.002	131.650	450
8	383592.246	410277.056	132.300	1.600	1200		1	6.000	131.050	100
							2	5.000	131.050	100
							3	1.002	130.750	450
							0	1.003	130.700	150
OUTFALL	383595.540	410262.640	132.000	2.506			1	1.003	129.494	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
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)	0.0
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	40	0	0

Node 8 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.4		
Invert Level (m)	130.700	Diameter (m)	0.030		

Node P18 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.5		
Invert Level (m)	133.240	Diameter (m)	0.017		

Node P19 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	132.640	Diameter (m)	0.024		

Node P20 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	132.440	Diameter (m)	0.024		

Node P21 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.2		
Invert Level (m)	132.130	Diameter (m)	0.026		

Node P22 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	131.840	Diameter (m)	0.025		

Node P18 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	133.240
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	182

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	11.0	0.0	0.450	11.0	0.0	0.451	0.0	0.0

Node P19 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.640
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	45

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.440
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	45

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P21 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	132.130
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	47

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	5.2	0.0	0.450	5.2	0.0	0.451	0.0	0.0

Node P22 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	131.840
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	64

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	7.1	0.0	0.450	7.1	0.0	0.451	0.0	0.0

Node P23 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	131.290
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	164

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	15.5	0.0	0.450	15.5	0.0	0.451	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	P18	84	133.322	0.082	0.7	0.9119	0.0000	OK
30 minute summer	P19	23	132.721	0.080	1.1	0.4313	0.0000	OK
30 minute summer	P20	23	132.521	0.080	1.1	0.4313	0.0000	OK
30 minute summer	P21	23	132.222	0.092	1.3	0.4922	0.0000	OK
60 minute summer	P22	40	131.926	0.086	1.1	0.6249	0.0000	OK
15 minute summer	P23	12	131.308	0.018	1.6	0.2798	0.0000	OK
60 minute summer	6	42	132.513	0.013	0.5	0.0021	0.0000	OK
60 minute summer	7	41	131.663	0.013	1.2	0.0021	0.0000	OK
120 minute summer	8	92	131.181	0.481	2.0	0.5438	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	129.494	0.000	1.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute summer	P18	Orifice	6	0.2				
30 minute summer	P19	Orifice	6	0.3				
30 minute summer	P20	Orifice	7	0.3				
30 minute summer	P21	Orifice	7	0.4				
60 minute summer	P22	Orifice	8	0.4				
15 minute summer	P23	6.000	8	1.3	1.431	0.060	0.0017	
60 minute summer	6	1.001	7	0.5	0.774	0.036	0.0066	
30 minute summer	7	1.002	8	1.2	0.646	0.001	0.9884	
120 minute summer	8	Orifice	OUTFALL	1.3				8.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	P18	96	133.445	0.205	1.2	2.2833	0.0000	SURCHARGED
60 minute summer	P19	42	132.865	0.225	2.0	1.2076	0.0000	SURCHARGED
60 minute summer	P20	42	132.665	0.225	2.0	1.2076	0.0000	SURCHARGED
60 minute summer	P21	41	132.375	0.245	2.3	1.3147	0.0000	SURCHARGED
60 minute summer	P22	43	132.070	0.230	2.6	1.6717	0.0000	SURCHARGED
120 minute winter	P23	124	131.510	0.220	1.6	3.4461	0.0000	SURCHARGED
60 minute summer	6	44	132.517	0.017	0.8	0.0027	0.0000	OK
60 minute summer	7	43	131.667	0.017	2.0	0.0027	0.0000	OK
120 minute winter	8	124	131.510	0.810	3.1	0.9162	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	129.494	0.000	1.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	P18	Orifice	6	0.3				
60 minute summer	P19	Orifice	6	0.6				
60 minute summer	P20	Orifice	7	0.6				
60 minute summer	P21	Orifice	7	0.7				
60 minute summer	P22	Orifice	8	0.6				
30 minute summer	P23	6.000	8	3.5	1.799	0.163	0.0151	
60 minute summer	6	1.001	7	0.8	0.910	0.062	0.0098	
60 minute summer	7	1.002	8	2.0	0.630	0.003	1.1630	
120 minute winter	8	Orifice	OUTFALL	1.7				18.2

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	P18	112	133.646	0.406	2.1	4.5259	0.0000	FLOOD RISK
60 minute summer	P19	44	133.119	0.479	3.7	2.4188	0.0000	FLOOD RISK
60 minute summer	P20	44	132.919	0.479	3.7	2.4188	0.0000	FLOOD RISK
60 minute summer	P21	42	132.837	0.706	4.3	2.4549	0.0000	FLOOD RISK
60 minute summer	P22	45	132.339	0.499	4.8	3.2779	0.0000	FLOOD RISK
180 minute winter	P23	176	132.119	0.829	2.4	7.1145	0.0000	FLOOD RISK
60 minute summer	6	44	132.521	0.021	1.2	0.0033	0.0000	OK
180 minute winter	7	176	132.119	0.469	2.6	0.0745	0.0000	SURCHARGED
180 minute winter	8	176	132.120	1.420	3.4	1.6056	0.0000	FLOOD RISK
15 minute summer	OUTFALL	1	129.494	0.000	1.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	P18	Orifice	6	0.4				
60 minute summer	P19	Orifice	6	0.8				
60 minute summer	P20	Orifice	7	0.8				
60 minute summer	P21	Orifice	7	1.2				
60 minute summer	P22	Orifice	8	0.9				
15 minute summer	P23	6.000	8	7.3	2.091	0.339	0.0151	
60 minute summer	6	1.001	7	1.2	1.015	0.091	0.0128	
60 minute summer	7	1.002	8	3.2	0.639	0.004	1.7669	
180 minute winter	8	Orifice	OUTFALL	2.2				36.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.600	Minimum Backdrop Height (m)	0.200
Ratio-R	0.259	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Circular Default Sewer Type Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
1	0.039	5.00	133.000	383438.711	410410.997	1.900
2			133.000	383438.377	410414.643	2.000

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)
1.000	1	2	3.661	0.600	131.100	131.000	0.100	36.6	225	5.03	50.0

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)
1.000	2.169	86.2	7.4	1.675	1.775	0.039	0.0	44	1.339

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.661	36.6	225	Circular_Default Sewer Type	133.000	131.100	1.675	133.000	131.000	1.775

Link	US Node	Node Type	DS Node	Node Type
1.000	1	Junction	2	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
1	383438.711	410410.997	133.000	1.900				
						0	1.000	131.100
2	383438.377	410414.643	133.000	2.000	1	1.000	131.000	225
								

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.600	Drain Down Time (mins)	240
Ratio-R	0.259	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	10	0

Node 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00360	Invert Level (m)	131.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00360	Time to half empty (mins)	10245	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	22.000		

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
5760 minute winter	1	4320	131.177	0.077	1.3	0.0000	0.0000	OK
5760 minute winter	2	4320	131.177	0.177	1.2	14.7979	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
5760 minute winter	1	1.000	2	1.2	0.578	0.014	0.0833
5760 minute winter	2	Infiltration		0.0			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	1	5340	131.377	0.277	0.3	0.0000	0.0000	SURCHARGED
5760 minute winter	2	5340	131.377	0.377	2.5	31.4959	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
5760 minute winter	1	1.000	2	2.5	0.578	0.029	0.1456
5760 minute winter	2	Infiltration		0.1			

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	1	9600	131.789	0.689	0.7	0.0000	0.0000	SURCHARGED
10080 minute winter	2	9600	131.789	0.789	0.8	65.9962	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
10080 minute winter	1	1.000	2	0.8	0.578	0.010	0.1456
10080 minute winter	2	Infiltration		0.1			

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.600	Minimum Backdrop Height (m)	0.200
Ratio-R	0.259	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Circular Default Sewer Type Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
1	0.110	5.00	133.000	383438.711	410410.997	2.330
2			133.000	383438.377	410414.643	2.400

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)
1.000	1	2	3.661	0.600	130.670	130.600	0.070	52.3	225	5.03	50.0

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)
1.000	1.812	72.1	20.9	2.105	2.175	0.110	0.0	83	1.578

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.661	52.3	225	Circular_Default Sewer Type	133.000	130.670	2.105	133.000	130.600	2.175

Link	US Node	Node Type	DS Node	Node Type
1.000	1	Junction	2	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)	
1	383438.711	410410.997	133.000	2.330					
						0	1.000	130.670	225
2	383438.377	410414.643	133.000	2.400		1	1.000	130.600	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.600	Drain Down Time (mins)	240
Ratio-R	0.259	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	10	0

Node 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Invert Level (m)	130.600	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.03600	Time to half empty (mins)	1432	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.500	Number Required	1
Porosity	0.95	Pit Length (m)	20.000		

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	1	705	130.796	0.125	3.8	0.0000	0.0000	OK
960 minute winter	2	690	130.795	0.195	8.0	16.6424	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
960 minute winter	1	1.000	2	8.0	0.703	0.111	0.1084
960 minute winter	2	Infiltration		0.5			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	1	780	131.104	0.434	4.5	0.0000	0.0000	SURCHARGED
960 minute winter	2	780	131.104	0.504	8.9	43.0661	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
960 minute winter	1	1.000	2	8.9	0.735	0.124	0.1456
960 minute winter	2	Infiltration		0.6			

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1320	131.770	1.100	7.9	0.0000	0.0000	SURCHARGED
1440 minute winter	2	1320	131.770	1.170	4.3	100.0460	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
1440 minute winter	1	1.000	2	-6.0	0.756	-0.083	0.1456
1440 minute winter	2	Infiltration		0.7			

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.600	Minimum Backdrop Height (m)	0.200
Ratio-R	0.259	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Circular Default Sewer Type Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
1	0.098	5.00	132.000	383438.711	410410.997	1.900
2			132.000	383438.377	410414.643	2.000

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)
1.000	1	2	3.661	0.600	130.100	130.000	0.100	36.6	225	5.03	50.0

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)
1.000	2.169	86.2	18.6	1.675	1.775	0.098	0.0	71	1.739

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.661	36.6	225	Circular_Default Sewer Type	132.000	130.100	1.675	132.000	130.000	1.775

Link	US Node	Node Type	DS Node	Node Type
1.000	1	Junction	2	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
1	383438.711	410410.997	132.000	1.900				
						0	1.000	130.100
2	383438.377	410414.643	132.000	2.000	1	1.000	130.000	225
								

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.600	Drain Down Time (mins)	240
Ratio-R	0.259	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	10	0

Node 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00360	Invert Level (m)	130.000	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.00360	Time to half empty (mins)	15935	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	13.000	Number Required	1
Porosity	0.95	Pit Length (m)	12.000		

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	1	9360	130.294	0.194	1.5	0.0000	0.0000	OK
10080 minute winter	2	9360	130.294	0.294	2.8	43.5744	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
10080 minute winter	1	1.000	2	2.8	0.645	0.032	0.1395
10080 minute winter	2	Infiltration		0.1			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
8640 minute winter	1	8400	130.550	0.450	2.6	0.0000	0.0000	SURCHARGED
8640 minute winter	2	8400	130.550	0.550	3.7	81.4383	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)
8640 minute winter	1	1.000	2	3.7	0.645	0.042	0.1456
8640 minute winter	2	Infiltration		0.1			

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	1	9420	131.171	1.071	1.5	0.0000	0.0000	SURCHARGED
10080 minute winter	2	9420	131.171	1.171	1.3	173.6073	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
10080 minute winter	1	1.000	2	1.3	0.645	0.015	0.1456
10080 minute winter	2	Infiltration		0.1			

APPENDIX E SIMPLE INDEX APPROACH

SIMPLE INDEX APPROACH: TOOL



HRW shall not be liable for any direct or indirect damage claims, loss, cost, expense or liability whatsoever arising out of the use or impossibility to use the tool, even when HRW has been informed of the possibility of this claim. The user hereby indemnifies HRW from and against any damage claim, loss, expense or liability resulting from any action taken against HRW that is related in any way to the use of the tool or any reliance made in respect of the output of such use by any person whatsoever. HRW does not guarantee that the tool's functions meet the requirements of any person, nor that the tool is free from errors.

- The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).
- The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.
- Relevant design examples are included in the SuDS Manual Appendix C.
- Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST	RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
USER ENTRY	USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL.

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

Runoff Area Land Use Description	Hazard Level	Pollution Hazard Indices		
		1 use suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable):				
Residential parking	Low	0.5	0.4	0.4
Landuse Pollution Hazard Index		Low	0.5	0.4

DESIGN CONDITIONS	
1	2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

SuDS Component Description		Pollution Mitigation Indices		
		Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component from the drop down list):				
Proprietary treatment system	Enter User Defined Indices in row below			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list:				
None				
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list:				
None				
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:		SuDS Component 1		
		0.8	0.6	0.7
Aggregated Surface Water Pollution Mitigation Index		0.8	0.6	0.7

DESIGN CONDITIONS		
1	2	3
Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of design indices. Error indices approved by the environmental regulator in appropriate 'User Defined Indices' row below	SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. WAT-RMA-08 (SEPA, 2014) also provides a flow chart with a summary of checks on suitability of a proprietary system.	See Chapter 15 Proprietary treatment systems for approaches to demonstrate product performance. Note: a British Water Environment Agency assessment Code of Practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at http://www.britishwater.co.uk/Publications/code-of-practice.aspx

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes? [Go to Step 2B](#)
No? [Go to Step 2C](#)

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

Select type of groundwater protection from the drop down list:		Pollution Mitigation Indices		
		Total Suspended Solids	Metals	Hydrocarbons
None				
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
Groundwater Protection Pollution Mitigation Index		0	0	0

DESIGN CONDITIONS			
1	2	3	4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

Combined Pollution Mitigation Indices for the Runoff Area	Combined Pollution Mitigation Indices		
	Total Suspended Solids	Metals	Hydrocarbons
	0.8	0.6	0.7

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater (an additional treatment component (ie near and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices		
Total Suspended Solids	Metals	Hydrocarbons
Sufficient	Sufficient	Sufficient

DESIGN CONDITIONS

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England.

APPENDIX F FLOOD MAP FOR PLANNING

Flood map for planning

Your reference
Site 1

Location (easting/northing)
383475/410403

Created
1 Jul 2024 15:01

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

Flood map for planning

Your reference

Site 1

Location (easting/northing)

383475/410403

Scale

1:2500

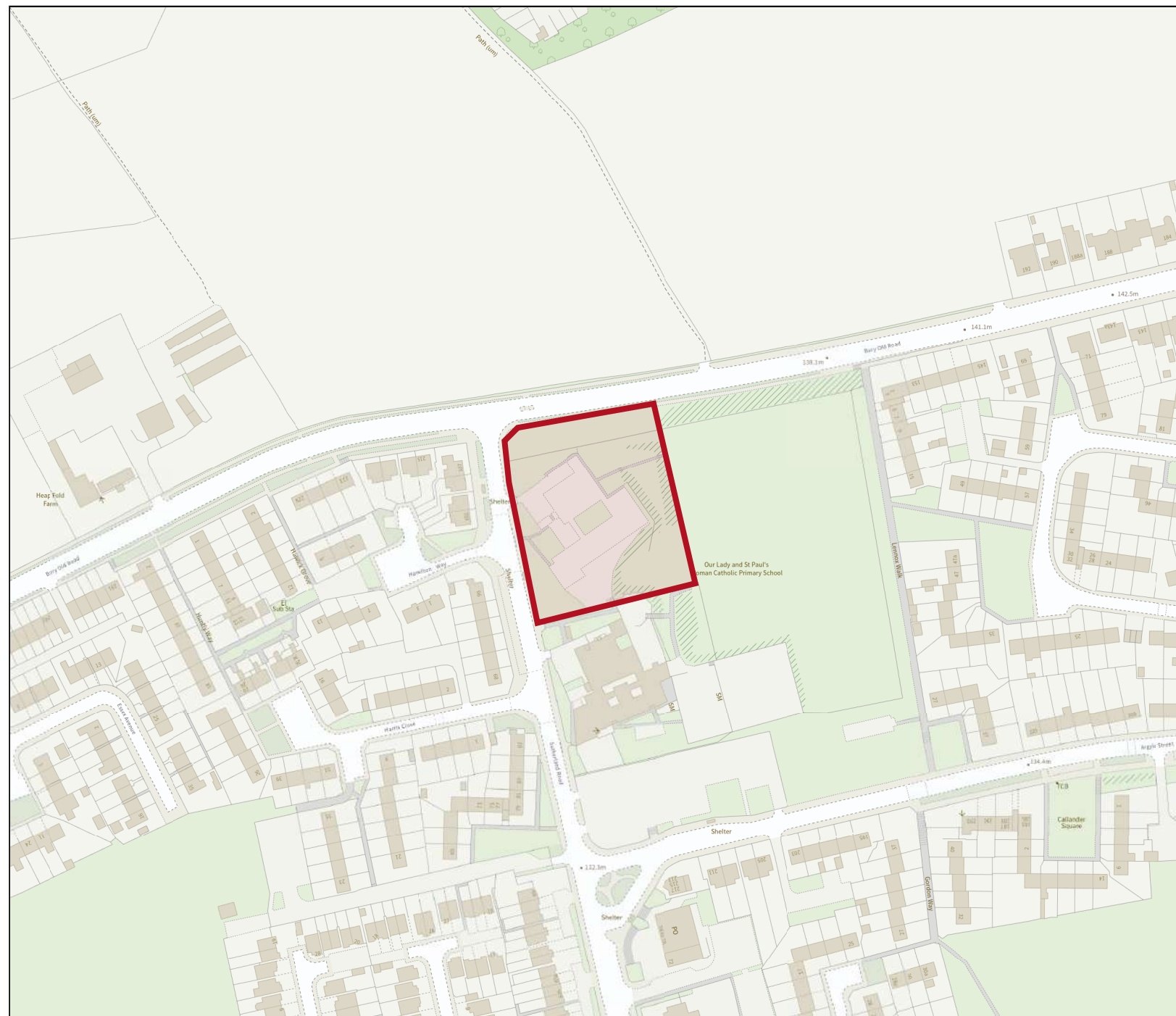
Created

1 Jul 2024 15:01

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

0 20 40 60m

Page 2 of 2



Flood map for planning

Your reference
Site 2

Location (easting/northing)
383599/410296

Created
1 Jul 2024 15:02

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

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Flood map for planning

Your reference

Site 2

Location (easting/northing)

383599/410296

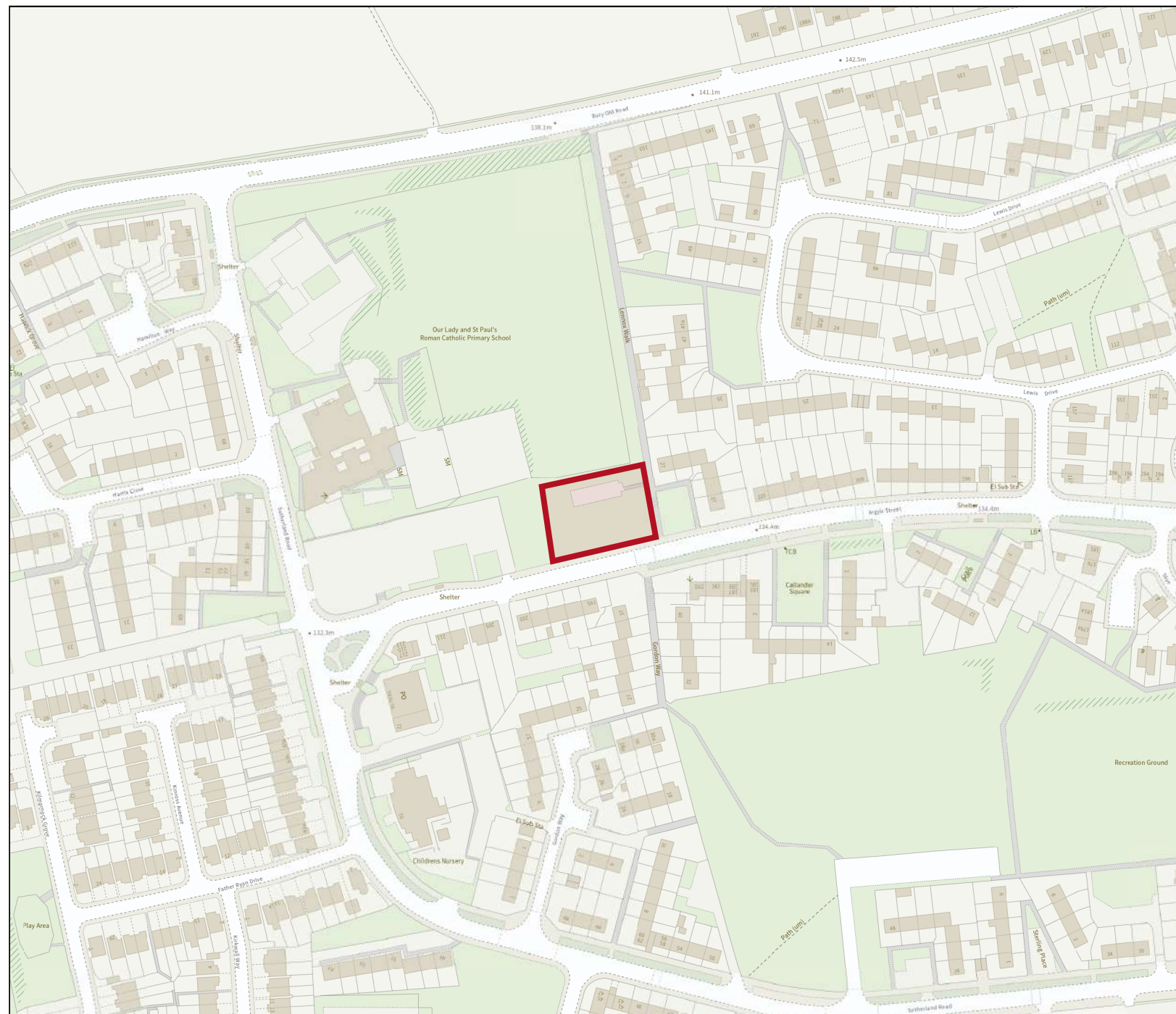
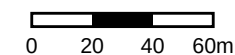
Scale

1:2500

Created

1 Jul 2024 15:02

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



APPENDIX G INFILTRATION TEST RESULTS

Our Ref: 1029/6544/G
Your Ref: 1763
Date: 29th October 2024

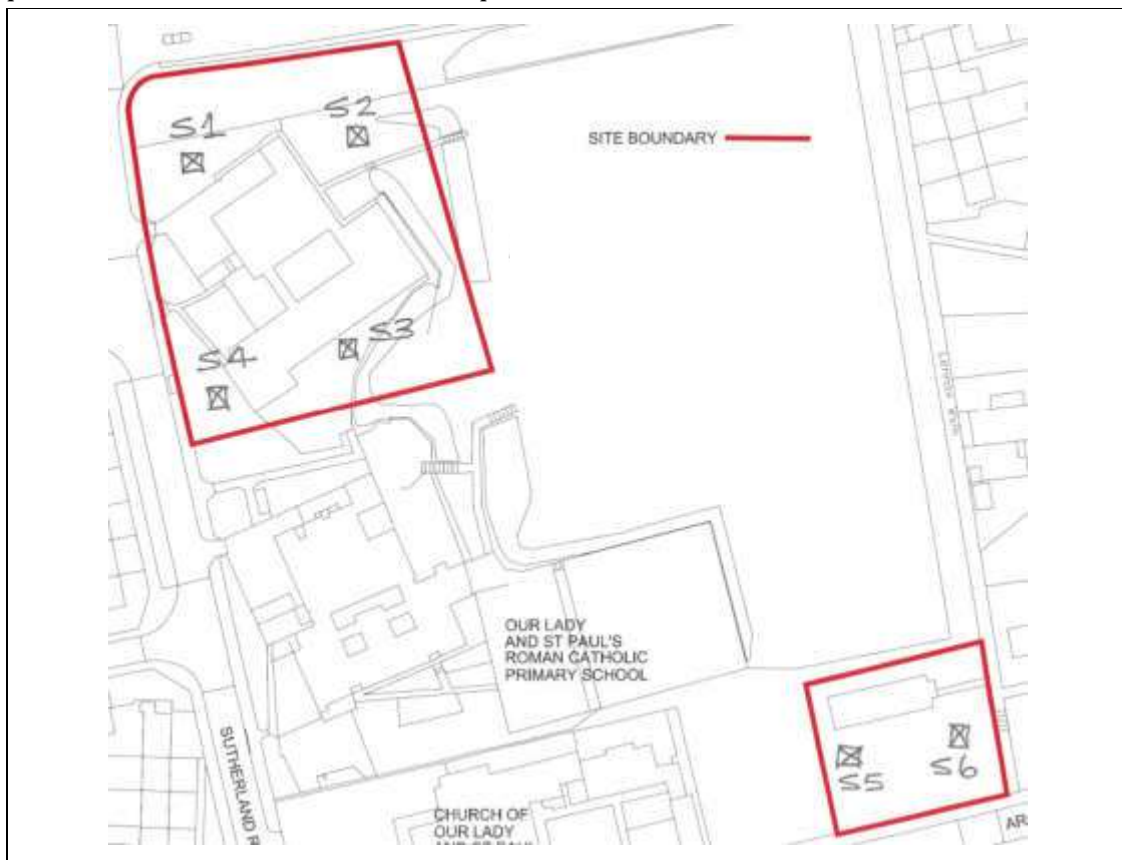
Built Development
c/o Inspire Design
Unit 2A
Church View Business Park
Coney Green Rd
Chesterfield S45 9HA



Humberside Materials Laboratory LTD
Atherton Way, Brigg
North Lincs DN20 8AR
Tel & fax 01652 652753
Email: info@humbersidematerialslab.co.uk

Dear Steven
1763 Sutherland Road, Heywood

Further to your instruction Humberside Materials Laboratory (HML) were engaged to undertake a site investigation within a proposed development off Sutherland Road, Heywood. The site investigation included six trial pits (S1 to S6) over two areas to assess the sites potential capacity for underground drainage via soakaway testing. Soakaway testing was undertaken within all six trial pits. All test locations were selected and positioned by the on-site HML engineer with reference to the supplied plan; locations are indicated on the plan below.



Trial pits

The trial pits were excavated by a tracked excavator utilising a 300mm width bucket. Encountered strata was logged on site as the trial pits advanced. Encountered strata is summarised within table 1 below. Photographs are enclosed.

Table 1: Summary of revealed ground conditions						
Strata descriptions	Exploratory hole					
	S1	S2	S3	S4	S5	S6
	Depth to base of stratum (m bgl)					
Dark brown to brown sandy (and clayey in S3 & S4) TOPSOIL with many rootlets (and roots in S1)	0.20	0.20	0.19	0.17	0.25	0.20
Orange brown slightly silty fine to medium SAND						0.45
Brown slightly silty fine to coarse SAND with occasional fine to coarse gravels of natural stone and rare coarse fragments of tar					0.75	
Brown clayey fine SAND	1.0					
Brown to dark brown clayey fine to coarse SAND with occasional Fine to coarse gravels of natural stone)and rare cobbles of natural stone in S4)				1.00		1.00
Orange brown slightly silty fine to medium SAND		1.25				
Light brown to brown silty fine SAND with pockets of stiff brown, grey mottled SILT/CLAY	1.90		1.90			2.10
Light brown to brown slightly silty fine to medium SAND (with very occasional fine to medium gravels in S2 & S4)		1.90		1.90	1.90	
Notes: Side of pit appeared very moist from 1.3m to 1.4m below ground level, possible very slight ingress						

Soakaway testing

Soakaway testing was completed within all excavated trial pits (S1 to S6), as per guidance within BRE Digest 365. A single sized 20mm gravel and slotted water pipe was placed within each pipe to prevent trial pit collapse during water placement, an air void quantity of 50% has been calculated from a sample of the 20mm gravel.

Trial pit 1 (S1) was excavated to 1.90m below ground level (bgl) with a width of 0.35m and a length of 1.60m. Water was introduced to the pit and monitored against time elapsed, this included three consecutive fills. Calculations show infiltration rates ranging from $1.71 \times 10^{-6} \text{m/s}$ to $9.76 \times 10^{-7} \text{m/s}$ with an effective test depth from 1.28m to 1.90m bgl. Individual test report enclosed.

Trial pit 2 (S2) was excavated to 1.90m below ground level (bgl) with a width of 0.35m and a length of 1.50m. Water was introduced to the pit and monitored against time elapsed, this included three consecutive fills. Calculations show infiltration

rates ranging from $2.01 \times 10^{-5} \text{m/s}$ to $9.43 \times 10^{-6} \text{m/s}$ with an effective test depth from 1.28m to 1.90m bgl. Individual test report enclosed.

Trial pit 3 (S3) was excavated to 1.90m below ground level (bgl) with a width of 0.35m and a length of 1.40m. Water was introduced to the pit and monitored against time elapsed, this included three consecutive fills. Calculations show infiltration rates ranging from $1.04 \times 10^{-6} \text{m/s}$ to $7.90 \times 10^{-7} \text{m/s}$ with an effective test depth from 1.15m to 1.90m bgl. Individual test report enclosed.

Trial pit 4 (S4) was excavated to 2.00m below ground level (bgl) with a width of 0.35m and a length of 1.40m. Water was introduced to the pit and monitored against time elapsed, this included three consecutive fills. Calculations show infiltration rates ranging from $2.39 \times 10^{-5} \text{m/s}$ to $1.77 \times 10^{-5} \text{m/s}$ with an effective test depth from 1.25m to 2.00m bgl. Individual test report enclosed.

Trial pit 5 (S5) was excavated to 1.90m below ground level (bgl) with a width of 0.35m and a length of 1.40m. Water was introduced to the pit and monitored against time elapsed, this included three consecutive fills. Calculations show infiltration rates ranging from $9.54 \times 10^{-5} \text{m/s}$ to $3.37 \times 10^{-5} \text{m/s}$ with an effective test depth from 1.27m to 1.90m bgl. Individual test report enclosed.

Trial pit 6 (S6) was excavated to 2.10m below ground level (bgl) with a width of 0.35m and a length of 1.50m. Water was introduced to the pit and monitored against time elapsed with an initial water depth of 1.49m bgl. The water level was monitored various times over a 130minute period with a final water level of 1.47m bgl recorded. With no drop in water level encountered over the test pits monitored period this test location was abandoned and deemed unsuitable for soakaways.

Summary

The encountered strata within the excavated trial pits appears to have identified two separate materials within the soakaway effective test depth ranges. S1, S3 and S6 has identified a silty sand with pockets of silt/clay were as S2, S4 and S5 have identified a slightly silty sand with gravels. These slightly differing material descriptions have given differing infiltration rates with trial pit S6 not providing any infiltration which may have been due to the encountered ingress.

For potential soakaway assessment and or design the following points may be considered.

- Exact locations of differing soil description noted above. Evidence of previous boreholes on site which could be utilised along with trial pit logs to identify soil areas, pockets of silt/clay may not have been easily identified within borehole and may have been logged as layers or bands
- Trial pits S1 to S4 are within a area separate from trial pits S5 and S6, each area may require its own assessment although soil description appear comparable between the two areas
- Trial pits S1 and S3, relatively slow infiltration encountered with a possible design rate of $7.90 \times 10^{-07} \text{m/s}$ within the silty sand with silt/clay pockets layer
- Trial pits S2, S4 and S5, reasonable infiltration encountered with a possible design rate of $9.43 \times 10^{-06} \text{m/s}$ within the slightly silty sand with gravels layer
- Trial pit S6, no infiltration achieved

If you require any further information, please contact the laboratory.

Yours Sincerely

D. Driver *Director*

*Enclosed: Photographs
 Soakaway test reports*



Trial Pit S1 – after excavations



Trial Pit S1 – excavated spoil



Trial Pit S2 – after excavations



Trial Pit S2 – excavated spoil



Trial Pit S3 – after excavations



Trial Pit S3 – excavated spoil



Trial Pit S4 – after excavations



Trial Pit S4 – excavated spoil



Trial Pit S5 – after excavations



Trial Pit S5 – excavated spoil



Trial Pit S6 – after excavations



Trial Pit S6 – excavated spoil

HUMBERSIDE MATERIALS LABORATORY LTD

Atherton Way, Brigg
North Lincolnshire DN20 8AR
Tel & Fax 01652 652753

DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/73092/01

Client Build Developments c/o Inspire Design

Site 1763 Sutherland Road, Heywood

Location S1

Date tested 23/10/2024

Determined by D. Driver (HML)

Soil type Silty fine sand with pockets of silt/clay

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

Calculation Data			
Soakaway pit No	S1		
Anticipated invert level	Unknown		
Pit Dimensions (l x w x d) (m)	1.60	0.35	1.90
Effective Depth (75% - 25%)	Determination 1	0.300	m
	Determination 2	0.310	m
	Determination 3	0.310	m
Effective volume (75% - 25%)	Determination 1	0.084	m ³
	Determination 2	0.087	m ³
	Determination 3	0.087	m ³
Effective Surface Area (75% - 25%)	Determination 1	1.730	m ²
	Determination 2	1.769	m ²
	Determination 3	1.769	m ²
Time for soakaway (75%-25% effective depth)	Determination 1	28440	Sec.
	Determination 2	40320	Sec.
	Determination 3	50280	Sec.
Soil Infiltration Rate (m/s)	Determination 1	1.71E-06	m/s
	Determination 2	1.22E-06	m/s
	Determination 3	9.76E-07	m/s

Comments

File ref 1029/6544/G

Date tested 23/10/2024

Date reported 28/10/2024

Signed - M.Driver / D. Driver / C. Driver
Director

HUMBERSIDE MATERIALS LABORATORY LTD

Atherton Way, Brigg
North Lincolnshire DN20 8AR
Tel & Fax 01652 652753

DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/73092/02

Client Build Developments c/o Inspire Design

Site 1763 Sutherland Road, Heywood

Location S2

Date tested 23/10/2024

Determined by D. Driver (HML)

Soil type Slightly silty sand with gravels

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

Calculation Data			
Soakaway pit No	S2		
Anticipated invert level	Unknown		
Pit Dimensions (l x w x d) (m)	1.50	0.35	1.90
Effective Depth (75% - 25%)	Determination 1	0.260	m
	Determination 2	0.310	m
	Determination 3	0.310	m
Effective volume (75% - 25%)	Determination 1	0.068	m ³
	Determination 2	0.081	m ³
	Determination 3	0.081	m ³
Effective Surface Area (75% - 25%)	Determination 1	1.487	m ²
	Determination 2	1.672	m ²
	Determination 3	1.672	m ²
Time for soakaway (75%-25% effective depth)	Determination 1	2280	Sec.
	Determination 2	3120	Sec.
	Determination 3	5160	Sec.
Soil Infiltration Rate (m/s)	Determination 1	2.01E-05	m/s
	Determination 2	1.56E-05	m/s
	Determination 3	9.43E-06	m/s

Comments

File ref 1029/6544/G

Date tested 23/10/2024

Date reported 28/10/2024

Signed - M.Driver / D. Driver / C. Driver
Director

HUMBERSIDE MATERIALS LABORATORY LTD

Atherton Way, Brigg
North Lincolnshire DN20 8AR
Tel & Fax 01652 652753

DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/73092/03

Client Build Developments c/o Inspire Design

Site 1763 Sutherland Road, Heywood

Location S3

Date tested 23/10/2024

Determined by D. Driver (HML)

Soil type Clayey sand with gravels and pockets of silt/clay

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

Calculation Data			
Soakaway pit No	S3		
Anticipated invert level	Unknown		
Pit Dimensions (l x w x d) (m)	1.40	0.35	1.90
Effective Depth (75% - 25%)	Determination 1	0.365	m
	Determination 2	0.370	m
	Determination 3	0.375	m
Effective volume (75% - 25%)	Determination 1	0.089	m ³
	Determination 2	0.091	m ³
	Determination 3	0.092	m ³
Effective Surface Area (75% - 25%)	Determination 1	1.768	m ²
	Determination 2	1.785	m ²
	Determination 3	1.803	m ²
Time for soakaway (75%-25% effective depth)	Determination 1	48480	Sec.
	Determination 2	58260	Sec.
	Determination 3	64560	Sec.
Soil Infiltration Rate (m/s)	Determination 1	1.04E-06	m/s
	Determination 2	8.72E-07	m/s
	Determination 3	7.90E-07	m/s

Comments

File ref 1029/6544/G

Date tested 23/10/2024

Date reported 28/10/2024

Signed - M.Driver / D. Driver / C. Driver
Director

HUMBERSIDE MATERIALS LABORATORY LTD

Atherton Way, Brigg
North Lincolnshire DN20 8AR
Tel & Fax 01652 652753

DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/73092/04

Client Build Developments c/o Inspire Design

Site 1763 Sutherland Road, Heywood

Location S4

Date tested 23/10/2024

Determined by D. Driver (HML)

Soil type Slightly silty sand with gravels

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

Calculation Data			
Soakaway pit No	S4		
Anticipated invert level	Unknown		
Pit Dimensions (l x w x d) (m)	1.40	0.35	2.00
Effective Depth (75% - 25%)	Determination 1	0.315	m
	Determination 2	0.380	m
	Determination 3	0.375	m
Effective volume (75% - 25%)	Determination 1	0.077	m ³
	Determination 2	0.093	m ³
	Determination 3	0.092	m ³
Effective Surface Area (75% - 25%)	Determination 1	1.593	m ²
	Determination 2	1.820	m ²
	Determination 3	1.803	m ²
Time for soakaway (75%-25% effective depth)	Determination 1	2028	Sec.
	Determination 2	2220	Sec.
	Determination 3	2880	Sec.
Soil Infiltration Rate (m/s)	Determination 1	2.39E-05	m/s
	Determination 2	2.30E-05	m/s
	Determination 3	1.77E-05	m/s

Comments

File ref 1029/6544/G

Date tested 23/10/2024

Date reported 28/10/2024

Signed - M.Driver / D. Driver / C. Driver
Director

HUMBERSIDE MATERIALS LABORATORY LTD

Atherton Way, Brigg
North Lincolnshire DN20 8AR
Tel & Fax 01652 652753

DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/73092/05

Client Build Developments c/o Inspire Design

Site 1763 Sutherland Road, Heywood

Location S5

Date tested 23/10/2024

Determined by D. Driver (HML)

Soil type Slightly silty sand

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

Calculation Data			
Soakaway pit No	S5		
Anticipated invert level	Unknown		
Pit Dimensions (l x w x d) (m)	1.40	0.35	1.90
Effective Depth (75% - 25%)	Determination 1	0.265	m
	Determination 2	0.325	m
	Determination 3	0.315	m
Effective volume (75% - 25%)	Determination 1	0.065	m ³
	Determination 2	0.080	m ³
	Determination 3	0.077	m ³
Effective Surface Area (75% - 25%)	Determination 1	1.418	m ²
	Determination 2	1.628	m ²
	Determination 3	1.593	m ²
Time for soakaway (75%-25% effective depth)	Determination 1	480	Sec.
	Determination 2	810	Sec.
	Determination 3	1440	Sec.
Soil Infiltration Rate (m/s)	Determination 1	9.54E-05	m/s
	Determination 2	6.04E-05	m/s
	Determination 3	3.37E-05	m/s

Comments

File ref 1029/6544/G

Date tested 23/10/2024

Date reported 28/10/2024

Signed - M.Driver / D. Driver / C. Driver
Director