

BURY NEW ROAD, BROUGHTON, MANCHESTER

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 21 1164

Date: November 2021

Client: Appian Way Development Ltd



INCREASING LAND VALUE

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GROUP

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LK Consult Document Verification			
Site Address	Land at Bury New Road, Broughton, Manchester, M7 4WZ		
Report Title	Sustainable Drainage Strategy		
Job Number	FRA 21 1164	Document Ref.	FRA 21 1164 - R0
Date Issued	November 2021	Report Version	R0
Prepared By	Jenna Lowe – Graduate Flood Risk Assessor	Signature	
Reviewed By	Mark Jones - Associate	Signature	

Revision Record			
Revision No.	Date	Nature of Revision	Approved By

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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land at Bury New Road, Broughton, Manchester. The development comprises two, 2 storey buildings in an L shaped configuration with proposed car parking and access off Bury New Road.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is within Flood Zone 1.

Mitigation

Design

Nearby boreholes indicate that made ground is present with layers of silty Sand, sandy Gravel and Clay. The site slopes in a south-westerly direction. The site is enclosed by highways and an access road.

There will be an increase in impermeable area drained to the existing culverted watercourse. No formal drainage system was observed where a connection could be made. The flows from the site should be restricted to an acceptable level to the Lead Local Flood Authority and the United Utilities.

In considering the potential drainage options for the site at present it is assumed that surface water runoff arising from the development will discharge into the former existing culverted watercourse that has been converted into a combined drain.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will therefore be required.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the combined sewer towards the southwest boundary of the site. Therefore, the most effective strategy, in line with the SuDS management train, would be to have a detention system at the southern boundary. The required tank or similar has been estimated to be **12.3m³** for the 1 in 30-year greenfield flow restriction.

Similarly, the estimated volume to be retained on site for the 1 in 100-year storm event including the allowance for climate change is between **24.9 m³** and **31.4 m³**.

The estimated volume can be stored within the site boundary.

Contents

EXECUTIVE SUMMARY	v
1 Introduction	1
1.1 Background	1
1.2 Site Details	2
2 Site Setting	3
2.1 Vulnerability	3
2.2 Environmental Setting	3
2.3 Site Reconnaissance	4
Site and Access Levels	4
3 Consultation	5
4 Sustainable Drainage Strategy	7
4.1 Introduction	7
4.1 Infiltration	7
4.2 Watercourses	8
4.3 Public Sewer	8
4.4 Other Sewers	8
4.5 Surface Water Drainage Strategy	8
4.6 Surface Water Attenuation Requirements	10
4.7 Foul Drainage	11
5 Conclusion	13

Appendices

Appendix A:	Figures, Plans and Drawings
Appendix B:	Site Information
Appendix C:	Environment Agency Data
Appendix D:	Consultee Correspondence
Appendix E:	Calculations

1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Appian Way Development Ltd to carry out a Sustainable Drainage Strategy for land off Bury New Road, Broughton, Manchester. The report was undertaken in support of a future planning application to redevelop the site for commercial use.

The report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- » Topography of the site.
- » Local water features and hydrological context.
- » Underlying geology, soil types and permeability.
- » Layout and geometry of the proposed development.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government April 2014

1.2 Site Details

A summary of the general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Site Details	
Location	Junction off Appian Way and Bury New Road. Centred at approximate National Grid Reference 383200E 400310N.
Area	Approximately 0.17 Ha.
Topography	Approximately 36 to 40 metres Above Ordnance Datum (AOD). Site is steeply sloping to the southwest.
Current Land Use	<u>Site</u> Vacant land with hardstanding and scrub vegetation present across the site. <u>Surrounding Area/Boundary Treatment</u> North: Commercial Properties. East: Residential Properties. South: Bury New Road and Car Parking. West: Commercial Properties.
Proposed Development	Commercial building with soft landscaping. L-shaped two storey building with access off Bury New Road and proposed car parking, turning area into soft landscaped areas.

Table 1-1: Summary of site details.

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2 Site Setting

2.1 Vulnerability

As an initial phase in identifying which Sustainable Drainage System is appropriate for the site, LKC has consulted the Environment Agency's (EA) website Flood Zone Mapping. This mapping is (often) based on coarse scale modelling and provides only an initial indication of the flood risk to a site.

The Flood Zones divide the floodplain into three categories of flood risk, and do not take flood defences into account. The NPPF defines the Flood Zones as:

- » Flood Zone 1 – little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).
- » Flood Zone 2 – low risk, with annual probability of flooding of 0.1 to 1.0% from rivers and 0.1 to 0.5% from the sea.
- » Flood Zone 3 – medium to high risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

The Flood Zone Mapping indicates the site as being within Flood Zone 1 in the PPG (paragraph 065, Table 1). The proposed development is for a commercial/non-residential end use, and this is classified within the 'Less Vulnerable' category in the PPG (paragraph 066, Table 2).

2.2 Environmental Setting

LKC have previously undertaken a Preliminary Risk Assessment for the site³ (CL-602-LKC 21 1671-01, October 2021) and pertinent environmental information for the site is summarised in Table 2-1 below.

Summary of the Environmental Setting		
Geology	Superficial	Glaciofluvial deposits (sand and gravel) for the majority of the site with River Terrace Deposits to the south.
	Bedrock	Chester Formation (sandstone).
	BGS Boreholes	BH Ref. Sd80sw499, 42 m W: made ground to 0.73m, silty sandy to 1.3 7m, sandy gravel to 2.39 m, stiff sandy silty clay to 2.6 m.
Hydrogeology	Superficial	Secondary Undifferentiated Aquifer.
	Bedrock	Principal Aquifer. Site is not within a SPZ.
Hydrology	All adjacent and internal surface water	Unnamed culverted watercourse running directly through the site in a south westerly direction.
Soilscape	Type 17	Slowly permeable seasonally wet acid loamy and clayey soils.
Site History		Culvert marked as 'Underground channel' on 1859 mapping, feeding into reservoirs to the NE / Broughton Brook to SW shown as culverted by the 1890 mapping. Pre 1977 the site was used for residential occupancy, but this has since been demolished.

Table 2-1: Summary of the Environmental Setting.

³ Phase 1 Preliminary Risk Assessment (PRA) report by LK Consult (Ref: LKC 21 1671-01 dated October 2021)

2.3 Site Reconnaissance

A site reconnaissance was undertaken on 15th October 2021 and photographs are provided in Appendix B.

Relevant features identified on site are summarised below:

- The site is currently disused and overgrown with vegetation and established trees. The site was formerly surfaced but in poor condition.
- Vehicular access is via an overgrown single-track lane, cobbled road from the southwest off Bury New Road.
- Generally, the site slopes down towards the main road in the southwest. The southwest is the lowest elevated area; the north of the site is up to 4m higher in elevation and the northwest around 1m higher in elevation.
- Large quantities of fly tipping are present across the whole site.
- Three visible man hole covers are located to the southeast of the site just north of the access road. A United Utilities service box is located along the access lane.

Site and Access Levels

The site slopes to the southwest with an approximate fall of 4m from the northern extent of the site to the proposed access road off Bury New Road. The site has an elevation ranging from 36 mAOD to 40 mAOD respectively. The final site levels and ground floor levels of dwellings have not yet been determined. The proposed access would join Bury New Road at around 36 mAOD.

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3 Consultation

Information from consultees (Environment Agency (EA), Salford Council and United Utilities) is summarised in Table 3-1 below.

Relevant correspondence / information is provided in Appendices C (EA) and D (Salford Council and United Utilities).

For modelled levels refer to extracted Level table and node location map in Appendix C.

Source	Details	
Environment Agency	Flood Zone 1: very low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).	
	Modelled Levels for Lower Irwell Nearest Node: ea013_0208_IRW14294	Level of 27.20 m for 1% annual probability event. Level of 28.54 m for 1% event with climate change allowance. Level of 30.66 m for 0.1% annual probability event.
Salford Council (LLFA)	According to the Anticipated Direction of Flood Water in the Lower Irwell Flood Plain Map provided by Salford Council, the site is not within an area of flood concern. According to the Sewer and Surface Water Drainage 'Trouble Spots' Map provided by Salford Council; the site is not within a drainage 'Trouble Spot'.	
United Utilities (UU)	Likely conditions for connecting into their sewerage system	UU would request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse, or surface water sewer. UU would also request for a condition to prevent development within 3m either side of the sewer running through the site. UU Wastewater Developer Services was contacted regarding connections to the public drainage system. UU request that any agreed rate does not exceed 5l/s.
	Sewer map	The site is congested with sewers and overflow chambers. There is a surface water sewer running parallel and partially through the site's northern boundary along Appian Way and is likely to have been connected into the former culvert, now converted into a combined sewer. There is a 1600 mm diameter pipeline which has been partially abandoned towards the centre of the site. The flow has been split into two different sewers most likely due to former capacity issues which has resulted in the many chambers observed within the site. The combined sewer is redirected to the east of the abandoned sewer running through the site and then separates into the two sewers that flow into Bury New Road.

Table 3-1: Summary Consultee Information.

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4 Sustainable Drainage Strategy

4.1 Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from any new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3⁴ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- » an adequate soakaway or other adequate infiltration system,
- » a watercourse or, where that is not practicable,
- » a sewer.

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁵.

4.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones.

A summary of the British Geological Survey superficial and bedrock aquifer descriptions and classifications supplemented by local records are shown in Table 4-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Glaciofluvial Deposits – Devensian for most of the site.	Sand and Gravel with clay bands.	Secondary Undifferentiated.	N/A.	Limited.
River Terrace Deposits Type 1.	Sand and Gravel.	Secondary A.	N/A	Good.
Chester Formation.	Sandstone.	Principal.	N/A.	Good.

Table 4-1: Geological and Hydrogeological Setting.

⁴ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁵ Flood and Water Management Act 2010: UK Government.

Infiltration methods such as soakaways are not likely to be feasible due to the constraints to the site, adjacent roads and borehole records suggesting that stiff sandy silty clay is present at 2.6m below ground which is likely to limit the effectiveness of any infiltration facility. However, this may be investigated further at the detailed design stage, if required.

There is a slope over the site and surrounding area which indicates that groundwater in the vicinity of the site would drain towards the southwest.

4.2 Watercourses

There was a culverted watercourse running through the site in a south-westerly direction. This has been replaced by a combined sewer system.

4.3 Public Sewer

There is a surface water sewer running through the site in a northerly direction along Appian Way that appears to connect to the combined system within the site.

A combined sewer is redirected at the north-eastern site boundary due to the abandoned sewer running directly through the site, this is then separated into two sewers and runs through the site before connecting to Bury New Road.

4.4 Other Sewers

There is no evidence of existing connections to the public sewers from the study land, but the site was formally occupied by residential properties.

4.5 Surface Water Drainage Strategy

The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Comments
a	Soakaway/Infiltration	2	Not likely to be feasible due to the constraints on the site due to the presence of large diameter services beneath the site. The site is further constrained by the proximity of the adjacent roads. Borehole records suggest that stiff sandy silty clay is present at a depth of 2.6m which may not leave sufficient depth for infiltration to be practical.
b	Connection to Watercourse	N/A	The former culverted watercourse has been converted into a combined sewer.
c	Discharge into a sewer	1	Discharge into a public sewer is likely to be feasible.

Table 4-2: Drainage options.

Table 4-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁶ for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions and site constraints the use of infiltration systems may not be feasible.
Infiltration basin	X	Depressions that store and dispose of water via infiltration may not be appropriate given the ground conditions.
Sand filter	X	Treatment devices using sand beds as filter media may not be feasible.
Filter drains	*	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench may be suitable.
Detention basin	X	Dry depressions designed to hold water for a specific retention time will not be suitable due to size constraints of the site.
Swales	X	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses will not be suitable due to size constraints of the site and surrounding infrastructure (roads).
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. When required, the water is pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. Rainwater harvesting systems are currently not included in the development proposals but may be feasible.
Green roofs	*	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals but may be feasible.
Geo-cellular storage systems	✓	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage.
Permeable Pavements – with granular and geo-cellular storage systems	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.
Ponds	X	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. The storage volume afforded by these features should not include any permanent water in the pond. Due to size constraints of the site this would not be feasible.
Oversized Pipes	✓	Oversizing pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff.
Flow control devices	✓	The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development.

Table 4-3: Summary of the SuDS options appraisal.

Notes

- ✓ Suitable for use given the nature and scale of the development
- * Possibly suitable for use – not included in the client and architect design proposal at present
- X Not suitable

⁶ CIRIA C697 - The SUDS Manual. London 2015

4.6 Surface Water Attenuation Requirements

Although the site was formally developed it has become overgrown in the intermediate period thus the flow should be limited to a 'greenfield scenario' for estimating the attenuation volumes required.

It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 4-4).

Designated Areas	Plot Area
Total area (ha)	0.17
Impermeable Area (ha)	0
Permeable Area (ha)	0.17
Catchment	
Developable Area (ha)	0.17
Impermeable split (ha)	0.13
Permeable split (ha)	0.04

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed split in area included within the calculations.

It can be seen that there is an increase in impermeable area from the existing usage to the proposed. This is likely to require attenuation to reduce the existing flow off site to a level which is acceptable to the LLFA and UU.

4.6.1 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure (IH 124⁷) have been undertaken for the development and the output report is presented in Appendix E.

For the contributing catchment an estimate has been produced assuming a developable area of 0.17ha from the plot. Assuming conservatively that 55% of the developed area comprises roofs and hard surfacing, the resulting impermeable area would be 0.13ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

Q _{bar} :	0.410 l/s
1 in 1-year greenfield runoff rate:	0.346 l/s
1 in 30-year greenfield runoff rate:	0.685 l/s
1 in 100-year greenfield runoff rate:	0.856 l/s

The lowest practical flow restriction to the sewer system is 5l/s, so this has been utilised within the estimates for the attenuation required for development of the site.

All greenfield runoff estimates, and subsequent storage estimates are included in Appendix E.

The following attenuation has been estimated for the development using the minimum practical flow restriction of 5l/s runoff rates and utilises the FSR methodology⁸ as:

⁷ IH124 Flood Estimation of Small Catchments.

⁸ Flood Studies Report Wallingford NERC 1975.

- Attenuation storage volume: **12.3 m³** (1 in 30-year event)
- Retention on site volume: **24.9 m³** (1 in 100 year + 20% Climate Change)
- Retention on site volume: **31.4 m³** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding runoff for a range of annual flow rate probabilities before discharge to watercourse. As the flow from the development would be restricted there should be little change in the flows within the sewer system and thus the risk of flooding. As a result, any flow contribution from the development should not increase the risk of flooding off-site.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **12.3 m³** and for the 1 in 100-year event, a storage capacity of between **24.9 m³** and **31.4 m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the on-site watercourse.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing area.

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

4.7 Foul Drainage

The potential foul drainage strategy is considered elsewhere.

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5 Conclusion

The site is currently vacant land with hardstanding and scrub vegetation present throughout. The proposal is to develop land at Bury New Road, Broughton, Manchester into two, 2 storey buildings in an L shaped configuration with service courtyard and additional parking along the frontage.

There is no evidence of an existing connections, but the site was formerly occupied by residential housing. These connections are likely to have been removed by the subsequent drainage works across the site.

A combination of the constraints on the site and the ground conditions indicates that infiltration may not be practical. The site is also considered to be too constrained due to the proximity of the adjacent roads and proposed foundations for the use of soakaways.

A pre-development advice enquiry received from United Utilities considered that a flow rate of up to 5 l/s would be acceptable if infiltration proved to be impractical.

The proposed outflow connections from the development should be agreed with the Local Planning Authority and United Utilities.

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APPENDIX A

FIGURES, PLANS AND DRAWINGS

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APPENDIX B

SITE INFORMATION

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SD805W499
8313 0029

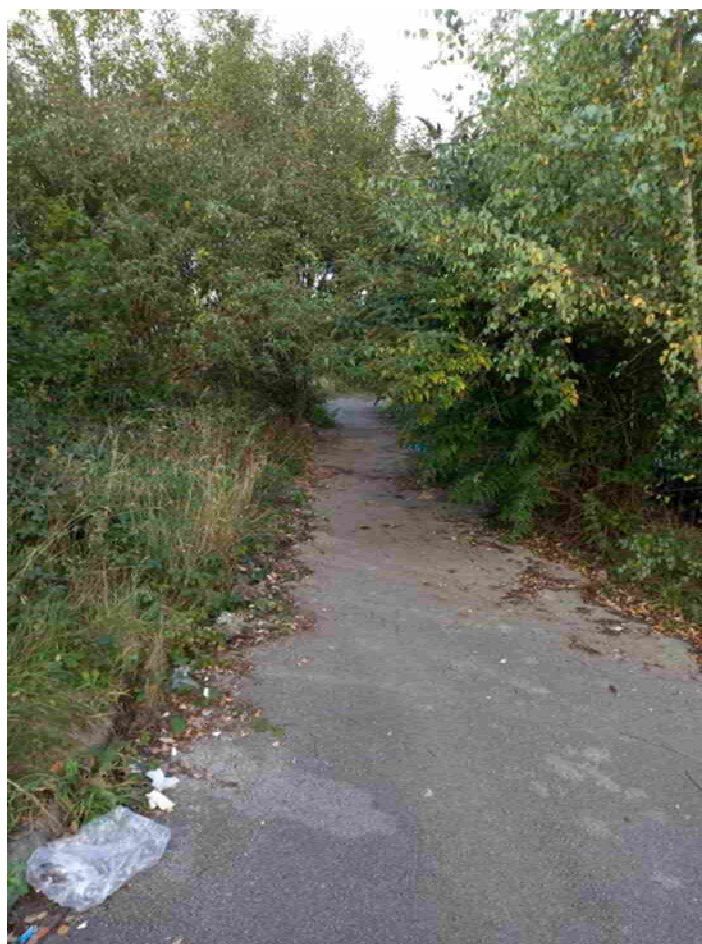
GEO-RESEARCH LTD. BRIGHTON ROAD, HEATON NORRIS, STOCKPORT, CHESHIRE.				Borehole No. 1 Sheet No. 1 Date Commenced 18/3/78 Date Completed 18/3/78 Scale 1:50			
CONTRACT: LOWER BROUGHTON 6 & 7 LOCATION: SALFORD							
Stratum	Legend	Thick-ness	Depth	Sample No.	N Value	Level	Remarks
			G.L.				
Brown sandy silty clay with pebbles and brick - FILL.		0.730	0.300	D1			
Compact light brown silty SAND.		1.370	1.000	D2 P1	22		Water added
			1.500	B1			
Compact/dense brown sandy GRAVEL.		2.100	2.200	D3 CP2	30		Water added
			2.800	B2			
			3.000	CP3	34		
			2.300	3.400			
Stiff brown sandy silty CLAY with silt inclusions and occasional pebbles.			4.000	D4 U1			Damp
			5.000	B3			
			5.500	U2			
			2.600	6.000			
Borehole Complete				On completion of Borehole at 6.000, Casing at 6.000, Water Nil. Borehole backfilled as casing withdrawn.			

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INVESTIGATIVE

Borehole Reference: SD805W499



Photograph 1 (facing SW):
View of the site from the southwest boundary where Bury New Road connects to the proposed access road.



Photograph 2:
View of a potential pedestrian access point that runs from the north of the site. Impermeable surface and overgrown vegetation on site.



Photograph 3:
View of one of the
man holes located
in the site.



Photograph 4:
View of the
remaining two
manholes located
in the site.



Photograph 5:
Site at the
northern boundary
off Appian Way.



Photograph 6:
North of the site
boundary off
Sandering Drive.

APPENDIX C

ENVIRONMENT AGENCY DATA

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Flood map for planning

Your reference
Bury New Road

Location (easting/northing)
383166/400345

Created
2 Nov 2021 14:53

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

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

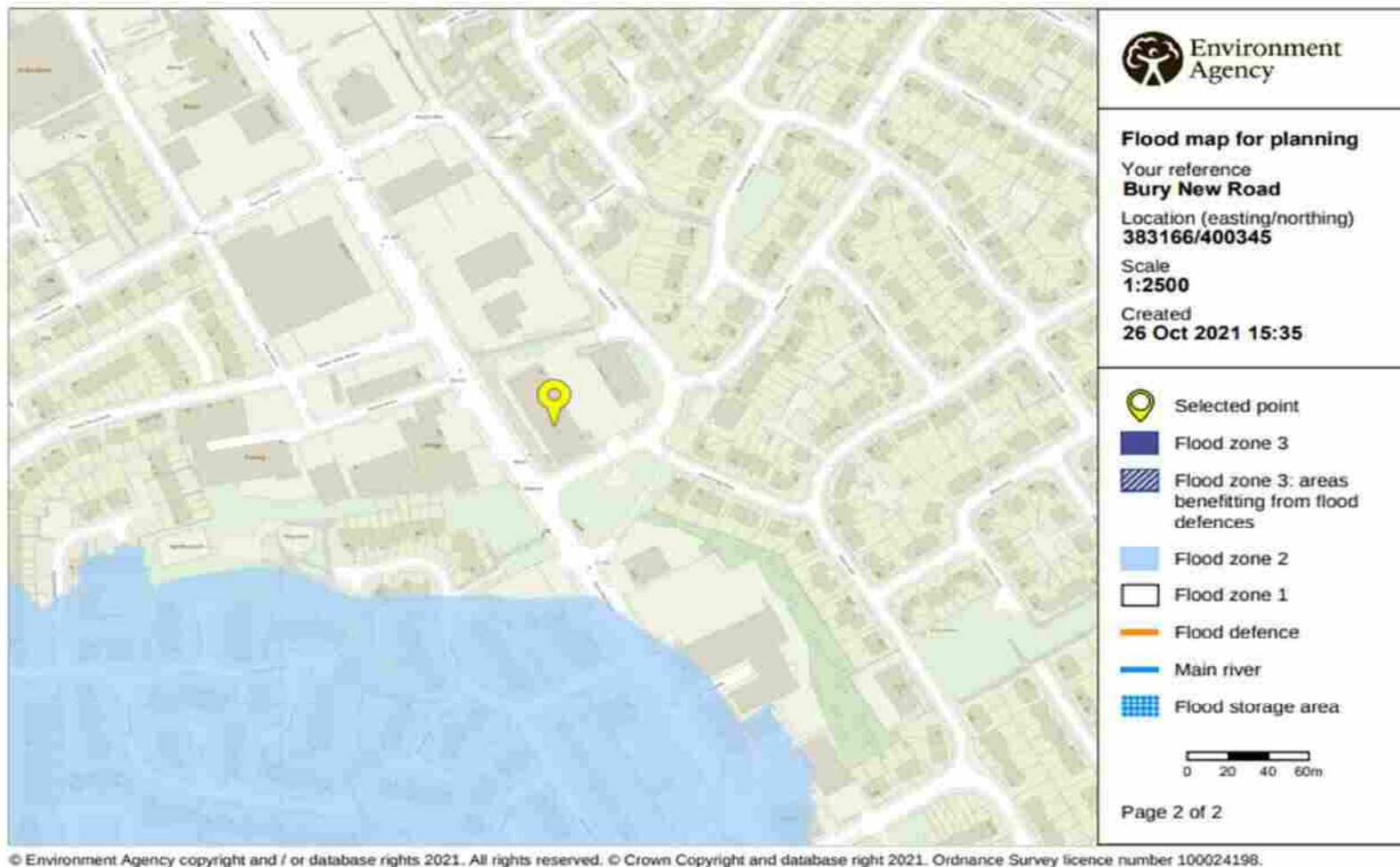
Notes

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 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



2, APPIAN WAY, SALFORD, M7 4WZ

Rivers and sea risk

Very low risk

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

Surface water risk

Low risk

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

Lead local flood authorities (LLFA) manage the risk from surface water flooding and may hold more detailed information. Your LLFA is **Salford**.

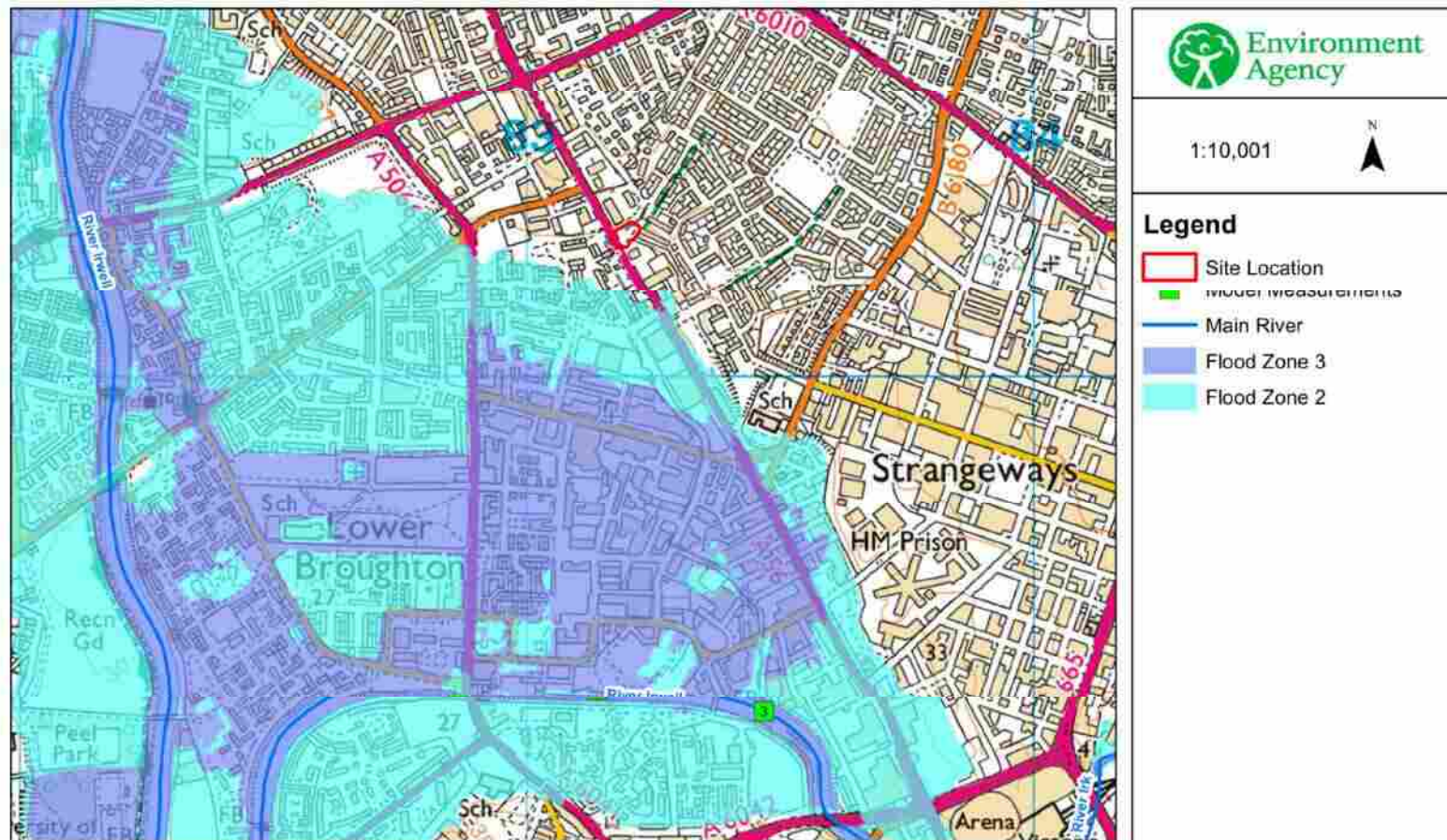
Reservoir risk

There is no risk of reservoir flooding

Groundwater risk

No risk of groundwater flooding

Detailed Flood Map centred on Bury New Road, Apian Way, Salford, Manchester, M7 4WZ.
Created on 25/10/2021 [GMMC238179SW]



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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

APPENDIX D

CONSULTEE CORRESPONDENCE

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Jenna Lowe
From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 28 October 2021 09:45
To: Jenna Lowe
Cc: Wastewater Developer Services
Subject: FW: Pre Development Enquiry for: PDE CA37 Bury New Road, Appian Way Salford
UU Reference Number: 4200044579
Attachments: wastewater pre development.pdf; Bury New Roadl.pdf

Good morning, Jenna

**Pre Development Enquiry for: PDE CA37 Bury New Road, Appian Way Salford
UU Reference Number : 4200044579**

For future reference we now have a new wastewater pre-development enquiry form designed to be easier and more user friendly which is available on our website via the following link:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/wastewater-pre-dev/>

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 1600mm diameter public combined sewer within the site of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional

sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

- 1. into the ground (infiltration);**
- 2. to a surface waterbody;**
- 3. to a surface water sewer or highway drain;**
- 4. to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 225mm diameter public surface water sewer within the site boundary of the proposed development at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

We have many significant assets crossing this site that cannot realistically be diverted. We would ask that you obtain a copy of our asset data records from your provider and plan your development around them ensuring that all legal easements are observed. If any work is required that may impart vibration into the ground we would ask that you contact us for further advice.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/>

Historic Flooding

We do not have any record on file of historic flooding as a result of extreme weather / hydraulic inadequacy within the vicinity of the proposed development.

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-connections/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Gary Jaundrell
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07388 715 589
[unitedutilities.com](https://www.unitedutilities.com)



LKGroup

Unit 29 Eton Business Park
Eton Hill Road, Radcliffe
Radcliffe, Greater
M26 2ZS

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@uuwplc.co.uk

Your Ref: FRA21 1164
Our Ref: UUPS-ORD-338067
Date: 25/10/2021

Dear Sirs

Location: 1 APPIAN WAY, SALFORD, M7 4WZ

I acknowledge with thanks your request dated 21/10/2021 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 McCormick
Property Searches Manager

UUWaterLtd\041\03-15

United Utilities Water Limited
Registered in England & Wales No. 2356678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP



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:

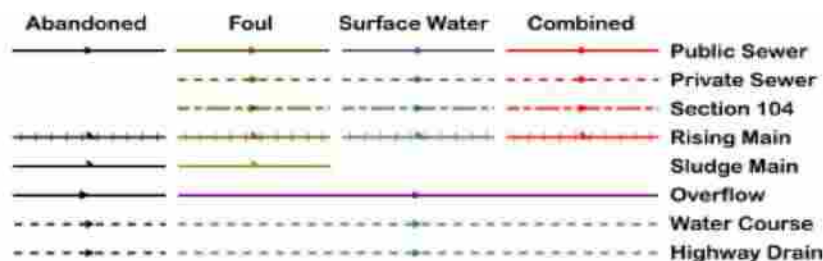
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out 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 from 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 effect.
- 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.

UUWaterLtd/041/03-15

United Utilities Water Limited
Registered in England & Wales No. 2356678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP



Wastewater Symbolology



All point assets follow the standard colour convention: red – combined brown - foul
blue – surface water purple - overflow

- | | |
|-----------------------------------|------------------------------------|
| • Manhole | • Side Entry Manhole |
| • ^{HS} Head of System | • Outfall |
| • ^{ES} Extent of Survey | • Screen Chamber |
| • ^{RE} Rodding Eye | • ^{IC} Inspection Chamber |
| • ^{IN} Inlet | • Bifurcation Chamber |
| • ^{DP} Discharge Point | • ^{LH} Lamp Hole |
| • ^{VX} Vortex | • T Junction / Saddle |
| • ^{PE} Penstock | • Catchpit |
| • ^{WC} Washout Chamber | • Valve Chamber |
| • ^{VA} Valve | • Vent Column |
| • ^{AV} Air Valve | • Vortex Chamber |
| • ^{NRV} Non Return Valve | • Penstock Chamber |
| • ^{SO} Soakaway | • Network Storage Tank |
| • ^{GU} Gully | • Sewer Overflow |
| • ^{CA} Cascade | • Ww Treatment Works |
| • ^{FM} Flow Meter | • Ww Pumping Station |
| • ^{HB} Hatch Box | • Septic Tank |
| • ^{OI} Oil Interceptor | • Control Kiosk |
| • SM Summit | ▽ Change of Characteristic |
| • ^{DS} Drop Shaft | |
| • ^{OP} Orifice Plate | |



APPENDIX E

CALCULATIONS

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HY 11.0

The LK Group www.theLKgroup.com		Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@theLKgroup.com		Job No. Sheet no. 1 Date 25/10/21	
Project Bury New Road		By	Checked	Reviewed	
Title Runoff calculations for Greenfield					

Hydrological Data:-

FSR Hydrology:-

Location = Salford 1
 M5-60 (mm) = 18
 Soil runoff = 0.30
 WRAP = 2
 Hydrological area = 10

Grid reference = SJ8098
 r = 0.37
 SAAR (mm/yr) = 885
 Area = England & Wales
 Hydrological zone = 5

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. The layer is low in organic matter, mottled and slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Area = 0.0017 Km² - 0.17 Ha - 1700 m²

Calculation method:-

Runoff is calculated from:-

$$Q_{BAR(rural)} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km²
 SAAR = Standard Average Annual Rainfall (mm/yr)
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential
 $Q_{BAR(rural)}$ = Runoff (cumecs)

$Q_{BAR(rural)}$ is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
 Reducing factor used for these calculations is 0.003

$$\text{Mean Annual Peak Flow } Q_{BAR(rural)} = 0.41 \text{ l/s}$$



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Project Bury New Road		Sheet no. 2		Date 25/10/21	
Title Runoff calculations for Greenfield		By		Checked	Reviewed

Values for $Q_{BAR(rural)}$

Ret. per.	m ³ /hr	l/s	l/s/ha	Ret. per.	m ³ /hr	l/s	l/s/ha
1yr	1.247	0.346	2.038	100yr+20%	3.698	1.027	6.042
2yr	1.365	0.379	2.230	100yr+30%	4.006	1.113	6.546
5yr	1.776	0.493	2.901	100yr+40%	4.314	1.198	7.050
10yr	2.025	0.563	3.309	200yr	3.522	0.978	5.755
30yr	2.465	0.685	4.028	200yr + 30%	4.578	1.272	7.481
50yr	2.715	0.754	4.436	500yr	4.006	1.113	6.546
100yr	3.082	0.856	5.035	1000yr	4.461	1.239	7.289

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.93	1.21	1.38	1.68	1.85	2.10	2.40	2.73	3.04

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.



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Job No.		
Sheet no. 1		
Date 25/10/21		
By	Checked	Reviewed

Project **Bury New Road**
Title **30 year storage calculations**

Data:-

FSR Hydrology:-

Location = Salford 1
M5-60 (mm) = 18
Soil index = 0.30
Return period = 30
UCWI = 94.7

Grid reference = SJ8098
r = 0.37
SAAR (mm/yr) = 885
WRAP = 2
Climate change = 0

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 58.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1300 m²
Total area (TA) = 1700 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 400 m²
Equiv area = 986 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 25.0 mins
Rainfall at max = 49.00 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 12.3 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 7.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	1564.4	1125	12.4	400 x 600	68.2	500 x 500	49.1
150	695.3	1200	10.9	600 x 900	29.7	500 x 750	32.8
225	309.0	1275	9.6	800 x 1200	16.7	500 x 1000	24.6
300	173.8	1350	8.6			750 x 1000	16.4
375	111.2	1425	7.7			750 x 1200	13.6
450	77.3	1500	7.0			750 x 1500	10.9
525	56.8	1575	6.3			1000 x 1000	12.3
600	43.5	1650	5.7			1000 x 1200	10.2
675	34.3	1725	5.3			1000 x 1500	8.2
750	27.8	1800	4.8			1000 x 1800	6.8
825	23.0	1875	4.4			1000 x 2000	6.1
900	19.3	1950	4.1			1500 x 1500	5.5
975	16.5	2025	3.8			1500 x 1800	4.5
1050	14.2	2100	3.5			1500 x 2000	4.1



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Data:-

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Job No.		
Sheet no. 2		
Date 25/10/21		
By	Checked	Reviewed

Project **Bury New Road**
Title **30 year storage calculations**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	82.0	13.234	3.000	10.234
20	56.0	18.120	6.000	12.120
30	44.0	21.180	9.000	12.180
40	36.0	23.449	12.000	11.449
50	31.0	25.269	15.000	10.269
60	28.0	26.796	18.000	8.796
70	25.0	28.117	21.000	7.117
80	23.0	29.285	24.000	5.285
90	21.0	30.332	27.000	3.332
100	19.0	31.283	30.000	1.283
110	18.0	32.155	33.000	0.000
120	17.0	32.961	36.000	0.000
130	16.0	33.710	39.000	0.000
140	15.0	34.411	42.000	0.000
150	14.0	35.069	45.000	0.000
160	14.0	35.689	48.000	0.000
170	13.0	36.276	51.000	0.000
180	13.0	36.833	54.000	0.000
190	12.0	37.363	57.000	0.000
200	12.0	37.869	60.000	0.000
210	11.0	38.352	63.000	0.000
220	11.0	38.816	66.000	0.000
230	11.0	39.260	69.000	0.000
240	10.0	39.687	72.000	0.000
250	10.0	40.098	75.000	0.000
260	10.0	40.494	78.000	0.000
270	9.0	40.876	81.000	0.000
280	9.0	41.246	84.000	0.000
290	9.0	41.603	87.000	0.000
300	9.0	41.949	90.000	0.000
310	8.0	42.284	93.000	0.000
320	8.0	42.609	96.000	0.000
330	8.0	42.924	99.000	0.000
340	8.0	43.230	102.000	0.000
350	8.0	43.528	105.000	0.000
360	8.0	43.818	108.000	0.000
370	7.0	44.115	111.000	0.000
380	7.0	44.405	114.000	0.000
390	7.0	44.689	117.000	0.000
400	7.0	44.967	120.000	0.000
410	7.0	45.240	123.000	0.000
420	7.0	45.507	126.000	0.000
430	7.0	45.769	129.000	0.000
440	6.0	46.027	132.000	0.000
450	6.0	46.280	135.000	0.000
460	6.0	46.528	138.000	0.000
470	6.0	46.772	141.000	0.000
480	6.0	47.012	144.000	0.000
490	6.0	47.247	147.000	0.000
500	6.0	47.480	150.000	0.000
510	6.0	47.708	153.000	0.000
520	6.0	47.933	156.000	0.000
530	6.0	48.154	159.000	0.000
540	6.0	48.372	162.000	0.000
550	5.0	48.587	165.000	0.000
560	5.0	48.799	168.000	0.000
570	5.0	49.007	171.000	0.000
580	5.0	49.213	174.000	0.000
590	5.0	49.416	177.000	0.000
600	5.0	49.616	180.000	0.000

Storage volume (m³) = 12.3 m³



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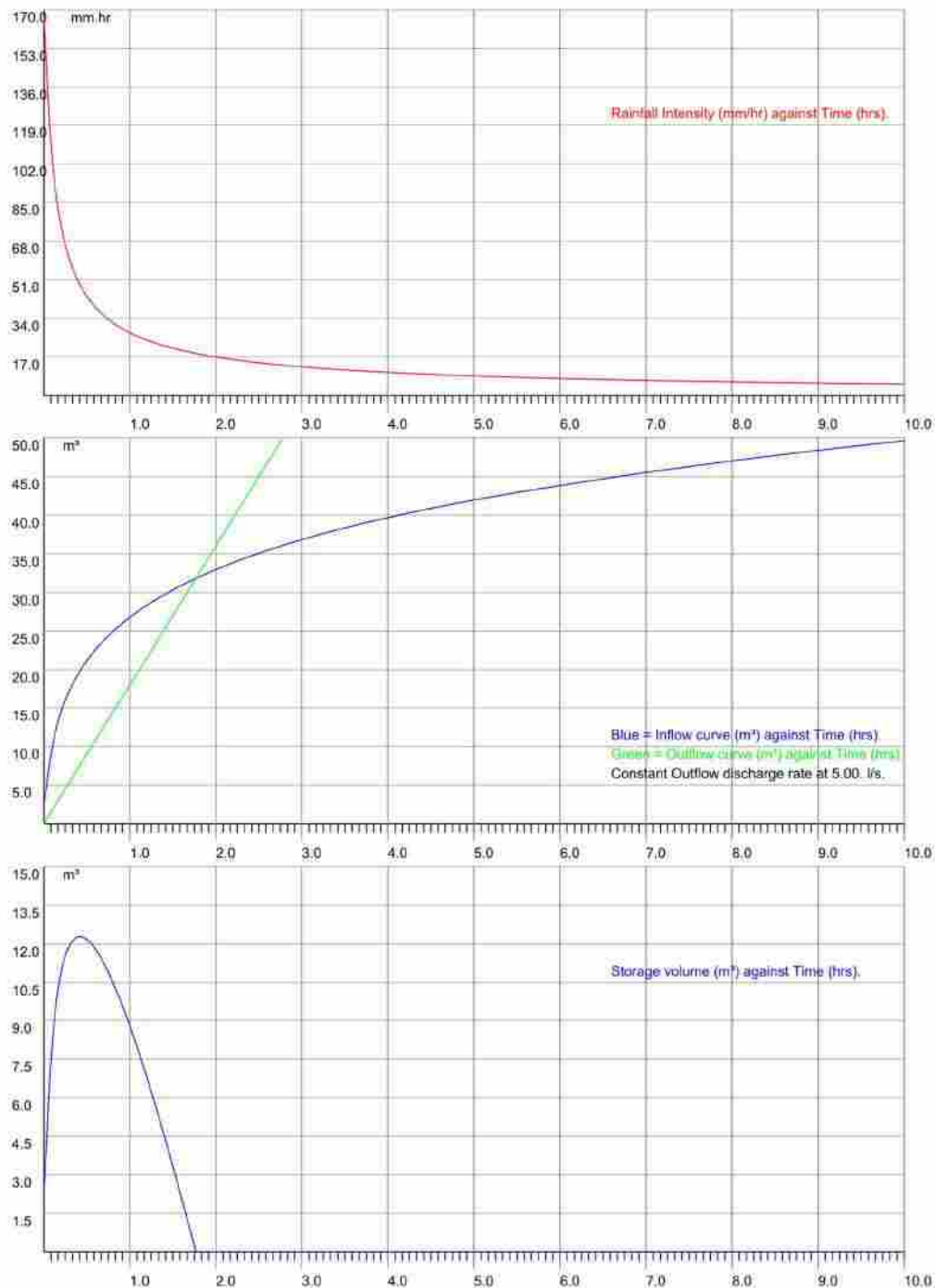
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Job No.		
Sheet no. 3		
Date 25/10/21		
By	Checked	Reviewed

Project **Bury New Road**
Title **30 year storage calculations**





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Job No.	
Sheet no.	1
Date	25/10/21
By	
Checked	
Reviewed	

Project **Bury New Road**
Title **100 years + 20% storage calculations**

Data:-

FSR Hydrology:-

Location = Salford 1
M5-60 (mm) = 18
Soil index = 0.30
Return period = 100
UCWI = 94.7

Grid reference = SJ8098
r = 0.37
SAAR (mm/yr) = 885
WRAP = 2
Climate change = 20

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 58.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1300 m²
Total area (TA) = 1700 m²
Mean pump disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 400 m²
Equiv area = 986 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 44.0 mins
Rainfall at max = 53.55 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 24.9 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 12.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	3164.9	1125	25.0	400 x 600	138.1	500 x 500	99.4
150	1406.6	1200	22.0	600 x 900	60.1	500 x 750	66.3
225	625.2	1275	19.5	800 x 1200	33.8	500 x 1000	49.7
300	351.7	1350	17.4			750 x 1000	33.1
375	225.1	1425	15.6			750 x 1200	27.6
450	156.3	1500	14.1			750 x 1500	22.1
525	114.8	1575	12.8			1000 x 1000	24.9
600	87.9	1650	11.6			1000 x 1200	20.7
675	69.5	1725	10.6			1000 x 1500	16.6
750	56.3	1800	9.8			1000 x 1800	13.8
825	46.5	1875	9.0			1000 x 2000	12.4
900	39.1	1950	8.3			1500 x 1500	11.0
975	33.3	2025	7.7			1500 x 1800	9.2
1050	28.7	2100	7.2			1500 x 2000	8.3



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Job No.		
Sheet no.	2	
Date	25/10/21	
By	Checked	Reviewed

Project **Bury New Road**
Title **100 years + 20% storage calculations**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	126.0	20.339	3.000	17.339
20	87.0	28.205	6.000	22.205
30	68.0	33.143	9.000	24.143
40	57.0	36.808	12.000	24.808
50	49.0	39.744	15.000	24.744
60	44.0	42.203	18.000	24.203
70	39.0	44.324	21.000	23.324
80	36.0	46.192	24.000	22.192
90	33.0	47.863	27.000	20.863
100	31.0	49.375	30.000	19.375
110	29.0	50.756	33.000	17.756
120	27.0	52.027	36.000	16.027
130	25.0	53.204	39.000	14.204
140	24.0	54.301	42.000	12.301
150	23.0	55.326	45.000	10.326
160	22.0	56.290	48.000	8.290
170	21.0	57.197	51.000	6.197
180	20.0	58.055	54.000	4.055
190	19.0	58.868	57.000	1.868
200	18.0	59.641	60.000	0.000
210	18.0	60.376	63.000	0.000
220	17.0	61.077	66.000	0.000
230	17.0	61.748	69.000	0.000
240	16.0	62.389	72.000	0.000
250	16.0	63.004	75.000	0.000
260	15.0	63.593	78.000	0.000
270	15.0	64.160	81.000	0.000
280	14.0	64.705	84.000	0.000
290	14.0	65.230	87.000	0.000
300	14.0	65.737	90.000	0.000
310	13.0	66.225	93.000	0.000
320	13.0	66.696	96.000	0.000
330	13.0	67.152	99.000	0.000
340	12.0	67.592	102.000	0.000
350	12.0	68.019	105.000	0.000
360	12.0	68.432	108.000	0.000
370	12.0	68.871	111.000	0.000
380	11.0	69.298	114.000	0.000
390	11.0	69.716	117.000	0.000
400	11.0	70.125	120.000	0.000
410	11.0	70.525	123.000	0.000
420	10.0	70.918	126.000	0.000
430	10.0	71.303	129.000	0.000
440	10.0	71.680	132.000	0.000
450	10.0	72.050	135.000	0.000
460	10.0	72.414	138.000	0.000
470	10.0	72.771	141.000	0.000
480	9.0	73.121	144.000	0.000
490	9.0	73.466	147.000	0.000
500	9.0	73.805	150.000	0.000
510	9.0	74.138	153.000	0.000
520	9.0	74.466	156.000	0.000
530	9.0	74.789	159.000	0.000
540	9.0	75.106	162.000	0.000
550	8.0	75.419	165.000	0.000
560	8.0	75.727	168.000	0.000
570	8.0	76.031	171.000	0.000
580	8.0	76.330	174.000	0.000
590	8.0	76.625	177.000	0.000
600	8.0	76.915	180.000	0.000

Storage volume (m³) = 24.9 m³



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Job No.

Sheet no.

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Date

25/10/21

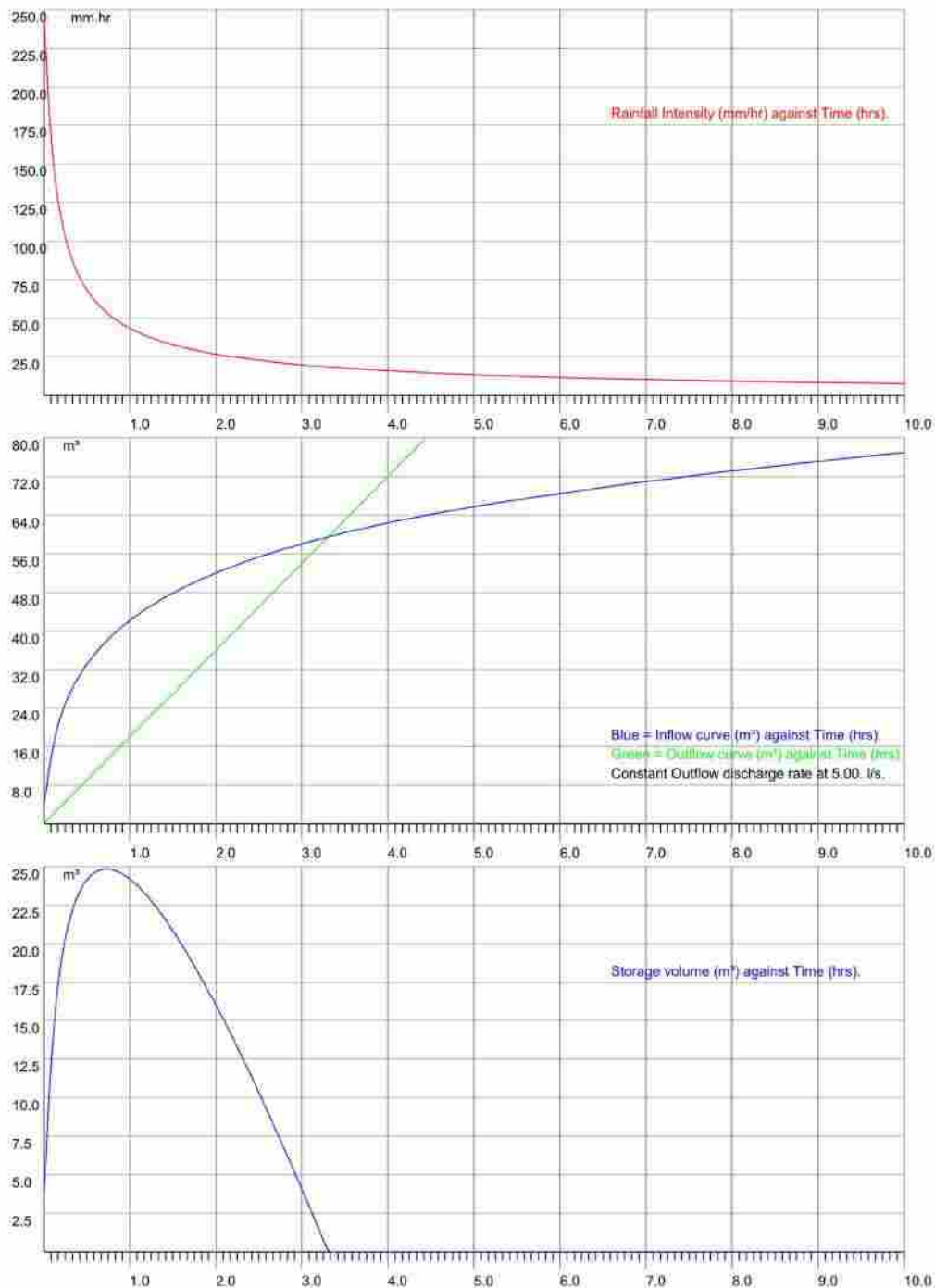
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Project **Bury New Road**

Title **100 years + 20% storage calculations**





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Job No.		
Sheet no. 1		
Date 25/10/21		
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Project **Bury New Road**
Title **100 years + 40% storage calculations**

Data:-

FSR Hydrology:-

Location = Salford 1
M5-60 (mm) = 18
Soil index = 0.30
Return period = 100
UCWI = 94.7

Grid reference = SJ8098
r = 0.37
SAAR (mm/yr) = 885
WRAP = 2
Climate change = 40

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 58.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1300 m²
Total area (TA) = 1700 m²
Mean pump disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 400 m²
Equiv area = 986 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 52.0 mins
Rainfall at max = 55.94 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 31.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 13.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	3996.1	1125	31.6	400 x 600	174.3	500 x 500	125.5
150	1776.1	1200	27.8	600 x 900	75.9	500 x 750	83.7
225	789.4	1275	24.6	800 x 1200	42.7	500 x 1000	62.8
300	444.0	1350	21.9			750 x 1000	41.8
375	284.2	1425	19.7			750 x 1200	34.9
450	197.3	1500	17.8			750 x 1500	27.9
525	145.0	1575	16.1			1000 x 1000	31.4
600	111.0	1650	14.7			1000 x 1200	26.1
675	87.7	1725	13.4			1000 x 1500	20.9
750	71.0	1800	12.3			1000 x 1800	17.4
825	58.7	1875	11.4			1000 x 2000	15.7
900	49.3	1950	10.5			1500 x 1500	13.9
975	42.0	2025	9.7			1500 x 1800	11.6
1050	36.2	2100	9.1			1500 x 2000	10.5



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Project **Bury New Road**
Title **100 years + 40% storage calculations**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	147.0	23.729	3.000	20.729
20	102.0	32.905	6.000	26.905
30	80.0	38.667	9.000	29.667
40	66.0	42.943	12.000	30.943
50	57.0	46.368	15.000	31.368
60	51.0	49.237	18.000	31.237
70	46.0	51.712	21.000	30.712
80	42.0	53.891	24.000	29.891
90	38.0	55.840	27.000	28.840
100	36.0	57.604	30.000	27.604
110	33.0	59.215	33.000	26.215
120	31.0	60.698	36.000	24.698
130	30.0	62.072	39.000	23.072
140	28.0	63.351	42.000	21.351
150	27.0	64.547	45.000	19.547
160	25.0	65.671	48.000	17.671
170	24.0	66.730	51.000	15.730
180	23.0	67.731	54.000	13.731
190	22.0	68.680	57.000	11.680
200	22.0	69.581	60.000	9.581
210	21.0	70.439	63.000	7.439
220	20.0	71.257	66.000	5.257
230	19.0	72.039	69.000	3.039
240	19.0	72.787	72.000	0.787
250	18.0	73.504	75.000	0.000
260	18.0	74.192	78.000	0.000
270	17.0	74.854	81.000	0.000
280	17.0	75.490	84.000	0.000
290	16.0	76.102	87.000	0.000
300	16.0	76.693	90.000	0.000
310	15.0	77.262	93.000	0.000
320	15.0	77.812	96.000	0.000
330	15.0	78.344	99.000	0.000
340	14.0	78.858	102.000	0.000
350	14.0	79.355	105.000	0.000
360	14.0	79.837	108.000	0.000
370	13.0	80.350	111.000	0.000
380	13.0	80.848	114.000	0.000
390	13.0	81.335	117.000	0.000
400	13.0	81.812	120.000	0.000
410	12.0	82.280	123.000	0.000
420	12.0	82.737	126.000	0.000
430	12.0	83.186	129.000	0.000
440	12.0	83.627	132.000	0.000
450	12.0	84.059	135.000	0.000
460	11.0	84.483	138.000	0.000
470	11.0	84.899	141.000	0.000
480	11.0	85.308	144.000	0.000
490	11.0	85.710	147.000	0.000
500	11.0	86.106	150.000	0.000
510	11.0	86.494	153.000	0.000
520	10.0	86.877	156.000	0.000
530	10.0	87.253	159.000	0.000
540	10.0	87.624	162.000	0.000
550	10.0	87.989	165.000	0.000
560	10.0	88.348	168.000	0.000
570	10.0	88.702	171.000	0.000
580	10.0	89.052	174.000	0.000
590	9.0	89.396	177.000	0.000
600	9.0	89.735	180.000	0.000

Storage volume (m³) = 31.4 m³



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25/10/21

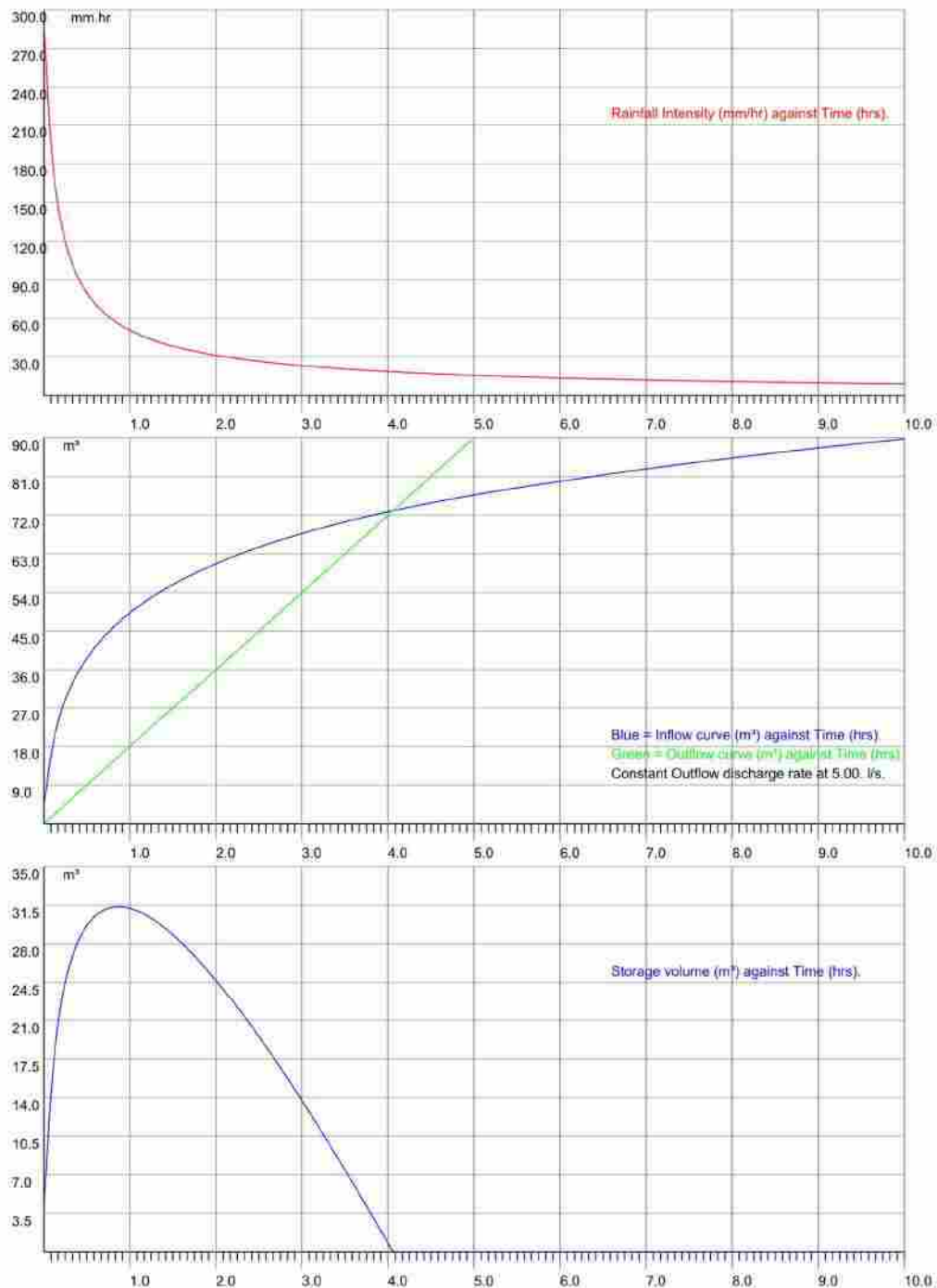
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Project **Bury New Road**

Title **100 years + 40% storage calculations**





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Title 100 years + 40% storage calculations			Reviewed

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute.

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function.
Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

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