



Flood Risk Assessment and Drainage Strategy at

**Pennington Street,
Levenshulme,
M12 4QJ**

Client: Onward Homes

Reference: 34391-SUT-ZZZ-XX-RP-C-0001

Date: 20th November 2025

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Flood Risk Assessment & Drainage Strategy

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Flood Risk Assessment

1 Introduction

- 1.1 As part of the planning requirements for the development along Pennington Street, Levenshulme, it is necessary to prepare a site-specific flood risk assessment to ensure the flood risk is appropriately considered and managed to protect people and property from flooding.
- 1.2 The site boundary, Figure 1, totals to 0.40 hectares and is entirely within flood zone 1 as defined by the Environment Agency.
- 1.3 The National Planning Policy Framework (NPPF) Paragraph 170 seeks to promote development in areas at low risk of flooding and to reduce the flood risk resulting from development. This assessment will demonstrate that all sources of flooding have been considered, and that development of the site is appropriate.
- 1.4 The existing site is classed as a greenfield site however it does have live adopted drainage running through the site. The site is to be developed with 14 dwellings along with an associated adopted road and private parking. The proposed site boundary is shown in figure 1.
- 1.5 The proposed site plans are provided in Appendix A for reference.
- 1.6 The development site is located just off Pennington Street to the south of Manchester City Centre. The location data for the site is:

Post Code:	M12 4QJ		
Grid Reference:	SJ 87211 94694		
Coordinates:	X: 387211	Y: 394694	
Latitude:	53°26'56"N	Longitude:	002°11'39"W
What3Words:	Ranges.issued.camera		

Table 1 – Location details

- 1.7 Flood risk information for planning has been obtained from the Environment Agency (EA) website and is provided in Appendix C. The EA data confirms the sites falls entirely within Flood Zone 1.



Figure 1: Site Boundary

— Development
Site 1 Boundary

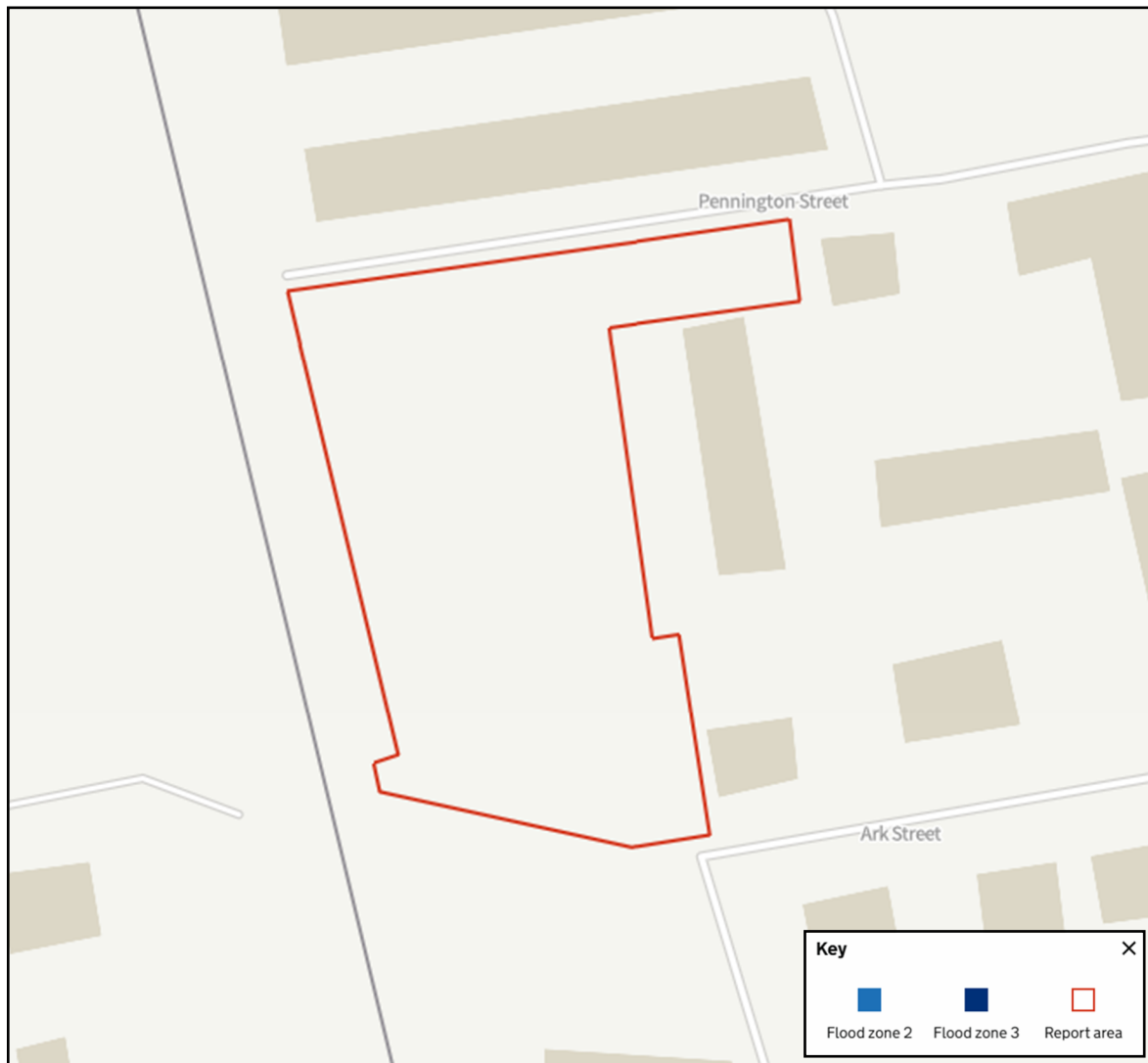


Figure 2: Environment Agency Flood Map for Planning (Flood Zones)

2 Planning Context

- 2.1. The National Planning Policy Framework expects Local Planning Authorities (LPA) to protect people and property from flooding. In fulfilling their duty LPAs are to ensure the following steps are assessed prior to granting planning permission:
 - 2.1.1 Assess flood risk
 - 2.1.1.1 The LPA must undertake a Strategic Flood Risk Assessment to inform the local plan and identify development sites that are in areas of low flood risk.
 - 2.1.1.2 Sites greater than 1 hectare or in areas of flood risk must have a Site-Specific Flood Risk Assessment prepared.
 - 2.1.2 Avoid flood risk
 - 2.1.2.1 The LPA should apply the sequential test to, as far as practicable, locate development sites in areas at the least risk of flooding from area survey, and if required carry out the exception test.
 - 2.1.3 Manage and mitigate flood risk

- 2.1.3.1 Where alternative sites are not available the LPA should ensure that development is flood resilient and resistant, safe for the users over the development's lifetime and will not increase overall flood risk.
- 2.1.3.2 LPAs and developers should manage flood risk through the inclusion of sustainable drainage techniques.
- 2.2. There is no general statutory duty on the Government to protect land or property against flooding. However, the Government recognises the need for action to be taken to safeguard the wider social and economic wellbeing of the country.
- 2.3. Landowners have the primary responsibility for safeguarding their land and others property against natural hazards such as flooding. Individual property owners and users are also responsible for managing the drainage of their land in such a way as to prevent, as far as is reasonably practicable, adverse impacts on neighbouring land.
- 2.4. Those proposing development are responsible for:
 - 2.1.4 Demonstrating that it is consistent with the NPPF.
 - 2.1.5 Providing an assessment of:
 - 2.1.5.1 Whether any proposed development is likely to be affected by flooding from any source.
 - 2.1.5.2 Whether it will increase flood risk elsewhere.
 - 2.1.5.3 The measures to deal with these effects and risks.
 - 2.1.5.4 Satisfying the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect.
 - 2.1.5.5 Designs which reduce flood risk to the development and elsewhere, by incorporating sustainable drainage systems and where necessary flood resilience measures.
 - 2.1.5.6 Identifying opportunities to reduce flood risk, enhance biodiversity and amenity and seek collective solutions to managing flood risk.

3 Catchment/Site Description

- 3.1 The topography of the development boundary generally slopes from north to south. The maximum elevation is 55.31mAOD, the minimum elevation is 52.95mAOD. The topographic survey is included within the appendix A for reference.
- 3.2 A review of grid reference finder confirms the Nico Ditch is a culverted watercourse running through the site, an extract of the Map is in Figure 3 below.



Figure 3: Existing Watercourses. (Source: Google Maps)

- 3.3 The National Soils Resources Institute, through the Soilscapes web viewer, identifies the soil type within the proposed sites as Soilscape 17, Slowly permeable seasonally wet acid loamy and clayey soils.
- 3.4 The British Geological Survey (BGS) Geology of Britain viewer defines the bedrock geology within the proposed site as Chester Formation - Sandstone. Superficial deposits are shown as Till, Devensian - Diamicton.
- 3.5 Flood Risk Assessment
- 3.5.1 The National Planning Policy Framework (NPPF) seeks to promote development in areas at low risk of flooding and to reduce the flood risk resulting from development. The purpose of this site-specific flood risk assessment is to demonstrate that the site can be considered to fall within an area of low annual probability and assess the risk to the site from all sources of flooding.
- 3.5.2 The planning flood maps from the Environment Agency show that the site boundary falls within Flood Zone 1 in terms of risk posed by sea or river as seen in Figure 2 above.
- 3.6 The Sequential Test
- 3.6.1 In accordance with the NPPF it is required to apply the sequential test at all stages of the planning process.
- 3.6.2 The aim of this process is to steer new developments to areas at the lowest probability of flooding (Flood Zone 1).
- 3.6.3 The Environment Agency's flood zones are the starting point for applying the sequential test. The zones refer to flooding from sea and river flooding only.

- 3.6.4 The proposed buildings are already located within a Flood Zone 1 so therefore passes the sequential test for flooding related to rivers or the sea.
- 3.6.5 Paragraph 23 of the NPPF (Flood Risk and Coastal Change) requires developments avoid, so far as possible, development in areas of current and future medium and high-risk flooding, including surface water flooding.
- 3.6.6 The Environmental Agency Flood Map for Planning (surface water) indicates that the site may be at risk of flooding from the 1 in 30 year event.
- 3.6.7 The Environment Agency cautions that due to the limitations within the model (single drainage rate, national level modelling, LiDAR data etc.) the surface water flood maps do not provide a definitive risk of surface water flooding at the plot level. This flood map reflects the current scenario and provides an indication of the potential surface water flood risk in the absence of drainage network designed to facilitate the proposed development through the management of surface water.
- 3.6.8 Surface water flooding is shown on site during the 30-year storm and above.

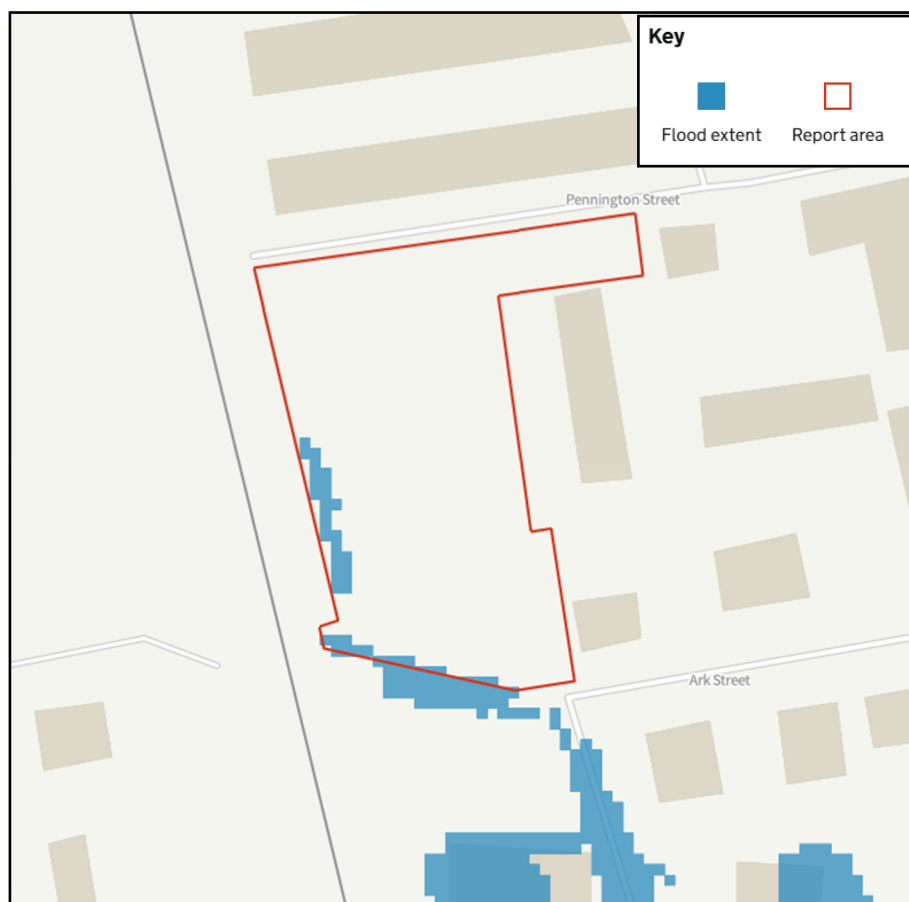


Figure 4: Environment Agency Surface Water Long Term Flood Risk (30 year)

- 3.6.9 A new drainage network is to be designed and installed to current standards, reducing peak run off to as close to greenfield rates as practically possible, therefore reducing flood risk. Following this the site passes the sequential test.

- 3.7 According to the NPPF Annex 3: Flood risk vulnerability classification the site is classed as 'more vulnerable'.

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	✗	✗	✗
Key: ✓ Development is appropriate. ✗ Development should not be permitted.						

Figure 5: Table 3 from the NPPF Technical Guide illustrating site classification

- 3.7.1 A review of Table 3 of the NPPF Technical guide indicates that an exception test is not required for areas classed as more vulnerable that falls within Flood Zone 1.
- 3.8 Sources of Flooding
- 3.8.1 Flooding is a natural hazard and can happen at any time in a wide variety of locations. There are several forms of flooding, which present a range of different risks. The speed of inundation and the duration of different forms of flooding vary greatly. With climate change, the frequency, patterns, and severity of flooding are forecast to change and become more damaging.
- 3.8.2 The limits of flood risk areas cannot be defined precisely because floods with similar probability can arise from different combinations of weather, sources, rainfall patterns, local topography, and patterns of development.
- 3.8.3 Every flood will have different consequences on people, property and the environment and depends on the land use.
- 3.9 Flooding from the River and the Sea
- 3.9.1 Flooding from rivers or the sea is classed as a low/no risk (flood zone 1) across the site boundary as seen in Figure 6.

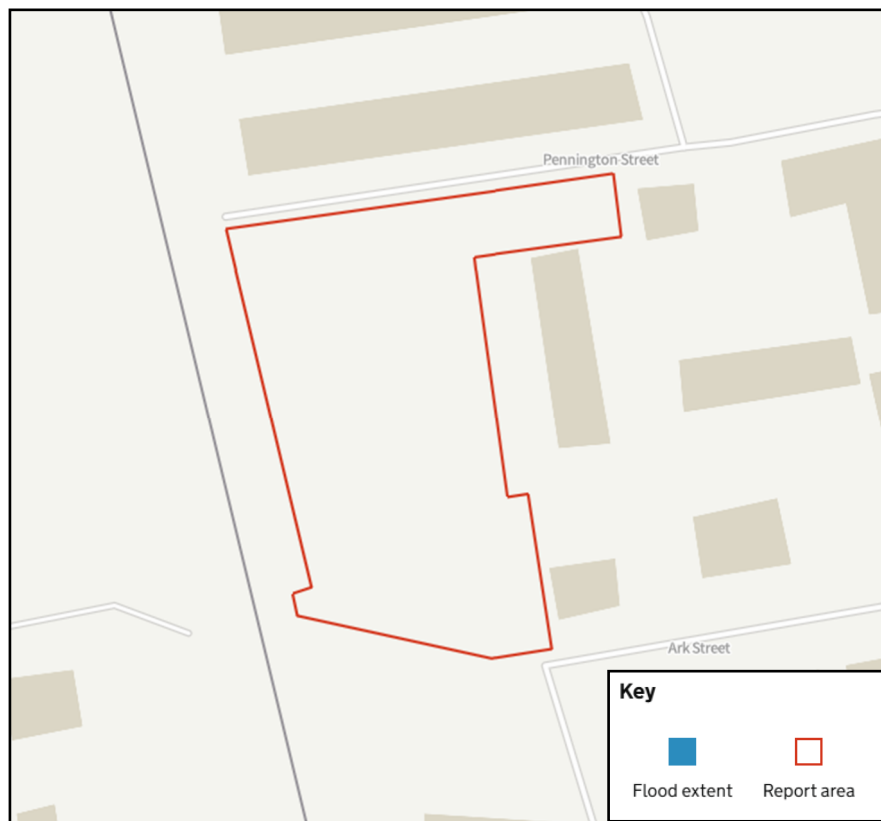


Figure 6: Environment Agency Flood Map - Extents of Flooding from Rivers or the Sea

3.10 Flooding from Surface Water

- 3.10.1 Flooding from surface water may occur in times of intense rainfall at a local site level as any drainage system may not be able to disperse the rainfall quickly enough. Surface flooding occurs when both the natural interception capacity of the ground is exceeded and the capacity of inlets to the drainage system are exceeded.
- 3.10.2 The Environment Agency provides surface water flood maps for the high (greater than 3.3% Annual exceedance probability (AEP), medium (1% AEP) and low (0.1% AEP) risk scenarios. The surface water flood maps from the Environment Agency website are provided in Appendix C for reference, although the low-risk scenario is generally considered above the design return period.
- 3.10.3 The extent of surface water flooding, Figure 4 above, indicates that there is a risk of surface water flooding occurring within the site boundary during the 30-year, 100-year and 1000-year storms.
- 3.10.4 As stated within the sequential test a surface water network is proposed to mitigate against any on site surface water flooding, Entrances to buildings will also be set to direct water away from the building entrances, therefore the risk of surface water flooding to the site can be considered low.
- 3.10.5 Flooding from Sewers
- 3.10.6 Flooding from the sewers occurs when surcharging during periods of excess flow breaks ground, typically at manholes or road gullies. The proposed development will not increase the risk off site posed by sewer flooding as the surface water runoff, a primary cause of sewer surcharging, from the site is to be managed in accordance with the requirements of the NPPF and LLFA.
- 3.10.7 The development site is an existing greenfield site however does have existing sewers within it; a new surface water network will be designed and manage surface water discharge to greenfield rates.

- 3.10.8 Drainage for the proposed development will be designed to current best practice for both foul and surface water drains using Approved Document H. The new surface water drainage network for the site shall be designed to cater for the 100-year plus climate change event in accordance with current guidance and will incorporate long-term storage and SuDS as appropriate.
- 3.10.9 The existing culvert within the site will be used as the point of discharge for the proposed surface water network. The foul water network will discharge to the combined sewer within the site boundary. Proposed drainage within the site will be designed to the current requirements of the LLFA, the site can therefore be considered at low risk of sewer flooding.
- 3.11 Flooding from Infrastructure
- 3.11.1 Flooding from infrastructure occurs when canals, dams or other manmade structures capacity is exceeded, or fail. The Environment Agency Flood Map for Planning confirms the site is not within a flood risk area for a reservoir and the site is not located near canals.
- 3.11.2 There is no risk of flooding associated with infrastructure failure.
- 3.12 Flooding from Groundwater
- 3.12.1 The 'Manchester City Strategic Flood Risk Assessment maps' shows no risk of groundwater flooding within the site area or surrounding areas as seen in Figure 7 below.

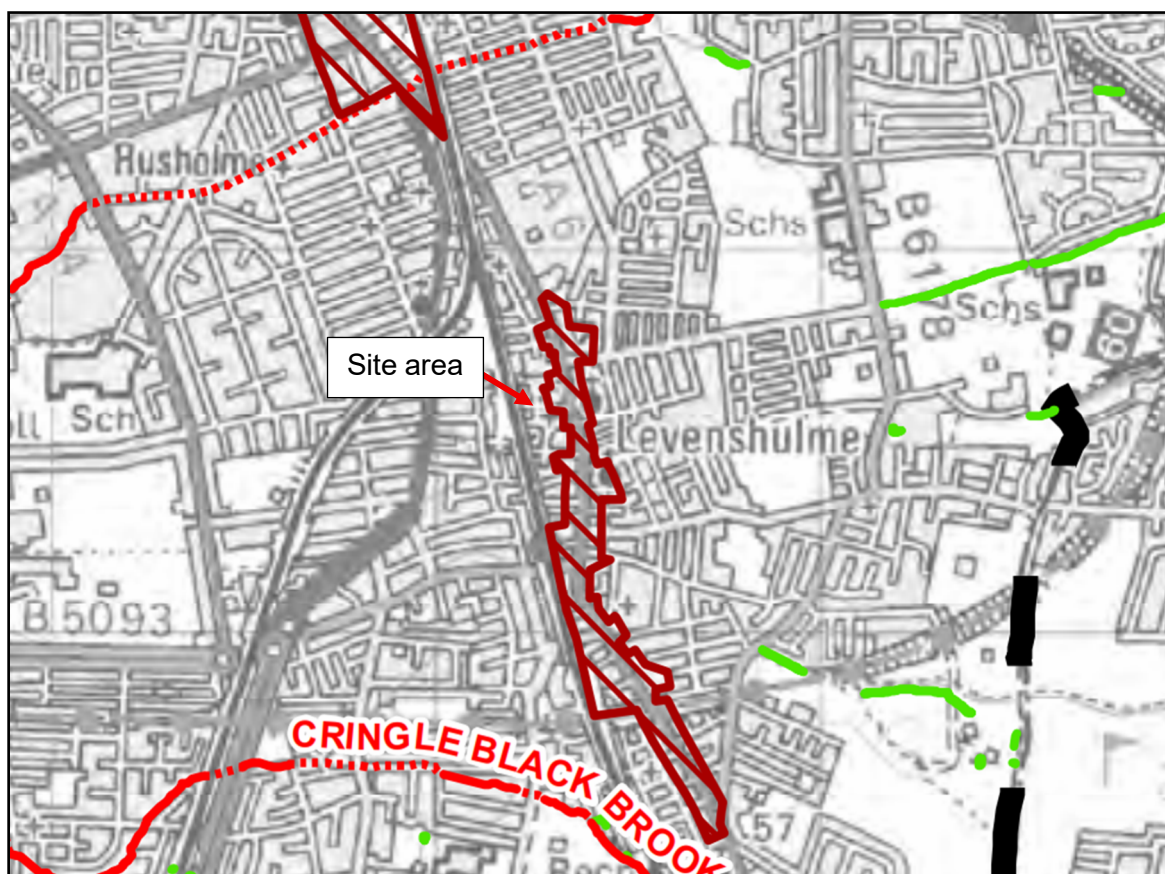


Figure 7: Map – Groundwater flooding - Manchester City Strategic Flood Risk Assessment

- 3.12.2 This indicates that the site falls within a low likelihood area for groundwater flooding.
- 3.12.3 There are no other sources of flooding that affect the site. Overall flood risk to the proposed development can be considered low.

4 Climate Change

- 4.1 Paragraph 162 of the National Planning Policy Framework (NPPF) requires that plans should take a proactive approach to mitigating and adapting to climate change.
- 4.2 Paragraph 181 of the NPPF requires all plans to adopt a sequential risk-based approach considering all sources of flood risk and future impacts of climate change.
- 4.3 To appropriately mitigate the increased flood risk caused by climate change the Government has published guidance (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>) related to the appropriate climate change allowances.

3.3% Annual Exceedance Rainfall Event		
Upper Mersey	Central Allowance	Upper End Allowance
2050s	20%	35%
2070s	30%	40%
1% Annual Exceedance Rainfall Event		
Upper Mersey	Central Allowance	Upper End Allowance
2050s	25%	40%
2070s	30%	45%

Table 1: Climate Change Allowances. (Upper Mersey Management Catchment)

- 4.4 For developments with a lifetime between 2061 and 2125 the 2070s Upper Mersey data should be used.
- 4.5 To mitigate the impact of climate change on the development the upper end allowances should be considered for both the 1% and 3.3% annual exceedance probability events and the development should be design for the 1% annual exceedance probability event so that there is:
- 4.5.1 No increased flooding elsewhere.
- 4.5.2 And the development is safe from surface water flooding.
- 4.6 Where new surface water drainage is proposed an allowance for climate change shall be included to mitigate the risk.

5 Emergency Access/Escape

- 5.1 With flood risk to the site considered low and the area being within a flood zone 1 for sea and rivers, there is no requirement for an emergency access or escape routes.

6 Flood Risk Summary and Conclusion

- 6.1 From the above assessment of flood risk, it has been established that the development site is entirely within Flood Zone 1 for river and sea flooding.
- 6.2 Surface water flood risk can be mitigated through careful consideration of finished floor levels and implementation of a SuDS drainage scheme that helps to manage runoff from the development.
- 6.3 The surface water drainage network will be designed taking climate change into consideration and to help ensure the development is safe for its lifetime.
- 6.4 The development will not increase the risk of flooding off site.

Surface Water Drainage Strategy

7 Policy Context

- 7.1 The LLFA expect the surface water management strategy to comply with:
- 7.2 Paragraph 80 of the Planning Practice Guidance (PPG);
- 7.3 Paragraph 175 of the National Planning Policy Framework; and
- 7.4 Paragraph 56 of the Planning Practice Guide requires that surface water from development be discharged in line discharge hierarchy.
- 7.5 The discharge hierarchy from of the part New National Standards for SuDS. Standard S1 requires it to be managed in line with the below hierarchy.
 - 7.5.1 Collected for non-potable use
 - 7.5.2 Infiltrate into the ground close to source.
 - 7.5.3 Discharge runoff to a surface water body.
 - 7.5.4 Discharge runoff to a surface water sewer, highway drain or other surface water drainage system.
 - 7.5.5 Discharge to a combined sewer.
- 7.6 The implementation of the hierarchy will be discussed in greater detail in Section 11.
- 7.7 Paragraph 175 of the National Planning Policy requires major developments to incorporate sustainable drainage systems unless there is clear evidence that their inclusion would be inappropriate. Sustainable drainage systems should:
 - 7.7.1 Take account of advice from the LLFA.
 - 7.7.2 Have appropriate proposed minimum operational standards.
 - 7.7.3 Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
 - 7.7.4 Where possible, provide multifunctional benefits.
- 7.8 The National Standards for SuDS are:
 - 7.8.1 S1 requires, that runoff should be discharged following the hierarchy stated above. Appropriate evidence is to be provided to demonstrate all higher priority final destinations have been utilised to the maximum extent practicable. Higher cost alone shall not be a reason to utilise lower priority destinations. Where more than one destination is utilised, each final destination's ability to accept runoff shall be maximised in order of priority.
 - 7.8.2 S2 requires, that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems. Evidence shall be provided that the approach to managing runoff from 'everyday' rainfall has been developed alongside and in support of the management of runoff quality and the delivery of amenity and biodiversity benefits.

- 7.8.3 S3 requires, development runoff is managed during extreme rainfall, including allowances for climate change and urban creep. Across all discharge methods the flood risk should be mitigated to ensure there is no increased risk elsewhere. Any flooding for events up to the 1% AEP shall be managed within the development. Any flooding from off-site sources shall be managed on site or safely routed through the site, ensuring no increased downstream risks compared to the predevelopment scenario.
- 7.8.4 S4 requires, a SuDS approach that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development. The proposals shall utilise SuDS based on a robust water quality risk assessment, appropriate to the pollution hazard and sensitivity of receiving waters. It should reflect industry recognised guidance or other quantitative assessments as agreed with the approving body and permitting requirements.
- 7.8.5 S5 requires, that SuDS should maximise benefits for amenity through the creation of multi-functional places and landscapes.
- 7.8.6 S6 requires SuDS be used to ensure surface water drainage system maximises biodiversity benefits throughout the development lifecycle. This can be done by creating diverse, self-sustaining and resilient local ecosystems. Also, supporting natural local habitat and species and contributing to the delivery of local biodiversity strategies and contributing to habitat connectivity.
- 7.8.7 S7 requires that drainage systems can be easily and safely constructed and maintained. A maintenance plan is to be provided that support the design objectives within standards 1 to 6. Surface water drainage design should examine any potential failure scenarios that can occur during the operational design life and manage these risks. It shall be designed to ensure structural integrity under anticipated loading conditions to ensure the structural integrity of the proposed or existing components is not affected.
- 7.9 The requirements of the local and national policy will be addressed by the proposed site layout and proposed drainage system, discussed in detail in Sections 9 and 11.

8 Existing Drainage

- 8.1 Compliance with policy begins with a review of the existing site and its drainage characteristics.
- 8.2 As discussed within the flood risk assessment, the development site is considered to have a greenfield land classification as it falls with no existing infrastructure.
- 8.3 The nearest watercourse to the development is the Nico Ditch, a culverted watercourse running through the site.
- 8.4 The site topography directs runoff to the south
- 8.5 The surface water runoff from the development site is to be discharged as close as reasonably practicable to greenfield rates due to a new surface drainage network being proposed.

9 Proposed Site Layout

- 9.1 The proposed site layout is influenced by existing levels and infrastructure surrounding the site and the existing road connection points to the north and south of the site.
- 9.2 Proposed site levels are influenced by the existing topography with the site falling gently towards the south.
- 9.3 Appropriate FFLs are to be set for the proposed developments to mitigate against surface water flooding implied on the EA surface water flood maps.

10 Urban Creep

- 10.1 A 10% urban creep factor has been applied to the footprint of each house within the development.

11 Proposed Surface Water Drainage

- 11.1 Planning policy requires that the SuDS drainage hierarchy is explored when discharging surface water runoff as noted in Section 7.
- 11.2 The first level of the hierarchy requires for surface water to be collected for non-potable use within the proposed site.
- 11.3 Due to the development not being within a water stressed area and there being insufficient catchment area across the site for what would be required, the next stage of the hierarchy will be explored.
- 11.4 The second level of the hierarchy requires that infiltration solutions be considered for the management of surface water runoff.
- 11.4.1 Infiltration systems can take the form of soakaways, detention ponds, permeable pavements, bio-retention areas etc.
- 11.4.2 The Soilscape viewer identified the general area as Soilscape 18, Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
- 11.4.3 Infiltration testing has not been carried out on the proposed development site, but after reviewing the soilscape ground conditions it is believed the use of soakaways is not a viable solution for the management of surface water from the development. Infiltration testing will be carried out to BRE365 standards to confirm.
- 11.5 The third tier of the hierarchy requires surface water to be discharged to a surface water body.
- 11.5.1 A review of the area surrounding the site has confirmed that there is the Nico Ditch culverted watercourse running through the development site.
- 11.5.2 This will be used as the preferred point of discharge and will be restricted to as close to greenfield rates as possible. As the proposed road is to be adopted a minimum discharge rate of 5l/s has been used.
- 11.6 The fourth tier of the hierarchy requires surface water to runoff to a surface water sewer.
- 11.7 The fifth tier requires surface water to be discharged to a combined sewer.
- 11.7.1 With the proposed surface water sewer discharging to the culverted watercourse the development is considered to be managed at level three of the discharge hierarchy.
- 11.8 Details of the proposed drainage strategy are presented on the proposed drainage plans in Appendix A.
- 11.9 With the proposed surface water network in the proposed road being offered for adoption the minimum orifice size that can be used is 100mm, therefore the network has been restricted to the agreed discharge rate of 5l/s to comply with this.
- 11.10 The greenfield rate calculation is shown in Appendix B.

- 11.11 The proposed drainage network requires a flow control and attenuation, to achieve the required discharge rates and manage surface water to mitigate the flood risk stemming from the development, prior to discharging to the surface water network.
- 11.12 Attenuation is provided in the form of large drainage pipes prior to a controlled discharge into the culverted watercourse via a vortex control.
- 11.13 The calculations for the proposed drainage strategy network are provided in the Appendix D, for reference, these confirm the volume and discharge rates. The calculations confirm the resultant discharges can be managed to satisfy the limiting discharge rate.
- 11.14 The simulation results confirm that the proposed surface water network satisfies the required design standards for all events up to and including the 100 year plus 45% climate change event.
- 11.15 The proposed surface water drainage network can be considered to fulfil the policy requirements as far as practicable.

12 Water Quality

- 12.1 Water quality guidance is set out in Chapter 26 of the SuDS Manual (CIRIA C753). For the anticipated hazards the simple index approach is suitable.
- 12.2 Pollution hazard indices for the simple index approach are provided in Table 26.2 of the SuDS Manual. The development site primarily consists of roofs, roads and parking areas. The pollution hazard from these land use classifications can be considered low.
- 12.3 Suspended solids from the surface runoff will be managed through the use of permeable paving and trapped gullies with a sump, prior to the outfall, which will allow suspended solids to settle out.

13 Proposed Foul Water Network

- 13.1 The proposed foul water network will be designed in accordance with the requirement of Approved Document H.
- 13.2 The anticipated peak foul flow connection point and discharge rate will be agreed with United Utilities.

14 Maintenance and Management

- 14.1 The proposed drainage network will be managed by a building management company.
The piped network and flow control will be maintained in accordance with the building management company processes.

15 Surface Water Management summary and Conclusion

- 15.1 The proposed drainage network manages surface water runoff up to the 100-year plus 45% climate event.
- 15.2 Long-term storage is provided within large diameter pipes, and the runoff rate is controlled to comply with standards S3 of the National Standards for SuDS, as far as practicable, through the inclusion of a flow control in accordance with CIRIA C753.

-
- 15.3 The surface water discharge rate is controlled in line with the requirements of the Statutory Undertaker and the LLFA.
- 15.4 The proposed drainage network includes SuDS as far as practicable given the layout of the site and constraints set by the existing external constraints.
- 15.5 Through the implementation of the proposed drainage strategy the site does not increase flooding within or downstream of the catchment including an allowance for climate change.
- 15.6 The proposed drainage network is considered to satisfy the requirement of local and national planning policy.

16 Appendix A – Proposed plans / Topographic survey



Key		Accommodation Schedule	
	Site Boundary Line	1B2P Bungalow M4(3)	1no.
	Land within client ownership	2B4P House	9no.
		3B6P House (2.5-storey)	4no.
		Total	14no.
	Existing Levels	<i>all units to Manchester City Council space standards</i>	
	Proposed Levels		

Drawing Title:	Proposed Site Plan
Date:	10/06/2025
Drawing no:	1351 - 100
Scale:	1:500 @ A3
Drawn:	LC

revision: F			
revision notes:	D	15/09/2025	House types amended following design team comments dated 01/09/2025.
	E	18/11/2025	Amendments following Landscape Architect design information.
	F	03/03/2026	Road Layout amendments following Highways consultant comments.

A1.1 ALL DRAWING TO BE IN CONJUNCTION WITH THIS CONTRACT.

A1.2 ALL RELEVANT STRUCTURAL AND ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.

A1.3 ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR / FABRICATOR PRIOR TO COMMENCEMENT OF WORKS.

A1.4 ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.

A1.5 ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS AND WHERE APPLICABLE LOCAL AUTHORITIES REQUIREMENTS.

A1.6 ALL MATERIALS TO BE MARKED WITH BS KITE MARK WHERE APPLICABLE.

P01	PRELIMINARY ISSUE	03.10.25	AKG	MB
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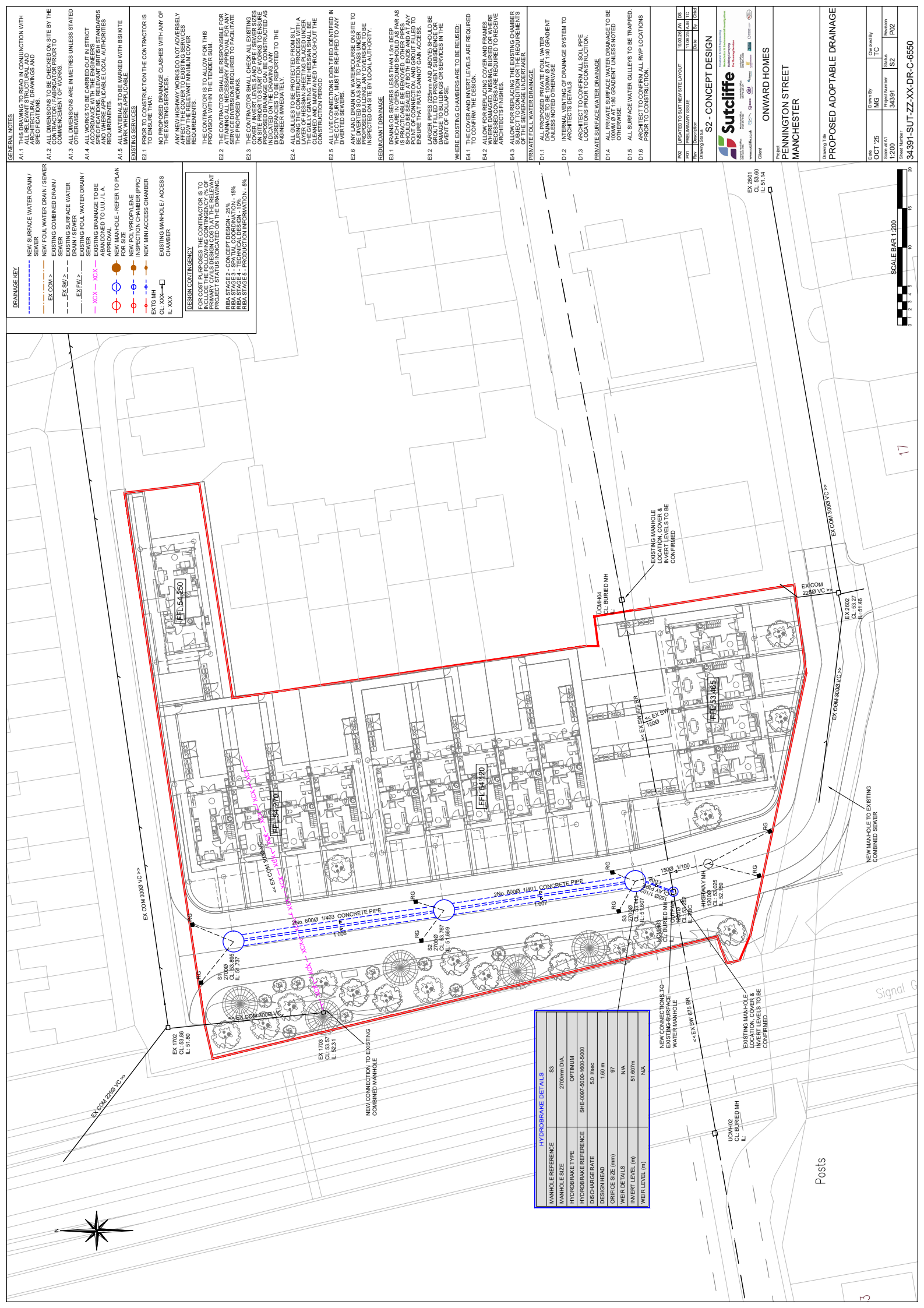
**PENNINGTON STREET
Project
MANCHESTER**

Drawing Title
EXISTING DRAINAGE

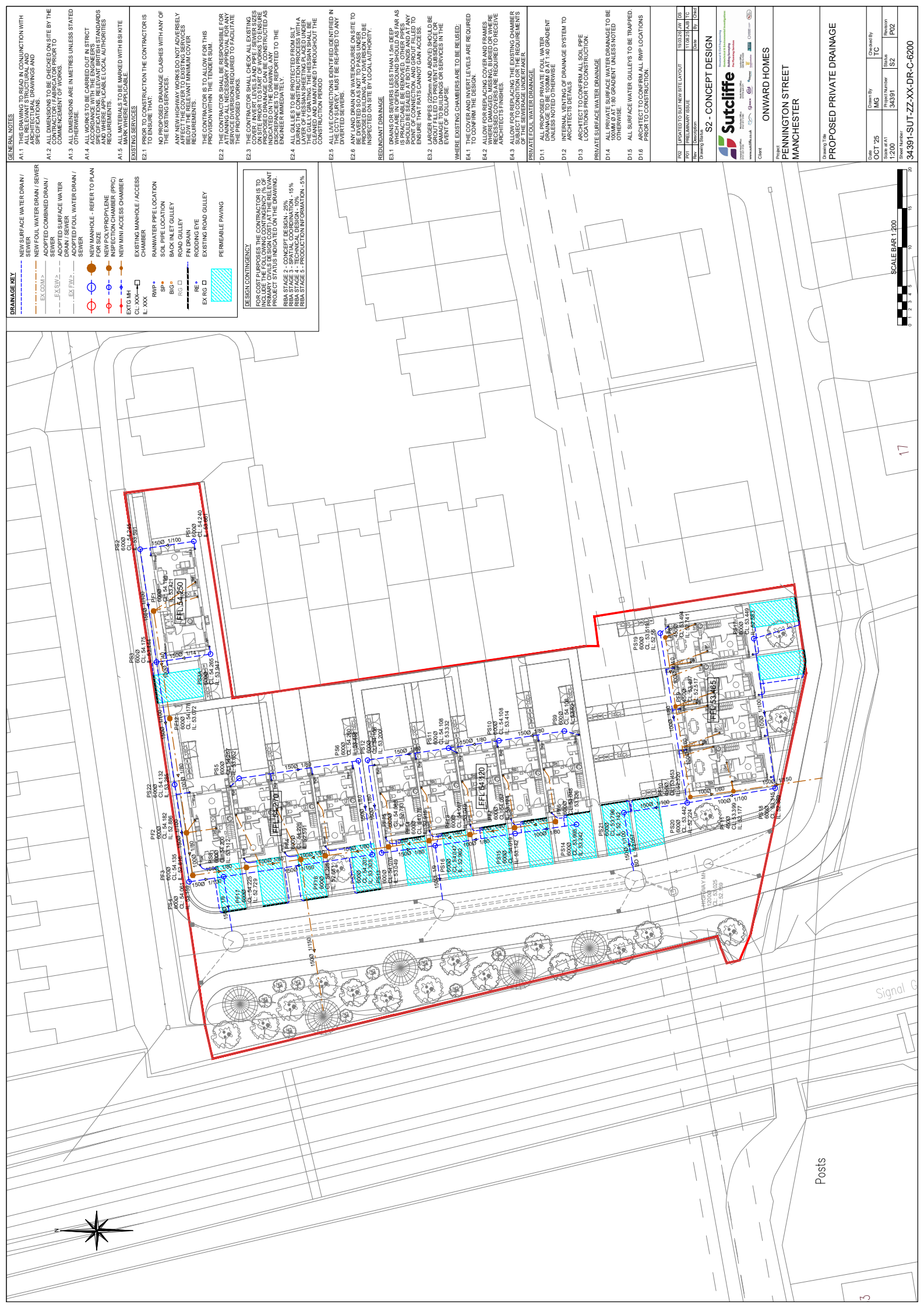
Date	OCT '25	Drawn By	MG	Checked By	MB
Scale at A1	1:200	Project Number	34391	Status	S2
				Revision	P01

Sheet Number
34391-SUT-ZZ-XX-DR-C-6000





HYDROBANE DETAILS	
MANHOLE REFERENCE	S3
MANHOLE SIZE	2700mm DIA
HYDROBANE TYPE	OPTIMUM
HYDROBANE REFERENCE	SHE-0097-5000-1600S-5000
DISCHARGE RATE	3.0 l/sec
DESIGN HEAD	1.60 m
ORIFICE SIZE (mm)	97
WEIR DETAILS	N/A
INVERT LEVEL (m)	51.607m
WEIR LEVEL (m)	N/A



date	PCT '25	Drawn By MG	Checked By TC
scale A1	:200	Project Number 34391	Status S2
Revision P02			

Sheet Number
34391-SUT-ZZ-XX-DR-C-6200

Sheet Number
44391-SUT-ZZ-XX-DR-C-6200

GENERAL NOTES

A1.1 THIS DRAWING TO BE READ IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.

A1.2 ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

A1.3 ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.

A1.4 ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE SPECIFICATIONS, RELEVANT BRITISH STANDARDS AND ANY APPLICABLE LOCAL AUTHORITIES REQUIREMENTS.

A1.5 ALL MATERIALS TO BE MARKED WITH BS9 KITE MARK WHERE APPLICABLE.

DESIGN CONTINGENCY

FOR COST PURPOSES THE CONTRACTOR IS TO PROVIDE A DESIGN CONTINGENCY FOR THE PROJECT STATUS INDICATED ON THE DRAWING.

RBA STAGE 2 - CONCEPT DESIGN - 25%
RBA STAGE 3 - PRELIMINARY DESIGN - 15%
RBA STAGE 4 - TECHNICAL DESIGN - 10%
RBA STAGE 5 - PRODUCTION INFORMATION - 5%

POD	UPDATED TO NEW SITE LAYOUT	10.02.2018	JW
POT	PRELIMINARY ISSUE	08.10.2018	NB
Rev	Description	Date	By
1	Issue	08.10.2018	NB

S2 - CONCEPT DESIGN

Sutcliffe
Sustainable & Cost Effective
Architectural & Planning
Solutions
www.sutcliffe.co.uk

Client: **ONWARD HOMES**

Project: **PENNINGTON STREET MANCHESTER**

Drawing Title: **IMPERMEABLE AREAS**

Date	Issued By	Checked By
OCT '25	MG	MB

Scale of A1	Project Number	Sheet	Revision
1:250	34391	S2	P02

Street Number: **34391-SUIT-ZZ-XX-DR-C-6100**



GENERAL NOTES

A1.1 THIS DRAWING IS TO BE USED IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.

A1.2 ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

A1.3 ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.

A1.4 ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS SPECIFICATIONS. RELEVANT BRITISH STANDARDS AND SPECIFICATIONS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

A1.5 ALL MATERIALS TO BE MARKED WITH B88 KITE MARK WHERE APPLICABLE.

EXISTING SITE CONDITIONS

E1.1 THE DEVELOPER SHALL NOT COMMENCE ANY WORKS PRIOR TO THE RECEIPT OF THE NECESSARY PERMITS AND APPROVALS FROM THE RELEVANT LOCAL AUTHORITY. MANAGEMENT MEASURES NECESSITATED BY THE WORKS ARE IN PLACE.

E1.2 THE DEVELOPER SHALL MAINTAIN ACCESS TO ALL ADJACENT PROPERTIES AND ALONG EXISTING FOOTWAYS, PRIVATE ACCESS, PUBLIC RIGHTS OF WAY AND THROUGHOUT THE CONSTRUCTION PHASE.

E1.3 THE CONTRACTOR IS TO CONFIRM EXISTING ROAD LEVELS AT ALL PROPOSED JUNCTIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION PRIOR TO COMMENCEMENT OF WORKS.

KEY

PROPOSED SITE BOUNDARY

PROPOSED SPOT LEVEL

PROPOSED LEVEL AT CORNER OF BUILDING

PROPOSED SURFACE GRADIENT

EXISTING SPOT LEVELS

FINISHED FLOOR LEVELS

PROPOSED GRAVEL BOARD / PROPOSED RETAINING WALL

GB / RTH = DIFFERENCE FROM PROPOSED LOWER GROUND LEVEL TO HIGHER GROUND LEVEL (mm).

PROPOSED CONTOURS

DESIGN CONTINGENCY

FOR COST PURPOSES THE CONTRACTOR IS TO PROVIDE A DESIGN CONTINGENCY OF 5% TO COVER ANY UNFORESEEN COSTS AT THE RELEVANT PROJECT STATUS INDICATED ON THE DRAWING.

RIBA STAGE 2 - CONCEPT DESIGN - 25%
RIBA STAGE 3 - PRELIMINARY DESIGN - 45%
RIBA STAGE 4 - TECHNICAL DESIGN - 10%
RIBA STAGE 5 - PRODUCTION INFORMATION - 15%

REV	DESCRIPTION	DATE	BY	CHECKED
P02	REVISED LEVELS UPDATED TO SUIT NEW SITE LAYOUT	23.03.20	HW	DB
P01	PRELIMINARY ISSUE	07.08.25	AWB	TC

S2 - CONCEPT DESIGN

Sutcliffe

Site Services & Construction Management
Sutcliffe Construction Management Ltd
100-102, The Quadrant, Manchester, M1 2JL
0161 275 1234
www.sutcliffe.co.uk

Client: **ONWARD HOMES**

Project: **PENNINGTON STREET MANCHESTER**

Drawn By	Checked By	Scale	Project Number	Sheet	Revision
AUG 2025	AUG 2025	1:200	34.391	S2	P02

34391-SUT-ZZ-XX-DR-C-0150



17 Appendix B – Greenfield calculations

Pennington Street:	Date: 22/09/2025		
	Designed by: MB	Checked by: TC	Approved By: TC
Report Title: UK and Ireland Rural Runoff Calculator	Sutcliffe: 18-20 Harrington Street		


Sutcliffe

ICP SUDS / IH 124

Details

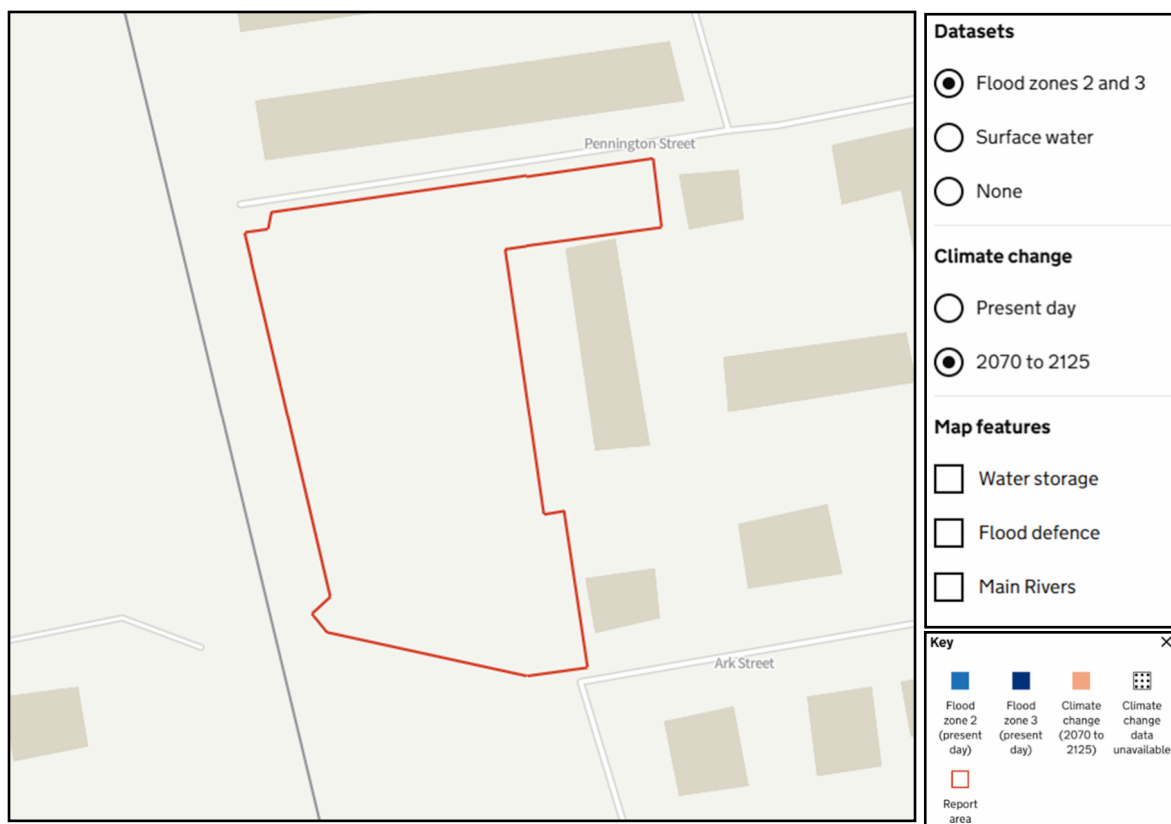
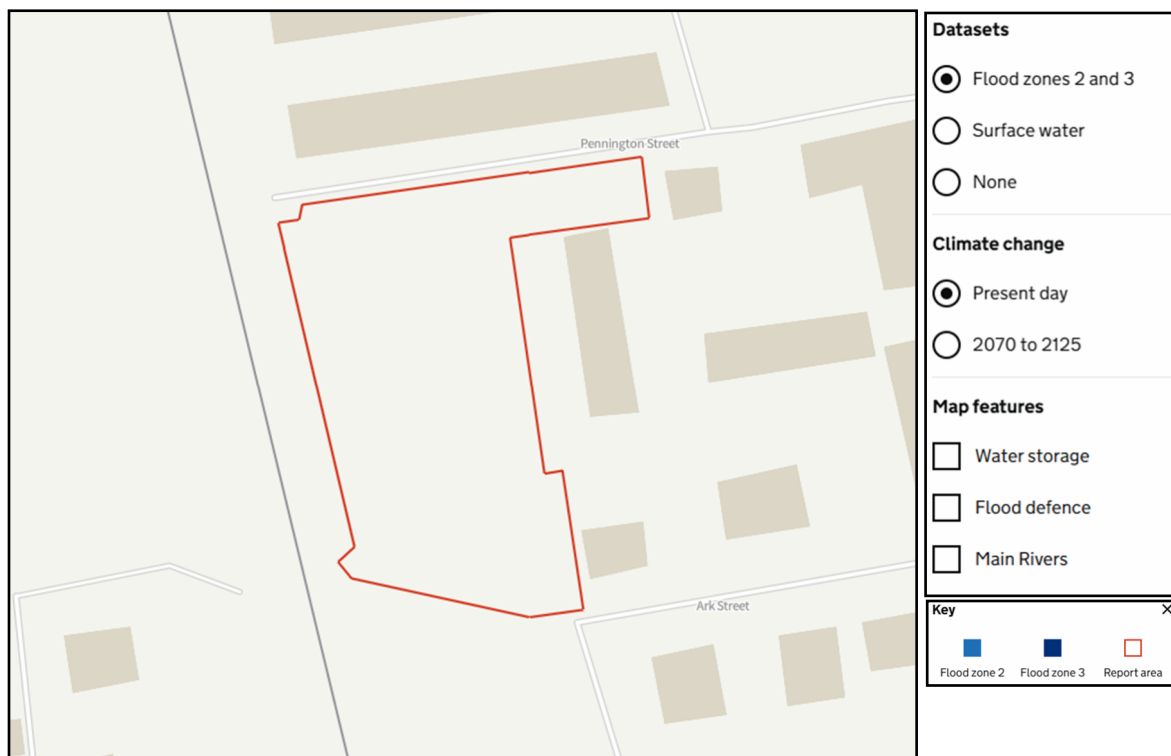
Method	ICP SUDS
Area (ha)	0.40
SAAR (mm)	823.0
Soil	0.3
Region	Region 10
Urban	0
Return Period (years)	0

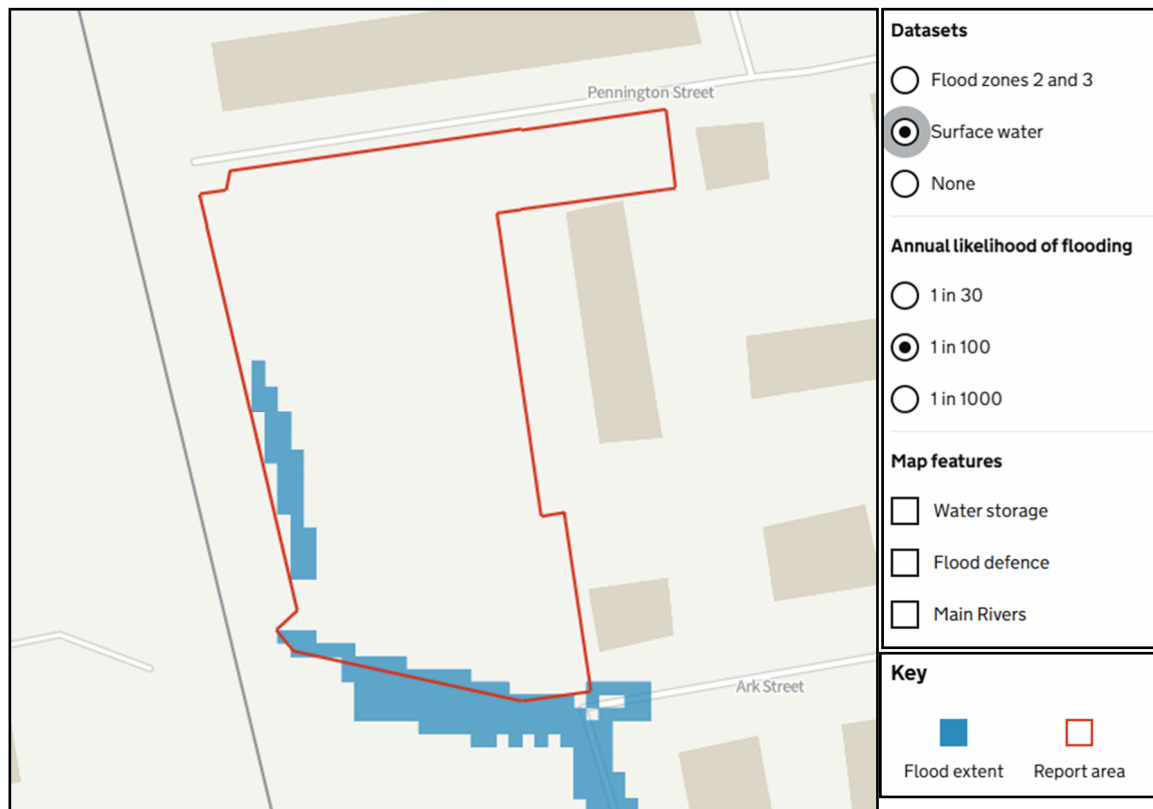
Results

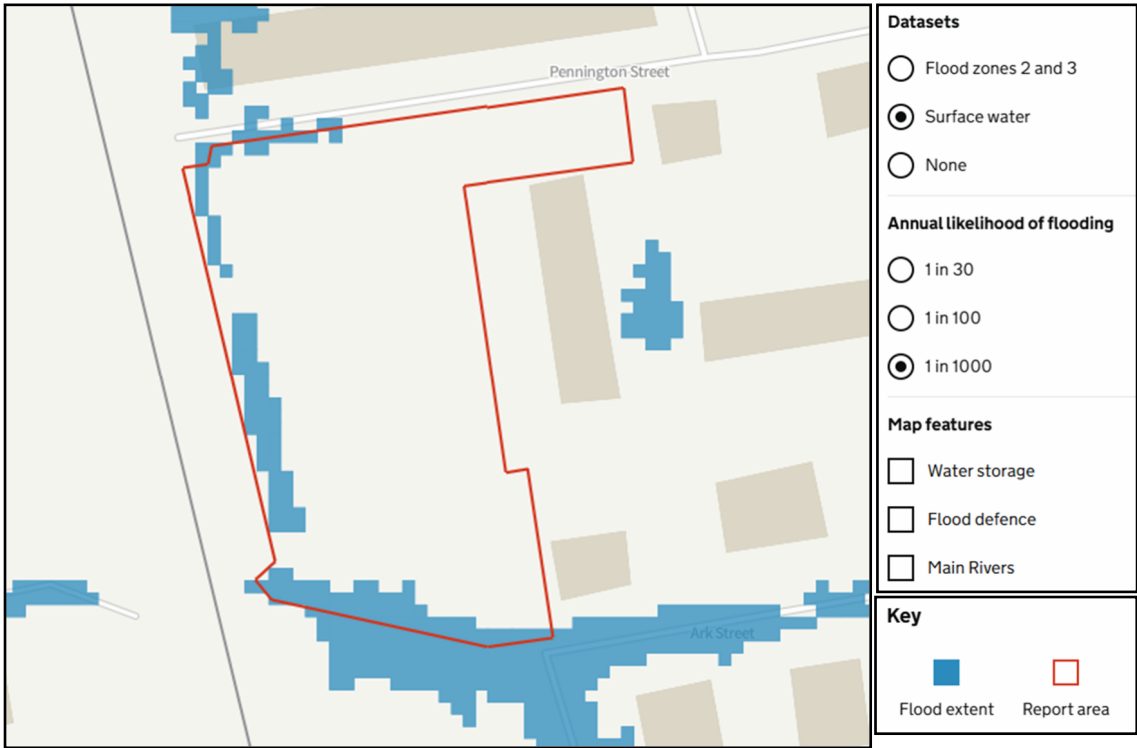
Region	QBAR Rural (L/s)	QBAR Urban (L/s)	Q 1 (years) (L/s)	Q 30 (years) (L/s)	Q 100 (years) (L/s)
Region 10	0.9	0.9	0.8	1.5	1.8

18 Appendix C – Environment Agency Data

EA Flood maps







19 Appendix D – Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.066	2700	Type B	53.895	51.737	1.558	387195.354	394723.176
S2	0.086	2700	Type C	53.767	51.669	1.498	387199.331	394696.093
S3	0.030	2700	Type B	53.443	51.607	1.686	387203.050	394671.502
OUTFALL	0.000	1200	Type B	53.252	51.555	1.547	387201.258	394666.529

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	51.737	S2	51.669	Circ	2No. 600	27.374	403	0.600	1.558	1.498
1.001	S2	51.669	S3	51.607	Circ	2No. 600	24.870	401	0.600	1.498	1.236
1.002	S3	51.607	OUTFALL	51.555	Circ	150	5.287	102	0.600	1.686	1.547

Permeable Paving Schedule

Permeable Paving	Assigned Manhole	Effective Storage Volume (m3)	CL (m)	IL (m)	Storage Infil Rate (m/hr)	Safety Factor	Easting (m)	Northing (m)
Permeable Paving 1	S1	7.844	53.895	53.515	0.00000000	2.00	387202.529	394718.190
Permeable Paving 2	S1	1.720	53.895	53.515	0.00000000	2.00	387204.339	394706.104
Permeable Paving 3	S2	15.769	53.767	53.387	0.00000000	2.00	387208.195	394680.557
Permeable Paving 4	S3	4.649	53.443	53.063	0.00000000	2.00	387209.793	394671.513

Outfall Details

Outfall Manhole OUTFALL : Free Discharge

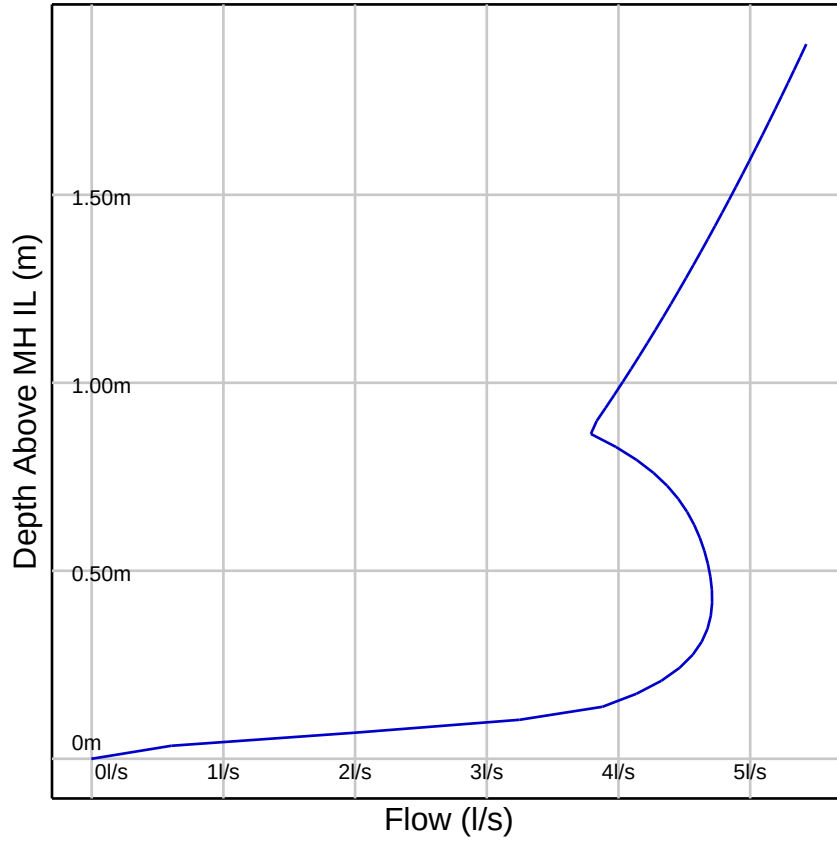
Flow Control Details

Controls within Manhole S3

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0097-5000-1600-5000	1.600	5.000	0.000	0.427	4.711	0.866	3.770

Hydro-Brake® Optimum Control from S3 to OUTFALL



Simulation Settings

FSR: M5-60=18.00, R=0.36, Locale=England and Wales

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (2, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	36.942	0.00	-0.21	2Yr 720Min Winter	2.568	0.00	0.00
2Yr 15Min Summer	36.942	0.00	-0.21	2Yr 960Min Summer	2.089	0.00	0.00
2Yr 30Min Winter	23.956	0.00	-0.18	2Yr 960Min Winter	2.089	0.00	0.00
2Yr 30Min Summer	23.956	0.00	-0.18	2Yr 1440Min Summer	1.561	0.00	0.00
2Yr 60Min Summer	15.001	0.00	-0.14	2Yr 1440Min Winter	1.561	0.00	0.00
2Yr 60Min Winter	15.001	0.00	-0.14	2Yr 2160Min Summer	1.167	0.00	0.00
2Yr 120Min Winter	9.225	0.00	0.00	2Yr 2160Min Winter	1.167	0.00	0.00
2Yr 120Min Summer	9.225	0.00	0.00	2Yr 2880Min Summer	0.949	0.00	0.00
2Yr 180Min Summer	6.915	0.00	0.00	2Yr 2880Min Winter	0.949	0.00	0.00
2Yr 180Min Winter	6.915	0.00	0.00	2Yr 4320Min Summer	0.710	0.00	0.00
2Yr 240Min Summer	5.634	0.00	0.00	2Yr 4320Min Winter	0.710	0.00	0.00
2Yr 240Min Winter	5.634	0.00	0.00	2Yr 5760Min Summer	0.578	0.00	0.00
2Yr 360Min Winter	4.221	0.00	0.00	2Yr 5760Min Winter	0.578	0.00	0.00
2Yr 360Min Summer	4.221	0.00	0.00	2Yr 7200Min Summer	0.492	0.00	0.00
2Yr 480Min Summer	3.435	0.00	0.00	2Yr 7200Min Winter	0.492	0.00	0.00
2Yr 480Min Winter	3.435	0.00	0.00	2Yr 8640Min Summer	0.432	0.00	0.00
2Yr 600Min Summer	2.927	0.00	0.00	2Yr 8640Min Winter	0.432	0.00	0.00
2Yr 600Min Winter	2.927	0.00	0.00	2Yr 10080Min Winter	0.387	0.00	0.00
2Yr 720Min Summer	2.568	0.00	0.00	2Yr 10080Min Summer	0.387	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):
2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	46	51.915	0.178	1.581		OK
S2	60 min Summer	45	51.914	0.245	5.838		OK
S3	60 min Summer	47	51.914	0.307	4.020		Surcharged
OUTFALL	60 min Summer	44	51.601	0.046	4.512		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	46	S1	S2	0.211	0.177	5.231	0.008	OK
1.001	60 min Summer	45	S2	S3	0.276	0.228	6.086	0.009	OK
1.002	60 min Summer	47	S3	OUTFALL	0.047	0.948	4.512	0.257	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Surface Runoff (m3)	Status
Permeable Paving 1	120 min Summer	74	53.532	0.017	0.330			OK
Permeable Paving 2	60 min Summer	37	53.525	0.010	0.137			OK
Permeable Paving 3	180 min Summer	112	53.408	0.021	0.438			OK
Permeable Paving 4	120 min Summer	71	53.077	0.014	0.253			OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.066	2700	Type B	53.895	51.737	1.558	387195.354	394723.176
S2	0.086	2700	Type C	53.767	51.669	1.498	387199.331	394696.093
S3	0.030	2700	Type B	53.443	51.607	1.686	387203.050	394671.502
OUTFALL	0.000	1200	Type B	53.252	51.555	1.547	387201.258	394666.529

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	51.737	S2	51.669	Circ	2No. 600	27.374	403	0.600	1.558	1.498
1.001	S2	51.669	S3	51.607	Circ	2No. 600	24.870	401	0.600	1.498	1.236
1.002	S3	51.607	OUTFALL	51.555	Circ	150	5.287	102	0.600	1.686	1.547

Permeable Paving Schedule

Permeable Paving	Assigned Manhole	Effective Storage Volume (m3)	CL (m)	IL (m)	Storage Infil Rate (m/hr)	Safety Factor	Easting (m)	Northing (m)
Permeable Paving 1	S1	7.844	53.895	53.515	0.00000000	2.00	387202.529	394718.190
Permeable Paving 2	S1	1.720	53.895	53.515	0.00000000	2.00	387204.339	394706.104
Permeable Paving 3	S2	15.769	53.767	53.387	0.00000000	2.00	387208.195	394680.557
Permeable Paving 4	S3	4.649	53.443	53.063	0.00000000	2.00	387209.793	394671.513

Outfall Details

Outfall Manhole OUTFALL : Free Discharge

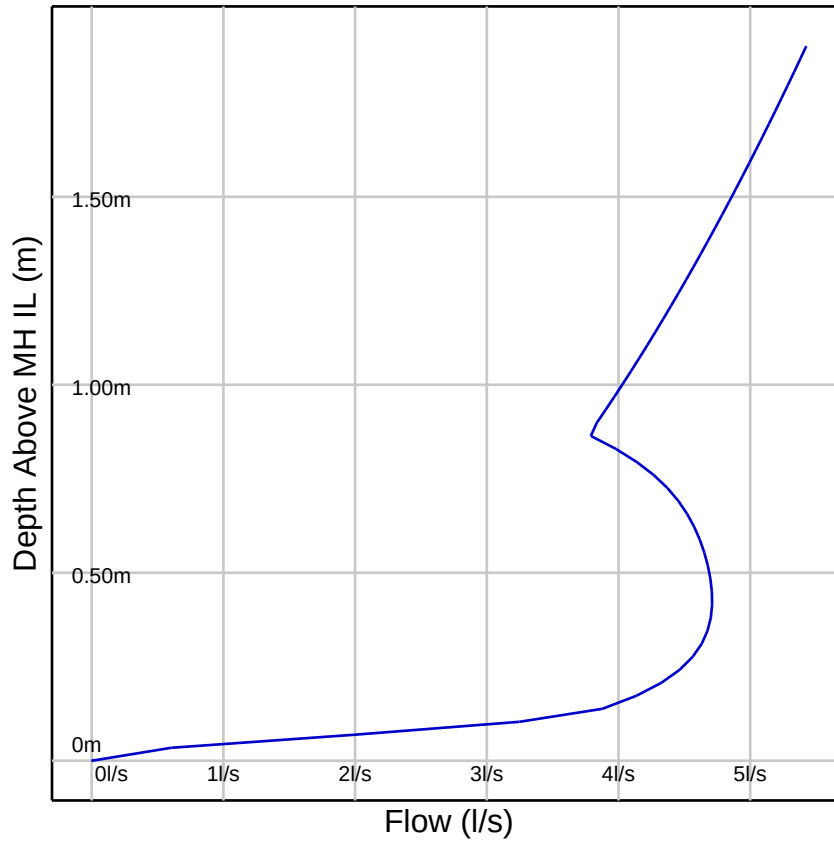
Flow Control Details

Controls within Manhole S3

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0097-5000-1600-5000	1.600	5.000	0.000	0.427	4.711	0.866	3.770

Hydro-Brake® Optimum Control from S3 to OUTFALL



Simulation Settings

FSR: M5-60=18.00, R=0.36, Locale=England and Wales

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (30, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 15Min Winter	65.624	0.00	0.00	30Yr 720Min Winter	4.528	0.00	0.00
30Yr 15Min Summer	65.624	0.00	0.00	30Yr 960Min Summer	3.643	0.00	0.00
30Yr 30Min Winter	43.507	0.00	0.00	30Yr 960Min Winter	3.643	0.00	0.00
30Yr 30Min Summer	43.507	0.00	0.00	30Yr 1440Min Summer	2.677	0.00	0.00
30Yr 60Min Summer	27.653	0.00	0.00	30Yr 1440Min Winter	2.677	0.00	0.00
30Yr 60Min Winter	27.653	0.00	0.00	30Yr 2160Min Summer	1.965	0.00	0.00
30Yr 120Min Winter	17.088	0.00	-0.08	30Yr 2160Min Winter	1.965	0.00	0.00
30Yr 120Min Summer	17.088	0.00	-0.08	30Yr 2880Min Summer	1.577	0.00	0.00
30Yr 180Min Summer	12.763	0.00	0.00	30Yr 2880Min Winter	1.577	0.00	0.00
30Yr 180Min Winter	12.763	0.00	0.00	30Yr 4320Min Summer	1.155	0.00	0.00
30Yr 240Min Summer	10.331	0.00	0.00	30Yr 4320Min Winter	1.155	0.00	0.00
30Yr 240Min Winter	10.331	0.00	0.00	30Yr 5760Min Summer	0.925	0.00	0.00
30Yr 360Min Winter	7.624	0.00	0.00	30Yr 5760Min Winter	0.925	0.00	0.00
30Yr 360Min Summer	7.624	0.00	0.00	30Yr 7200Min Summer	0.778	0.00	0.00
30Yr 480Min Summer	6.146	0.00	0.00	30Yr 7200Min Winter	0.778	0.00	0.00
30Yr 480Min Winter	6.146	0.00	0.00	30Yr 8640Min Summer	0.676	0.00	0.00
30Yr 600Min Summer	5.196	0.00	0.00	30Yr 8640Min Winter	0.676	0.00	0.00
30Yr 600Min Winter	5.196	0.00	0.00	30Yr 10080Min Winter	0.600	0.00	0.00
30Yr 720Min Summer	4.528	0.00	0.00	30Yr 10080Min Summer	0.600	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):
30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	120 min Winter	101	52.219	0.482	1.543		OK
S2	120 min Winter	99	52.219	0.550	3.698		OK
S3	120 min Winter	99	52.219	0.612	4.257		Surcharged
OUTFALL	480 min Summer	306	51.602	0.047	4.711		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	120 min Winter	101	S1	S2	0.516	0.172	4.087	0.006	OK
1.001	120 min Winter	99	S2	S3	0.575	0.207	5.658	0.008	OK
1.002	480 min Summer	306	S3	OUTFALL	0.048	0.959	4.711	0.268	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Surface Runoff (m3)	Status
Permeable Paving 1	60 min Summer	40	53.548	0.032	0.690			OK
Permeable Paving 2	30 min Summer	23	53.533	0.018	0.352			OK
Permeable Paving 3	120 min Summer	75	53.426	0.039	1.102			OK
Permeable Paving 4	60 min Summer	39	53.091	0.027	0.689			OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
PS1	0.000	450	Unknown	54.240	53.920	0.170	387246.313	394728.203
PS2	0.000	450	Unknown	54.245	53.638	0.457	387245.292	394735.107
PS3A	0.000	450	Unknown	54.265	53.947	0.168	387231.815	394726.051
PS3	0.000	450	Unknown	54.175	53.390	0.635	387230.780	394733.002
Simple Junction	0.000	450	Unknown	54.158	53.321	0.687	387225.322	394732.195
PS4	0.000	600	Unknown	54.061	53.033	0.878	387202.528	394728.825
PS5	0.000	450	Unknown	54.257	53.652	0.455	387215.830	394722.375
PS6	0.000	450	Unknown	54.260	53.393	0.717	387218.102	394707.042
PS7	0.000	450	Unknown	54.201	53.190	0.861	387206.032	394705.253
Simple Junction (2)	0.000	600	Unknown	54.200	53.105	0.945	387205.037	394711.961
Simple Junction (3)	0.000	600	Unknown	54.207	53.039	1.018	387204.265	394717.166
PS8	0.000	600	Unknown	54.200	52.948	1.102	387203.191	394724.371
S1	0.066	2700	Type B	53.895	51.737	1.558	387195.354	394723.176
PS9	0.000	450	Unknown	54.108	53.368	0.590	387221.921	394680.546
PS10	0.000	450	Unknown	54.108	53.226	0.732	387220.676	394688.961
PS11	0.000	450	Unknown	54.108	53.117	0.841	387219.717	394695.440
PS12	0.000	450	Unknown	54.108	52.985	0.973	387218.176	394705.857
PS13	0.000	600	Unknown	54.076	52.700	1.226	387206.243	394704.055
Simple Junction (4)	0.000	600	Unknown	54.054	52.631	1.273	387207.013	394698.565
PS14	0.000	600	Unknown	53.995	53.127	0.718	387209.913	394678.993
Simple Junction (7)	0.000	600	Unknown	54.009	53.062	0.797	387209.342	394682.825
PS15	0.000	450	Unknown	54.019	52.994	0.876	387208.738	394686.884
Simple Junction (6)	0.000	600	Unknown	54.023	52.975	0.899	387208.569	394688.023
Simple Junction (5)	0.000	600	Unknown	54.038	52.908	0.980	387207.776	394693.350
PS16	0.000	600	Unknown	54.048	52.612	1.286	387207.225	394697.053
S2	0.086	2700	Type C	53.767	51.669	1.498	387199.331	394696.093
PS17	0.000	450	Unknown	53.449	52.433	0.915	387233.795	394656.193
PS18	0.000	600	Unknown	53.315	52.239	0.976	387214.561	394653.452
PS19	0.000	450	Unknown	53.519	52.550	0.869	387234.501	394668.229
PS20	0.000	600	Unknown	53.442	52.074	1.218	387212.685	394664.761
PS21	0.000	600	Unknown	53.796	51.992	1.654	387211.433	394672.907
S3	0.030	2700	Type B	53.443	51.607	1.686	387203.050	394671.502
OUTFALL	0.000	1200	Type B	53.252	51.555	1.547	387201.258	394666.529

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	PS1	53.920	PS2	53.638	Circ	150	6.979	25	0.600	0.170	0.457
1.001	PS2	53.638	PS3	53.390	Circ	150	14.664	59	0.600	0.457	0.635
2.000	PS3A	53.947	PS3	53.390	Circ	150	7.029	13	0.600	0.168	0.635
1.002	PS3	53.390	Simple Junction	53.321	Circ	150	5.518	80	0.600	0.635	0.687
1.003	Simple Junction	53.321	PS4	53.033	Circ	150	23.041	80	0.600	0.687	0.878
1.004	PS4	53.033	PS8	52.948	Circ	150	4.503	53	0.600	0.878	1.102
3.000	PS5	53.652	PS6	53.393	Circ	150	15.501	60	0.600	0.455	0.717
3.001	PS6	53.393	PS7	53.190	Circ	150	12.202	60	0.600	0.717	0.861
3.002	PS7	53.190	Simple Junction (2)	53.105	Circ	150	6.781	80	0.600	0.861	0.945
3.003	Simple Junction (2)	53.105	Simple Junction (3)	53.039	Circ	150	5.262	80	0.600	0.945	1.018
3.004	Simple Junction (3)	53.039	PS8	52.948	Circ	150	7.285	80	0.600	1.018	1.102
1.005	PS8	52.948	S1	52.487	Circ	150	7.927	17	0.600	1.102	1.258
1.006	S1	51.737	S2	51.669	Circ	2No. 600	27.374	403	0.600	1.558	1.498
4.000	PS9	53.368	PS10	53.226	Circ	150	8.506	60	0.600	0.590	0.732
4.001	PS10	53.226	PS11	53.117	Circ	150	6.550	60	0.600	0.732	0.841
4.002	PS11	53.117	PS12	52.985	Circ	150	10.530	80	0.600	0.841	0.973

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
4.003	PS12	52.985	PS13	52.700	Circ	150	12.068	42	0.600	0.973	1.226
4.004	PS13	52.700	Simple Junction (4)	52.631	Circ	150	5.543	80	0.600	1.226	1.273
4.005	Simple Junction (4)	52.631	PS16	52.612	Circ	150	1.527	80	0.600	1.273	1.286
5.000	PS14	53.127	Simple Junction (7)	53.062	Circ	150	3.875	60	0.600	0.718	0.797
5.001	Simple Junction (7)	53.062	PS15	52.994	Circ	150	4.104	60	0.600	0.797	0.876
5.002	PS15	52.994	Simple Junction (6)	52.975	Circ	150	1.151	60	0.600	0.876	0.899
5.003	Simple Junction (6)	52.975	Simple Junction (5)	52.908	Circ	150	5.386	80	0.600	0.898	0.980
5.004	Simple Junction (5)	52.908	PS16	52.612	Circ	150	3.744	13	0.600	0.980	1.286
4.006	PS16	52.612	S2	52.419	Circ	150	7.952	41	0.600	1.286	1.198
1.007	S2	51.669	S3	51.607	Circ	2No. 600	24.870	401	0.600	1.498	1.236
6.000	PS17	52.433	PS18	52.239	Circ	100	19.429	100	0.600	0.915	0.976
6.001	PS18	52.239	PS20	52.124	Circ	100	11.464	100	0.600	0.976	1.218
7.000	PS19	52.550	PS20	52.124	Circ	100	22.090	52	0.600	0.869	1.218
6.002	PS20	52.074	PS21	51.992	Circ	150	8.242	100	0.600	1.218	1.654
6.003	PS21	51.992	S3	51.907	Circ	150	8.500	100	0.600	1.654	1.386
1.008	S3	51.607	OUTFALL	51.555	Circ	150	5.287	102	0.600	1.686	1.547

Permeable Paving Schedule

Permeable Paving	Assigned Manhole	Effective Storage Volume (m3)	CL (m)	IL (m)	Storage Infil Rate (m/hr)	Safety Factor	Easting (m)	Northing (m)
Permeable Paving 1	S1	7.844	53.895	53.515	0.00000000	2.00	387202.529	394718.190
Permeable Paving 2	S1	1.720	53.895	53.515	0.00000000	2.00	387204.339	394706.104
Permeable Paving 3	S2	15.769	53.767	53.387	0.00000000	2.00	387208.195	394680.557
Permeable Paving 4	S3	4.649	53.443	53.063	0.00000000	2.00	387209.793	394671.513

Outfall Details

Outfall Manhole OUTFALL : Free Discharge

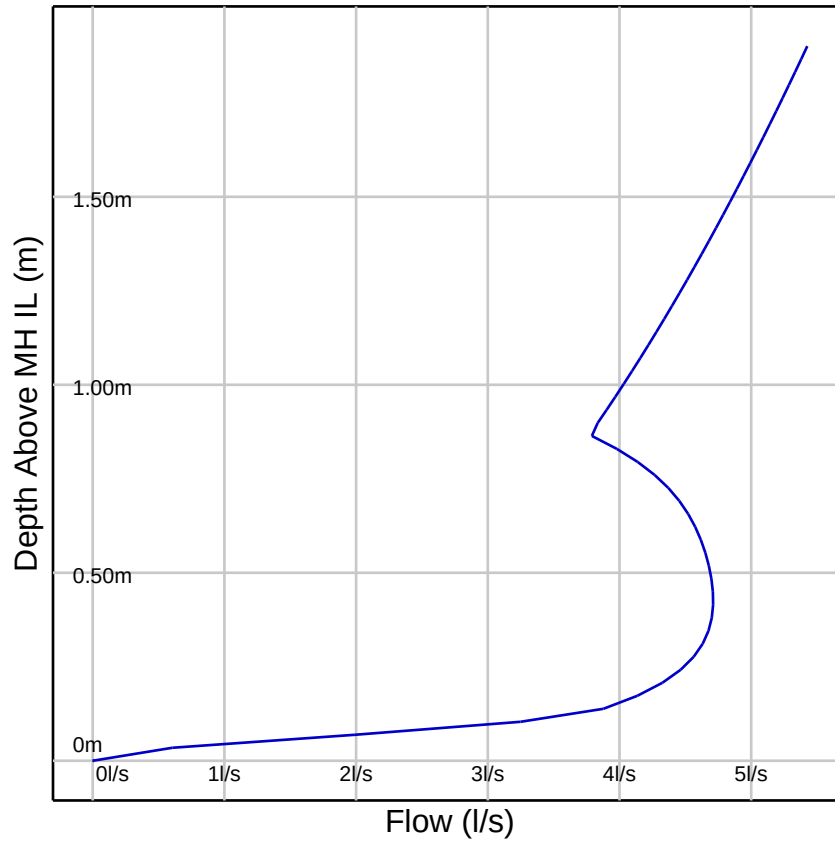
Flow Control Details

Controls within Manhole S3

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0097-5000-1600-5000	1.600	5.000	0.000	0.427	4.711	0.866	3.770

Hydro-Brake® Optimum Control from S3 to OUTFALL



Simulation Settings

FSR: M5-60=18.00, R=0.36, Locale=England and Wales

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (100, +45%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Item Volume Continuity Errors
100Yr+45% 15Min Winter	122.849	0.00	0.34	
100Yr+45% 15Min Summer	122.849	0.00	0.51	
100Yr+45% 30Min Winter	82.249	0.00	9.48	S2 16.29m3, S3 8.86m3, S1 8.37m3, PS20 0.69m3, PS18 0.32m3
100Yr+45% 30Min Summer	82.249	0.00	9.41	S2 16.54m3, S3 8.81m3, S1 8.32m3, PS20 0.64m3, PS18 0.32m3
100Yr+45% 60Min Summer	52.627	0.00	13.82	S2 19.70m3, S1 9.94m3, PS20 0.90m3, PS18 0.55m3, PS13 0.14m3
100Yr+45% 60Min Winter	52.627	0.00	13.82	S2 19.24m3, S1 9.94m3, PS20 0.90m3, PS18 0.55m3, PS13 0.13m3
100Yr+45% 120Min Winter	32.592	0.00	7.91	S2 17.85m3, S1 9.01m3, S3 8.97m3, PS20 0.75m3, PS18 0.41m3
100Yr+45% 120Min Summer	32.592	0.00	7.86	S2 17.82m3, S1 9.00m3, S3 8.94m3, PS20 0.75m3, PS18 0.42m3
100Yr+45% 180Min Summer	24.304	0.00	1.50	
100Yr+45% 180Min Winter	24.304	0.00	1.58	
100Yr+45% 240Min Summer	19.616	0.00	0.02	
100Yr+45% 240Min Winter	19.616	0.00	0.02	
100Yr+45% 360Min Winter	14.378	0.00	0.00	
100Yr+45% 360Min Summer	14.378	0.00	0.00	
100Yr+45% 480Min Summer	11.541	0.00	0.00	
100Yr+45% 480Min Winter	11.541	0.00	0.00	
100Yr+45% 600Min Summer	9.724	0.00	0.00	
100Yr+45% 600Min Winter	9.724	0.00	0.00	
100Yr+45% 720Min Summer	8.449	0.00	0.00	
100Yr+45% 720Min Winter	8.449	0.00	0.00	
100Yr+45% 960Min Summer	6.764	0.00	0.00	
100Yr+45% 960Min Winter	6.764	0.00	0.00	
100Yr+45% 1440Min Summer	4.934	0.00	0.00	
100Yr+45% 1440Min Winter	4.934	0.00	0.00	
100Yr+45% 2160Min Summer	3.592	0.00	0.00	
100Yr+45% 2160Min Winter	3.592	0.00	0.00	
100Yr+45% 2880Min Summer	2.864	0.00	0.00	
100Yr+45% 2880Min Winter	2.864	0.00	0.00	
100Yr+45% 4320Min Summer	2.078	0.00	0.00	
100Yr+45% 4320Min Winter	2.078	0.00	0.00	
100Yr+45% 5760Min Summer	1.653	0.00	0.00	
100Yr+45% 5760Min Winter	1.653	0.00	0.00	
100Yr+45% 7200Min Summer	1.383	0.00	0.00	
100Yr+45% 7200Min Winter	1.383	0.00	0.00	
100Yr+45% 8640Min Summer	1.196	0.00	0.00	
100Yr+45% 8640Min Winter	1.196	0.00	0.00	
100Yr+45% 10080Min Winter	1.056	0.00	0.00	
100Yr+45% 10080Min Summer	1.056	0.00	0.00	

Simulation Results

Return Period (yrs) + Climate Change (%):

100yr+45%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
PS1	15 min Winter	0	53.920	0.000	0.000		OK
PS2	15 min Winter	0	53.638	0.000	0.000		OK
PS3A	15 min Winter	0	53.947	0.000	0.000		OK
PS3	15 min Winter	0	53.390	0.000	0.000		OK
Simple Junction	15 min Winter	0	53.321	0.000	0.000		OK
PS4	180 min Winter	161	53.214	0.181	0.014		Surcharged
PS5	15 min Winter	0	53.652	0.000	0.000		OK
PS6	15 min Winter	0	53.393	0.000	0.000		OK
PS7	180 min Winter	162	53.214	0.024	0.000		OK
Simple Junction (2)	180 min Winter	162	53.214	0.109	0.014		OK
Simple Junction (3)	180 min Winter	162	53.214	0.175	0.009		Surcharged
PS8	180 min Winter	162	53.214	0.266	0.019		Surcharged
S1	180 min Winter	162	53.214	1.477	1.708		Surcharged
PS9	15 min Winter	0	53.368	0.000	0.000		OK
PS10	15 min Winter	0	53.226	0.000	0.000		OK
PS11	180 min Winter	164	53.214	0.097	0.003		OK
PS12	180 min Winter	160	53.214	0.228	0.010		Surcharged
PS13	180 min Winter	162	53.214	0.514	0.001		Surcharged
Simple Junction (4)	180 min Winter	163	53.214	0.583	0.016		Surcharged
PS14	180 min Winter	163	53.214	0.087	0.016		OK
Simple Junction (7)	180 min Winter	163	53.214	0.152	0.030		Surcharged
PS15	180 min Winter	161	53.214	0.220	0.025		Surcharged
Simple Junction (6)	180 min Winter	161	53.214	0.239	0.013		Surcharged
Simple Junction (5)	180 min Winter	163	53.214	0.306	0.000		Surcharged
PS16	180 min Winter	163	53.214	0.602	0.016		Surcharged
S2	180 min Winter	162	53.214	1.545	4.185		Surcharged
PS17	180 min Winter	162	53.214	0.780	0.000		Flood Risk
PS18	180 min Winter	161	53.214	0.975	0.001		Flood Risk
PS19	180 min Winter	162	53.214	0.664	0.000		Surcharged
PS20	180 min Winter	162	53.214	1.140	0.015		Flood Risk
PS21	180 min Winter	162	53.214	1.222	0.002		Surcharged
S3	180 min Winter	161	53.214	1.607	4.945		Flood Risk
OUTFALL	180 min Winter	162	51.603	0.048	4.942		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	0	PS1	PS2	0.000	0.000	0.000	0.000	OK
1.001	15 min Winter	0	PS2	PS3	0.000	0.000	0.000	0.000	OK
2.000	15 min Winter	0	PS3A	PS3	0.000	0.000	0.000	0.000	OK
1.002	15 min Winter	0	PS3	Simple Junction	0.000	0.000	0.000	0.000	OK
1.003	120 min Winter	106	Simple Junction	PS4	0.075	0.000	0.000	0.000	OK
1.004	180 min Summer	210	PS4	PS8	0.150	0.016	0.140	0.006	Surcharged
3.000	15 min Winter	0	PS5	PS6	0.000	0.000	0.000	0.000	OK
3.001	180 min Winter	162	PS6	PS7	0.012	0.000	0.000	0.000	OK
3.002	180 min Winter	178	PS7	Simple Junction (2)	0.067	0.010	0.055	0.003	OK
3.003	180 min Winter	180	Simple Junction (2)	Simple Junction (3)	0.130	0.018	0.118	0.006	OK
3.004	180 min Winter	180	Simple Junction (3)	PS8	0.150	0.015	0.175	0.009	Surcharged
1.005	240 min Winter	254	PS8	S1	0.150	0.019	0.336	0.008	Surcharged
1.006	30 min Summer	18	S1	S2	0.600	0.282	23.095	0.034	Surcharged
4.000	15 min Winter	0	PS9	PS10	0.000	0.000	0.000	0.000	OK
4.001	180 min Winter	164	PS10	PS11	0.048	0.000	0.000	0.000	OK
4.002	180 min Winter	182	PS11	PS12	0.123	0.007	0.092	0.005	OK
4.003	180 min Summer	232	PS12	PS13	0.150	0.020	0.205	0.007	Surcharged

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
4.004	120 min Summer	173	PS13	Simple Junction (4)	0.150	0.024	0.432	0.022	Surcharged
4.005	240 min Summer	280	Simple Junction (4)	PS16	0.150	0.070	0.549	0.028	Surcharged
5.000	180 min Winter	181	PS14	Simple Junction (7)	0.119	0.017	0.072	0.003	OK
5.001	180 min Winter	181	Simple Junction (7)	PS15	0.150	0.018	0.141	0.006	Surcharged
5.002	180 min Summer	183	PS15	Simple Junction (6)	0.150	0.096	0.234	0.010	Surcharged
5.003	240 min Summer	279	Simple Junction (6)	Simple Junction (5)	0.150	0.056	0.417	0.021	Surcharged
5.004	240 min Winter	280	Simple Junction (5)	PS16	0.150	0.034	0.534	0.011	Surcharged
4.006	240 min Winter	280	PS16	S2	0.150	0.039	0.688	0.025	Surcharged
1.007	15 min Summer	11	S2	S3	0.600	0.339	39.544	0.058	Surcharged
6.000	30 min Summer	39	PS17	PS18	0.100	0.014	0.108	0.018	Surcharged
6.001	15 min Summer	22	PS18	PS20	0.100	0.058	0.452	0.075	Surcharged
7.000	30 min Summer	42	PS19	PS20	0.100	0.018	0.104	0.012	Surcharged
6.002	15 min Summer	13	PS20	PS21	0.150	0.060	1.060	0.060	Surcharged
6.003	15 min Summer	18	PS21	S3	0.150	0.053	0.935	0.053	Surcharged
1.008	180 min Winter	162	S3	OUTFALL	0.050	0.971	4.942	0.281	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Surface Runoff (m3)	Status
Permeable Paving 1	60 min Summer	42	53.571	0.055	1.889			OK
Permeable Paving 2	30 min Summer	21	53.543	0.028	0.728			OK
Permeable Paving 3	60 min Summer	45	53.459	0.072	2.984			OK
Permeable Paving 4	180 min Winter	162	53.214	0.151	0.111			OK