

9-10 High Street, Hitchin North Hertfordshire

Sustainable Drainage Systems (SuDS) Strategy Assessment and Report

Prepared by:
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Job Number:

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Date	Revision	Notes/Amendments/Issue Purpose
April 2023	0	For Information
May 2024	1	Updated based on revised scheme
May 2024	2	Revised project description

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Acronyms	
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan

1 Introduction

Price & Myers have been commissioned to undertake a Sustainable Drainage Systems (SuDS) Strategy Assessment for the proposed development at 9-10 High Street, Hitchin, SG5 1BH. Hitchin is an urban district in North Hertfordshire District in Hertfordshire, England. The grid reference is TL 18398 29148. The Lead Local Flood Authority (LLFA) is Hertfordshire council.

This assessment will focus on the surface water management by outlining the proposed drainage strategy for the new development including a detailed SUDS assessment to support for the planning application.

1.1 Relevant Policy

The surface water drainage strategy is in accordance with:

- the Department for Environment, Food and Rural Affairs (DEFRA) "Non-Statutory Technical Standards for Sustainable Drainage Systems".
- the Lead Local Flood Authority (LLFA) guidance document on SUDS/Drainage.

2 Site Description and Location

The site is occupied by an existing building with two (2) retail units and a rooftop car park and another paved car park at the rear ground level. The site fronts to the High Street, a pedestrianised street lined with main retails within the town and is mainly accessible through the Paynes Park road from behind. The site postcode is SG5 1BH and the OS coordinates are 518398 (E) and 229148 (N). A site location plan is provided below in Figure 2.1, with the indicative site boundary.



https://earth.google.com/web/search/sg5+1bh/@51.94897934,-0.27998152,69.46464403a,1112.48731427d,35y,0h,0t,0r/data=CiglJgokCe-FDpF_v0IAESp2OeVTvkIAGXg11_aiN8e_laA-7IAix8q_

Figure 2.1: Existing site, showing site boundary.

The topographical survey drawing in Appendix A shows that the site falls to the east from 70.50m to 65.36m AOD and that the average ground level is 67.00m AOD. The site topographical survey drawing is found in Appendix A.

2.1 Existing Drainage

The nearest watercourse to the site is the River Purwell which runs approximately 1.5 km to the north-east. Another watercourse proximate to the site is River Oughton which is ~2 km to the north-west.

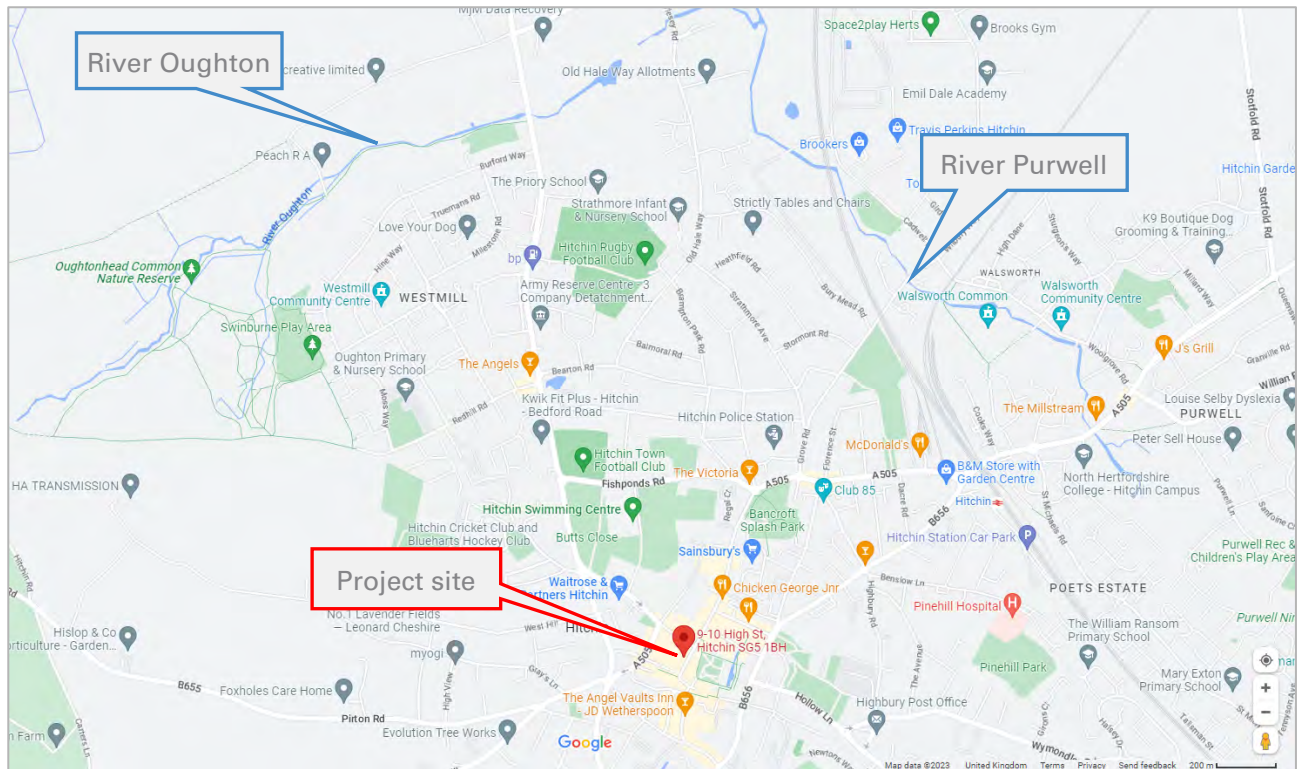


Figure 2.2: Site location, showing nearby watercourse etc.

Anglian Water's sewer records show that there are separate drainage networks for foul and surface water in High Street which then connect to the combined and surface water sewers along Hermitage Road. There is also a foul water public sewer in Payne's Park. The site's topography suggests that foul and surface water from the existing development discharges to the public sewers in High Street.

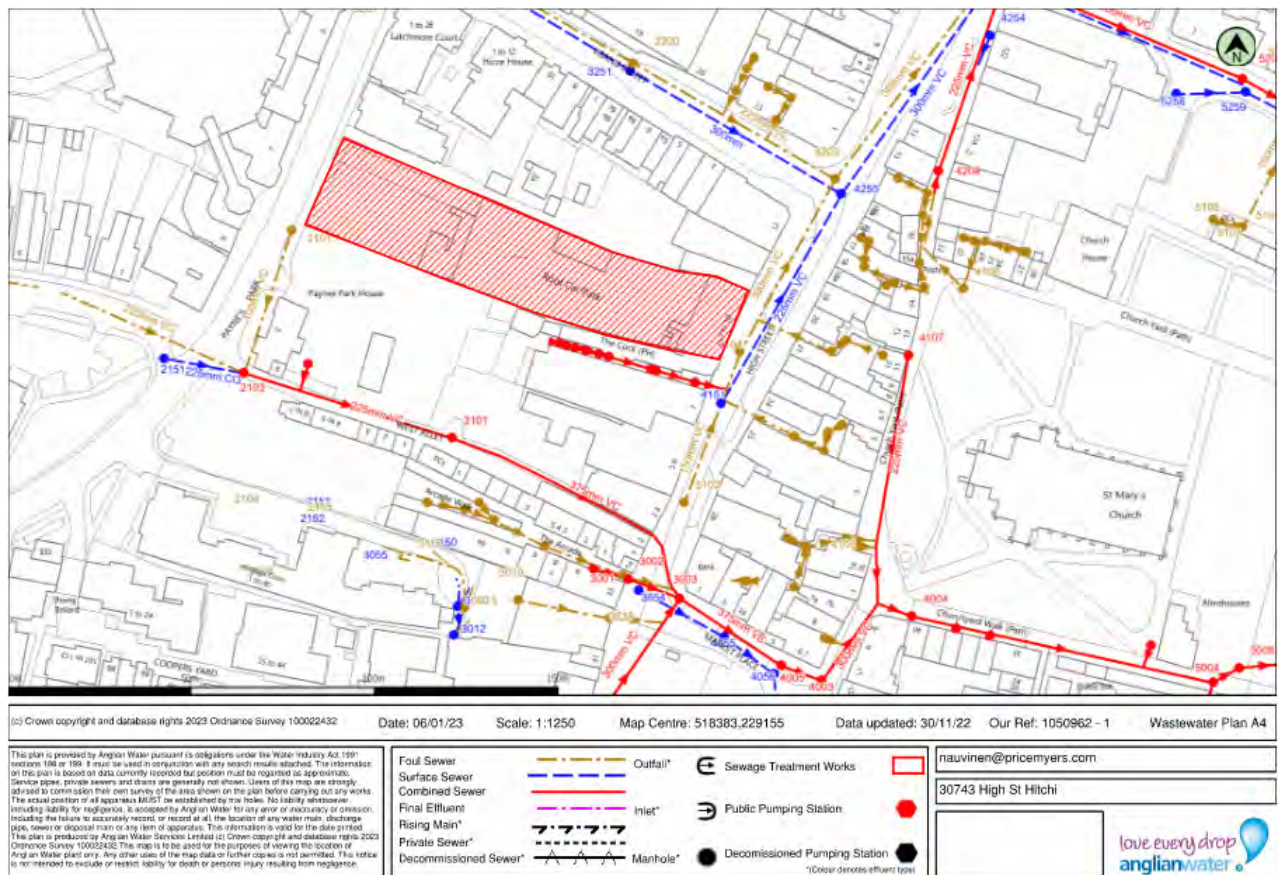


Figure 2.3: Sewer records map (Source: Anglian Water).

A CCTV drainage survey was undertaken to investigate the drainage connections from within the site and how these connect into the public sewer. Most manholes were inaccessible and hence their outfalls could not be determined. The CCTV drainage survey shows that a 100mm diameter surface water drainage pipe runs from the carpark then into the building where the CCTV information becomes unavailable from that point due to camera bend limitations. Survey information on the foul water run at the front, along High Street, is also limited due to restricted leverage. The drainage survey layout and full report is found in Appendix C.



Figure 2.4: Drainage CCTV Survey Layout. (Source: Survey Solutions).

Based on the sewer records and drainage CCTV survey, the site is presumed to be draining combined surface and foul into the 300-mm foul sewer running along High Street.

3 Development Proposal

The development proposal is for the demolition of the existing building to provide one retail unit and car parking on the lower ground floor, along with a residential scheme of 44 units from ground floor to the third floor. The proposed lower ground and third floor layout is shown in Figure 3.1.

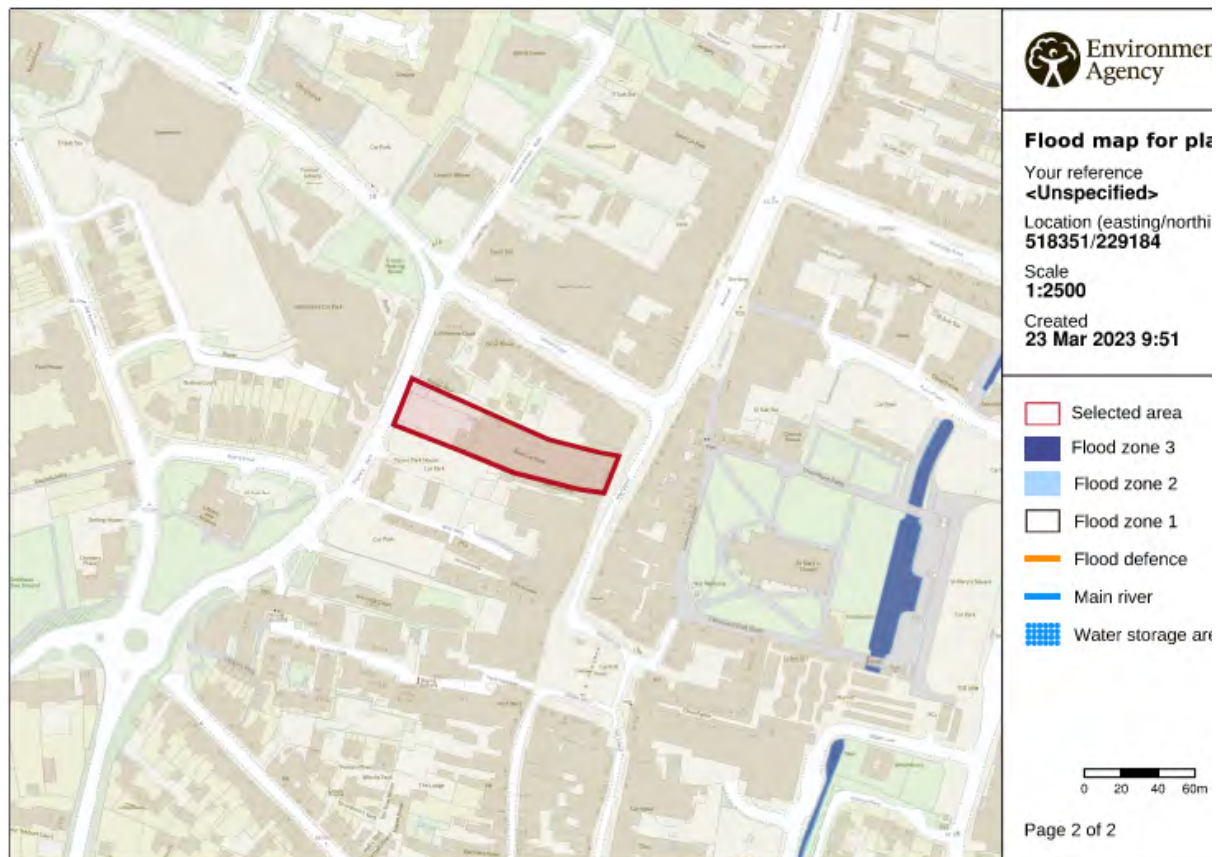


Figure 3.1: Proposed LGF and GF layouts and section.

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's flood map for planning in Figure 4.1 shows that the site is located in Flood Zone 1 and is not at risk of flooding. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.



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Figure 4.1: from EA Flood Map for Planning or Product 4 Data

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

Hertfordshire County Council LFRMS2 groundwater flooding susceptibility map information provided below in Figure 4.2, shows that the site is in an area with up to 50% risk of groundwater flooding. The British Geological Survey (BGS) maps show that superficial deposits of sand and gravel underlies the site, and that chalk forms the site's bedrock geology. Both layers should have the ability to store and transfer groundwater. This is most likely the reason the SFRA shows that here is medium risk of groundwater at this location.

As the development includes a car park basement that is susceptible to groundwater flooding, waterproofing will have to be done to prevent ingress of groundwater. Furthermore, the Sequential Approach has been adopted, locating the less vulnerable uses of the development at basement level. Therefore, the flood risk from groundwater is considered low.

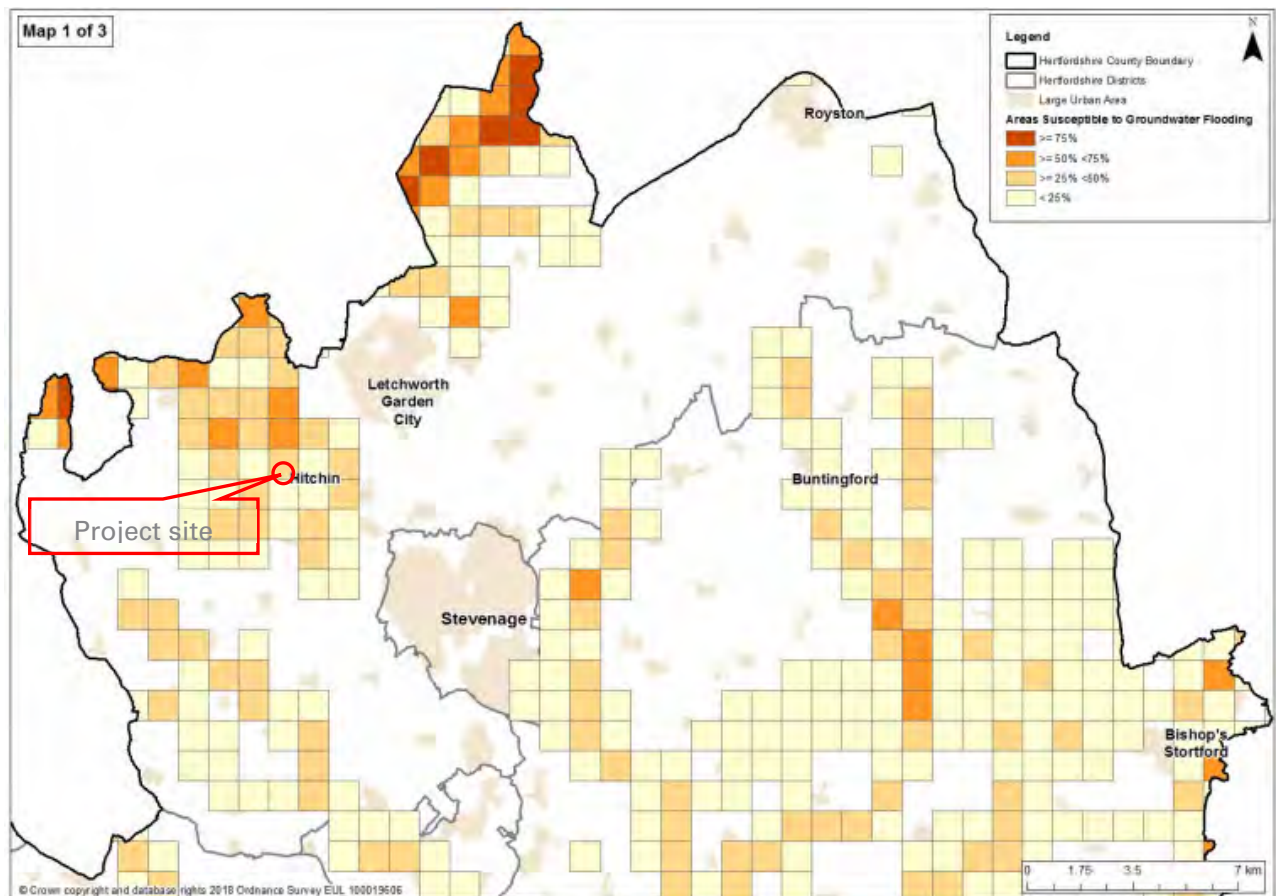


Figure 4.2: Susceptibility to Groundwater Flooding map (Hertfordshire County Council LFRMS 2, 2019)

4.3 Flood Risk from Surface Water

The EA's flood risk from surface water map shows a strip of floodwater at the east side of the site. This map suggests that water flows into the site from the gap that separates the site from the property to the south. The Finished Floor Level must be raised above the external area and falls should be provided on the ground to direct surface water away from the building.

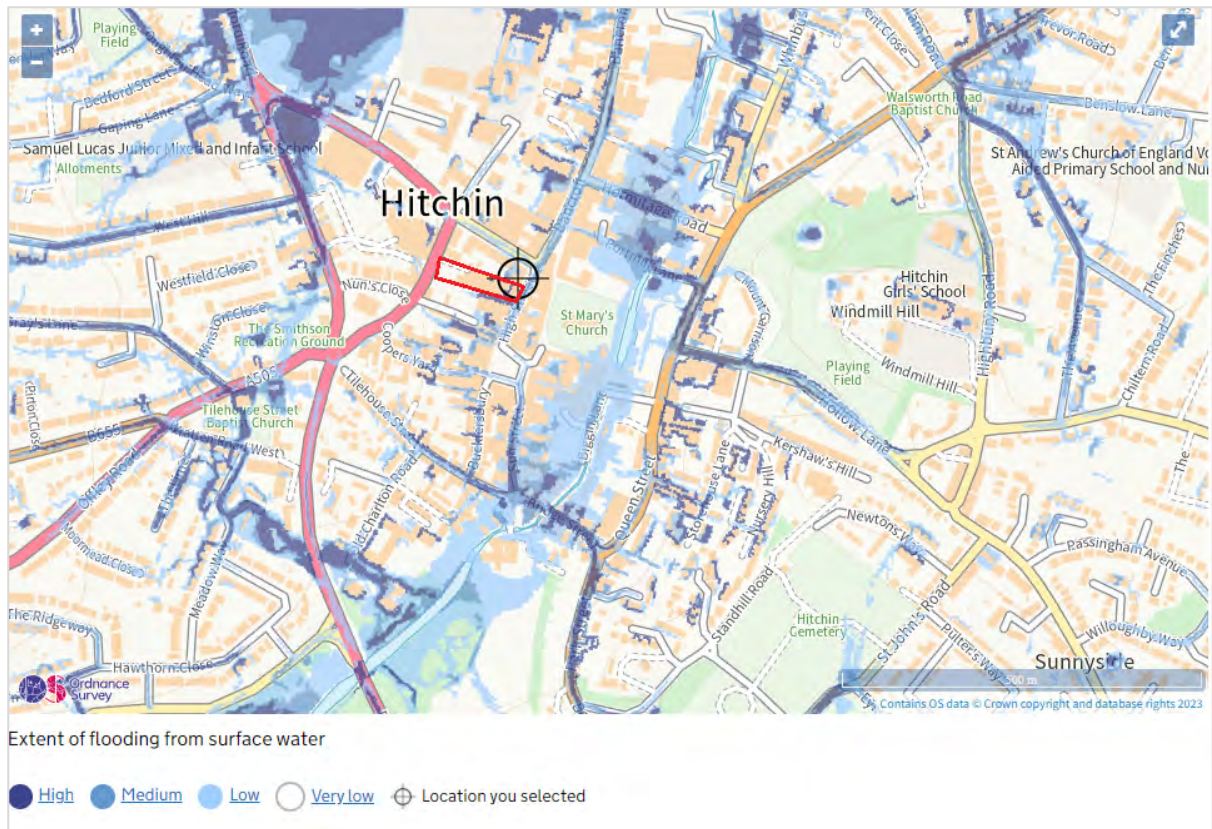


Figure 4.3: Flood Risk from Surface Water Map (EA, 2023)

5 Surface Water Run-off Assessment

5.1 Existing Runoff

The total site area is approximately 2,720m² or 0.272 ha, which is entirely impermeable as is currently occupied by existing hard standing areas – building and car park. As described in Section 2.1, the site currently drains to the Anglian Water foul sewer along High Street.

The existing peak run-off rates for the annual, 1 in 30 year and 1 in 100 year storm events were calculated using the modified rational method as shown below:

$$Q_{x_{ex}} = 2.78 \times A \times i$$

Where 'x' is the return period in years, 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr provided by the FEH method.

$$Q_{2_{ex}} = 2.78 \times 0.272 \times 34.540 = 26.118 \text{ l/s}$$

$$Q_{30_{ex}} = 2.78 \times 0.272 \times 79.640 = 60.221 \text{ l/s}$$

$$Q_{100_{ex}} = 2.78 \times 0.272 \times 100.280 = 75.828 \text{ l/s}$$

5.2 Greenfield Runoff

Hertfordshire County Council LFRMS 2 Policy 15 states that *"Previously developed sites should aim to discharge at the original pre-development greenfield rate for the whole site area where possible. If not, a significant reduction in the current rate of discharge should be achieved and evidence provided as to why greenfield rates are not viable."*

Greenfield run-off calculations using the UKSUDS tool – FEH Statistical run-off estimation approach are as follows:

$$Q_{1gr} = 0.08 \text{ l/s}$$

$$Q_{30gr} = 0.21 \text{ l/s}$$

$$Q_{100gr} = 0.31 \text{ l/s}$$

$$Q_{200gr} = 0.37 \text{ l/s}$$

Supporting documentation is found in Appendix D.

5.3 Proposed Runoff

As the proposed development will be constructed on an existing hard standing area and will keep the same area as impermeable, the peak run-off rates at various return periods are equal to the existing run-off. Though soft landscaping areas were added on the plan, these will not drain freely into the ground.

$$Q_{2_{pr}} = 2.78 \times 0.272 \times 34.540 = 26.694 \text{ l/s}$$

$$\begin{aligned} Q_{30_{pr}} &= 2.78 \times 0.272 \times 79.640 &= 60.221 \text{ l/s} \\ Q_{100_{pr}} &= 2.78 \times 0.272 \times 100.280 &= 75.828 \text{ l/s} \end{aligned}$$

5.3.1 Climate Change

The LLFA requires a climate change allowance that supports the NPPF. As such, flood risk assessments and surface water drainage strategies for planning applications should apply the upper end allowance of 40% climate change for the '2080s' (2070 to 2115) since the expected lifetime of this development is 100 years.

5.3.2 Proposed Discharge Rate

Hertfordshire LLFA LFRMS 2 (2019) guidance states that:

1. *"The volume of attenuation storage that would be required for the site should be based on the 1 in 100-year critical storm duration with an allowance for climate change and the allowable discharge rate."*; and that
2. *"During a 1 in 100 year plus climate change rainfall event no flooding should occur in any part of a building (including a basement); utility plant susceptible to water (e.g. pumping station or electrical sub-station) or on neighbouring sites."*

Similarly, The LLFA's guidance document for Developers state that *"where debris can enter the control (e.g. where the upstream system is open or where the inlets are gullies), static controls should have a minimum opening size of 100 mm unless appropriate pre-treatment is provided. Where the design of the upstream system will prevent debris entering the system (e.g. underground systems where the inlets are pervious pavement systems), static controls should have a minimum opening size of 50 mm"*.

Therefore, a flow control device with a minimum diameter of 100mm must be used in order to meet the LLFA's requirements. Calculations show that surface water must be restricted to 3.8 l/sec in order to meet this condition. Refer to Appendix E for the calculations. While this rate is higher than the Greenfield run-off rates, the proposed drainage system will significantly reduce the runoff rates in comparison with the existing situation, thereby meeting the LLFA's requirements for Brownfield sites. The discharge rate reduction on existing rates is shown below for a number of return periods:

$Q_{2_{pr}}$	= 3.8l/s	This represents a 85.48% reduction on existing rates
$Q_{30_{pr}}$	= 3.8l/s	This represents a 93.8% reduction on existing rates
$Q_{100+40_{pr}}$	= 3.8l/s	This represents a 95.1% reduction on existing rates

5.4 Surface Water SUDS Strategy

In accordance with EA guidelines and CIRIA documents, surface water runoff should be managed as close to its source as possible. The Hertfordshire LLFA states that a surface water drainage assessment should be carried out in accordance with the National Planning Policy Framework (NPPF) and the Practice Guide where the following drainage hierarchy should be used to manage surface water.

5.4.1 Living roofs and walls

Living roofs such as green roofs and blue roofs are the most sustainable as they provide flood reduction, pollution reduction, and biodiversity benefit.

A series of blue roof systems with storage crates beneath the permeable paving and vegetation growing medium is proposed for the external areas at the ground floor. Water will be stored in the crates and then drained through a flow restrictor.

5.4.2 Basins and ponds / Filter strips and swales / Infiltration devices

These drainage strategies rank 2nd thru 4th in the drainage hierarchy and they are also advantageous in terms of flood reduction, pollution reduction, and biodiversity benefit. However, these are not proposed due to insufficient open space available. Although infiltration can be feasible as the site is underlain by various chalk formations based on the British Geological Survey (BGS), soakaways cannot be implemented due to the space limitation and the 5-m offset from a building constraint.

5.4.3 Permeable surfaces and filter drains

Permeable surfaces and filter drains store surface water while reducing pollution. Permeable paving is proposed for some of the external areas above the blue roof system and growing medium. The storage volume from the permeable paving is accounted for within the blue roof system.

5.4.4 Tanked and pipe systems

Underground tanks are the least favourable means of surface water management, and these are only acceptable where other methods above are not appropriate or feasible. To comply with the required volume storage, an underground attenuation tank is proposed. The flow will be restricted to a certain rate prior to the discharge to the public sewer.

5.5 Water Quality

SuDS have the potential to provide water quality benefits to runoff entering the environment. The SuDS Manual states that SuDS should be designed to treat runoff to reduce the risk of environmental pollution. Chapter 26 of The SuDS Manual sets out the 'simple index approach' to water quality risk management. This approach has been used to quantify the benefits of the proposed SuDS scheme on water quality.

Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. The proposed residential-commercial development is considered to have a 'Low' to 'Very Low' pollution hazard level and Table 5.1 below shows the associated pollution hazard indices:

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05

Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4
--	-----	-----	-----	-----

Table 5.1: Pollution Hazard Indices, taken from Table 26.2 of The SuDS Manual (CIRIA, 2015)

Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

As the destination of the runoff is to surface water sewer and there is no infiltration from the SuDS to groundwater, the surface water pollution mitigation indices should be used as shown in Table 5.2.

The indicative surface water pollution mitigation index for a permeable pavement is shown in Table 5.2 below:

Type of SuDS Component	TSS	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7

Table 5.2 Surface Water Pollution Mitigation Indices, taken from Table 26.3 of The SuDS Manual

Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving watercourse or groundwater body. Therefore, the incorporation of a permeable paving will provide suitable prevention from pollution to surface water.

5.6 Summary of SuDS Measures

The summary of the proposed SuDS is shown in Table 5.3 below and a SuDS Drainage Plan is provided in Appendix F.

SUDS Method	Area Used on site:	Comment:
Blue roof	External areas at the ground floor	
Permeable paving	Some external areas above the blue roof system	
Attenuation tank	Lower ground floor	

Table 5.3 Summary of Suds Methods Used on Site.

6 Surface Water Maintenance Strategy

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

It is envisaged that the majority of the site drainage will be maintained as part of the site-wide maintenance operations. The works should be undertaken by a suitably qualified maintenance and management company, appointed by the residents or the site freeholder, depending on the terms of the leasehold contracts. The maintenance and management of the surface water system is set out below. These activities are to be carried out at frequencies stated.

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Green Roofs/ Blue roofs	Monitoring / Inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment sources	
		Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	
		Inspect underside of roof for evidence of leakage	
	Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Half yearly and annually or as required
		During establishment i.e., year one, replace dead plants as required	Monthly -but usually responsibility of manufacturer
		Post establishment, replace dead plants where > 5% of coverage	Annually in autumn
		Remove fallen leaves and debris from deciduous plant foliage	Half yearly or as required
		Remove nuisance and invasive vegetation, including weeds	
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Permeable Paving	Remedial Actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required.
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	
		Clear perforated pipework of blockages	
	Monitoring / Inspections	Initial inspection	Monthly for three months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
	Regular Maintenance	Brushing and vacuuming -standard cosmetic sweep over whole surface	Once a year after autumn leaf fall
		Rubbish and litter removal	As required
	Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Attenuation Tank	Monitoring / Inspections	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
		Inspect and identify any elements that are not operating correctly.	Monthly for three months, then half yearly or as required.
	Regular Maintenance	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
	Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required

Table 6.1 SuDS Maintenance Strategy as taken from The SuDS Manual

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce and mitigate risks.

This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner.

7 Exceedance Routes and Overland Flows

Surface water exceedance and overland flows occur when intense rainfall is unable to either soak into the ground or enter a drainage system; due to blockages or the capacity of the system being exceeded. Although drainage systems are currently designed for extreme storm events, it is not economical or sustainable to build large, oversized drainage networks for all types of extreme rainfall or scenarios. As a result, there will be occasions when surface water runoff will exceed the capacity of drains as outlined in CIRA 635 document 'Designing for exceedance in urban drainage – good practice'":

"It is inevitable that as a result of extreme rainfall the capacities of sewers, covered watercourses and other drainage systems will be exceeded on occasion. Periods of exceedance occur when the rate of surface runoff exceeds the drainage system inlet capacity, when the pipe system becomes overloaded, or when the outfall becomes restricted due to flood levels in the receiving water."

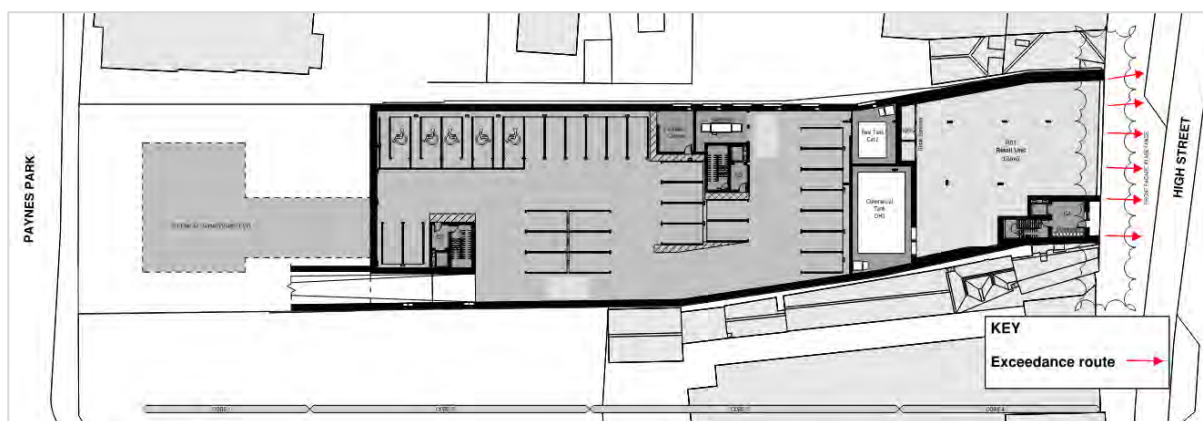
Designing for exceedance aims to divert and control flood flows along routes where the risk of property flooding and the risk to health and safety is minimised and can be managed.

The following sections assess the overland flow routes for the existing and developed site. Proposed mitigation measures, where required, are then developed which will be incorporated into development proposals. These will route water away from vulnerable areas, avoid creating hazards to end users and also not increase flood risk on or off site.

7.1 Proposed Exceedance and Overland Flow Routes

The proposed SUDS have been designed so that there is no flooding within the site for up to and including the 1 in 100-year + 40% climate change rainfall event, which is in line with the LLFA guidance.

An exceedance flow path plan provided below in Figure 7.1 shows that surface water exceedance events can be captured and managed on-site should they occur by creating conveyance and storage areas for flood waters on-site within the underground attenuation tank. This will allow safe egress from the proposed building to outside of the site in the event of a flood whilst mitigating against flooding offsite areas.



8 Foul Water Assessment

As outlined in Section 2.1, there is an existing foul drainage network serving the site along High Street which eventually outfalls to the combined public sewers in Hermitage Road.

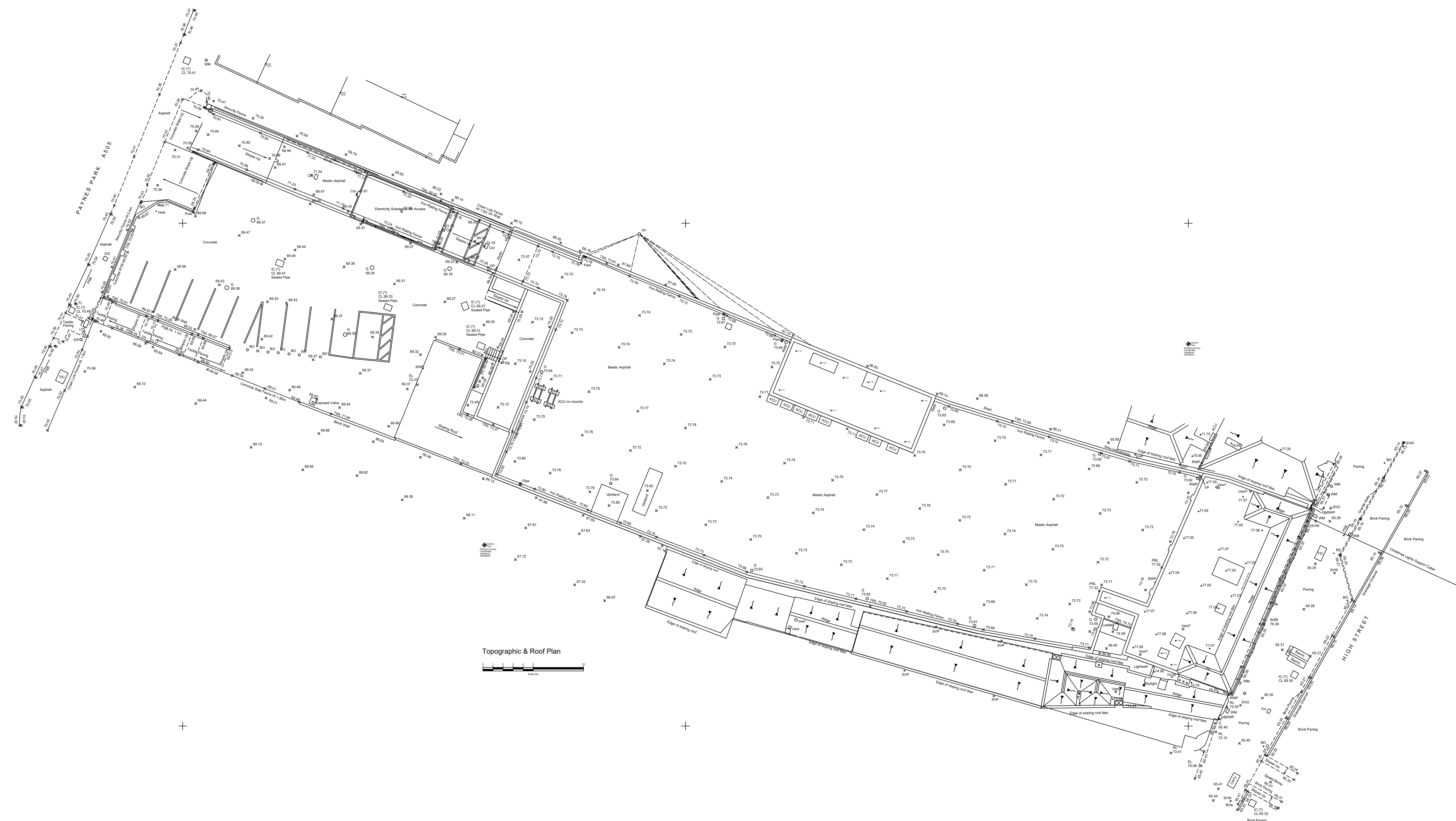
It is proposed to re-use this existing connection to the public sewers with a new foul water network constructed to serve the proposed buildings. This network will connect into the public sewer via existing manhole 4104 located to the east of the site.

9 Conclusions

- The development proposal is for the demolition of the existing building to provide one retail unit and car parking on the lower ground floor, along with a residential scheme of 44 units from ground floor to the third floor.
- The proposed development will be constructed on an existing hard standing area and will keep the same area as impermeable, thus the peak run-off rates at various return periods are equal to the existing run-off.
- As infiltration techniques are not feasible, surface water run-off from the site will need to instead discharge to the surface water sewer at a controlled rate of 3.8 l/s via a hydrobrake.
- A drainage plan considering SuDS such as blue roof and attenuation tank has been designed and recommended to manage surface water in accordance with LLFA guidance.
- The surface water drainage system will be designed for the 1 in 100 year plus 40% climate change rainfall event.
- The proposals will increase the number of people on site as new residential units are being added. Therefore, the foul water rates from the site will increase. The existing connection to the public sewers can be re-used with a new foul water network constructed to serve the proposed buildings.

Appendix A

Site Topographic Survey

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS[illegible]

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cell heights are measured

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Kemetan Services immediately.

The measure

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

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A	INITIAL ISSUE (Drawing updated/verified where applicable from original survey undertaken & issued by Omega Geomatics 2018)	NA	TC	06/07/21
REV	DESCRIPTION	DRAWN	APPRO	DATE



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Email: admin@kempstonsurveys.co.uk

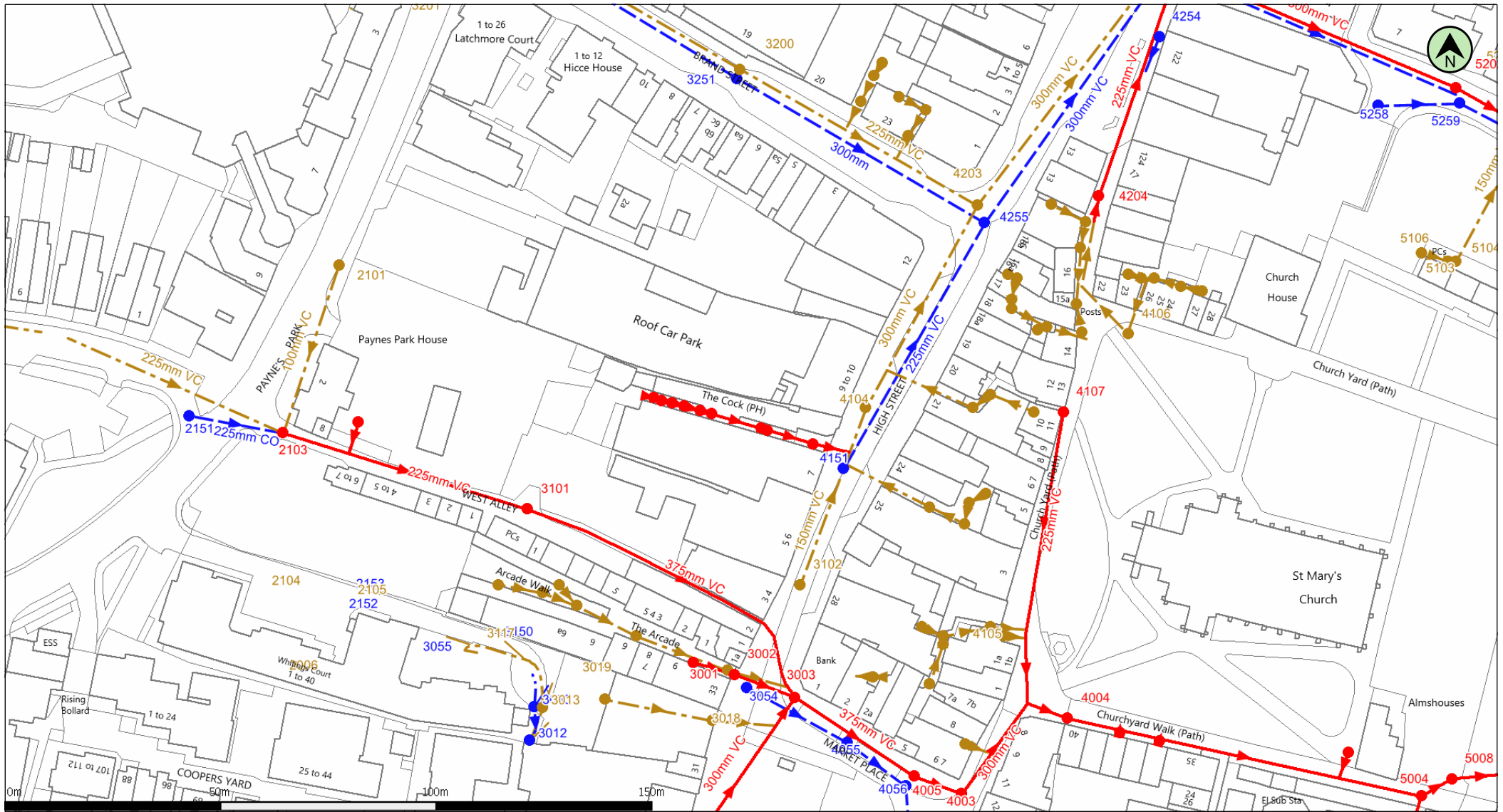
PROJECT TITLE	9-10 High Street, Hitchin
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	DRAWING DETAIL
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Topographical Survey & Roof Plan				
CLIENT Petit Papillon				SCALE 1-200
SURVEYOR PY	SURVEY DATE JUNE 2021	CHECKED BY TC	APPROVED BY TC	OWG STATUS FINAL
DRAWING NUMBER 33787KMLS-01			REVISION A	ISSUE DATE 06/07/2021

Appendix B

Sewer Records



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Date: 06/01/23

Scale: 1:1250

Map Centre: 518383,229155

Data updated: 30/11/22

Our Ref: 1050962 - 1

Wastewater Plan A4

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2023 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	--- --	Outfall*	⊕	Sewage Treatment Works	□
Surface Sewer	--- --		⊕	Public Pumping Station	●
Combined Sewer	--- --		⊕	Decommissioned Pumping Station	●
Final Effluent	--- --	Inlet*			
Rising Main*	--- --				
Private Sewer*	--- --				
Decommissioned Sewer*	--- --	Manhole*			

*(Colour denotes effluent type)

nauvinen@pricemyers.com

30743 High St Hitchi



Appendix C

CCTV Survey Report

Q-LEVEL	DESCRIPTION	ACC.	Q-LEVEL	DESCRIPTION
QL-D	Service positions taken from records.	undefined	QL-B2	Horizontal & vertical location using only one geophysical technique.
QL-C	Visual evidence of service existence but substantiated by geophysical technology.	undefined	QL-B1	Horizontal & vertical location using multiple geophysical techniques.
QL-B4	Undetectable service present shown as an assumed scale (IAS).	± 300m ± 2 m	QL-A	Horizontal & vertical position verification by open excavation, manhole and/or responder chambers.
QL-B3	Description of location by one geophysical technique but with none or poor depth information.			

LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING

 **SURVEY**
SOLUTIONS
0845 040 5969
survey-solutions.co.uk

IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH
NOTTINGHAM YEOVIL

CCTV Report



Project

9-10 High Street, Hitchin,
Hertfordshire, SG5 1BH.

Survey Date

06/02/2023

Client

Price & Myers LLP

Surveyor

GB

Job Number

47144CCTV-01

Issue Date

07/02/2023

Checked by

JAB

Revision - Issue Date

00/00/0000



High Pressure Jetting & Resurvey

Maintenance Visits

Following the initial investigations completed on site we would recommend a quarterly re-survey of the drainage network in order to monitor the ongoing pipework condition.

System Maintenance Survey:

Quarterly Assessment of Existing Defects Due – 06/05/23

Annual Full System Re-survey Due – 06/02/2024

High Pressure Jetting Required:

(5% - 30%) - MH4 B, MH6 X

(35 % - 60%) -

(65% - 95%) -

Project**Project Name:** 47144 - High street, Hitchin**Project Date:** 06/02/2023

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47144 - High street, Hitchin		06/02/2023

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Project Information

Project Name	Project Number	Project Date
47144 - High street, Hitchin		06/02/2023

Client

Company: Price & Myers LLP
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Town or City: London
County: Greater London
Post Code: WC1E 7DP
Phone: 02045246772
Email: mtamayo@pricemyers.com

Site

Company: Price & Myers LLP
Contact: Maureen Tamayo
Street: 9-10 High Street, Hitchin
Town or City: Hitchin
County: Hertfordshire
Post Code: SG5 1BH
Phone: 020 4524 6772
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Contractor

Company: Survey Solutions
Contact: Gregory Bott
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Town or City: Ipswich
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Email: greg.baird@survey-solutions.co.uk

Scoring Summary

Project Name 47144 - High street, Hitchin	Project Number	Project Date 06/02/2023
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Structural Defects

Section	PLR	Grade	Description
All inspected pipes are in an acceptable structural condition (< grade 3).			

Service / Operational Condition

- Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.
- Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.
- Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
1	06/02/2023 12:47	4	Attached deposits, encrustation from 8 o'clock to 9 o'clock, 30% cross-sectional area loss
4	06/02/2023 13:40	3	Multiple defects
5	06/02/2023 14:50	3	Settled deposits, fine, 10% cross-sectional area loss

Abandoned Surveys

Section	PLR	Description
3	06/02/2023 13:17	Survey abandoned
5	06/02/2023 14:50	Survey abandoned
6	06/02/2023 15:02	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRC.

Project Summary

Project Name
47144 - High street, Hitchin

Project Number

Project Date
06/02/2023

Pipe Summary

No.	Type	PLR	Upstream Node	Downstream Node	Road	Town	Use	Mat.	Profile	Length
1	SEC	06/02/2023 12:47	MH3 X	MH4 C	High Street	Hitchin	S	CI	Circular 100mm	4.22 m
2	SEC	06/02/2023 13:04	GULLY	MH3 A	High Street	Hitchin	S	CI	Circular 100mm	4.13 m
3	SEC	06/02/2023 13:17	MH4 X	SA	High Street	Hitchin	S	CI	Circular 100mm	6.00 m
4	SEC	06/02/2023 13:40	GULLY	MH4 B	High Street	Hitchin	S	CI	Circular 100mm	26.62 m
5	SEC	06/02/2023 14:50	MH6 X	SA	High Street	Hitchin	F	CO	Circular 375mm	3.20 m
6	SEC	06/02/2023 15:02	SA	MH6 A	High Street	Hitchin	F	CO	Circular 225mm	3.00 m
Total:										47.17 m

Pipe Levels

No.	PLR	Upstream Node	Upstream C.L.	Upstream I.L.	Upstream I.D.	Downstream Node	Downstream C.L.	Downstream I.L.	Downstream I.D.
1	06/02/2023 12:47	MH3 X			0.000 m	MH4 C			0.000 m
2	06/02/2023 13:04	GULLY			0.000 m	MH3 A			0.000 m
3	06/02/2023 13:17	MH4 X			0.000 m	SA			0.000 m
4	06/02/2023 13:40	GULLY			0.000 m	MH4 B			0.000 m
5	06/02/2023 14:50	MH6 X			0.000 m	SA			0.000 m
6	06/02/2023 15:02	SA			0.000 m	MH6 A			0.000 m

Pipe Summary by Profile

Profile	Total Length	No. Pipes
Circular 100mm	4.22 m	
Circular 100mm	4.13 m	
Circular 100mm	6.00 m	
Circular 100mm	26.62 m	
Circular 100mm =	40.97 m	4
Circular 225mm	3.00 m	
Circular 225mm =	3.00 m	1
Circular 375mm	3.20 m	

Project Summary

Project Name 47144 - High street, Hitchin	Project Number	Project Date 06/02/2023
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Profile	Total Length	No. Pipes
Circular 375mm =	3.20 m	1
Total =	47.17 m	6

Inspection Summary

Pipe No.	Insp. No.	Upstream Node	Downstream Node	Dir.	Operator	Insp. Date	Insp. Time	Str	Ser	Final Observation	Length
1	1	MH3 X	MH4 C	DS	Gregory Bott	06/02/2023	12:47	1	4	MHF	4.22 m
2	1	GULLY	MH3 A	US	Gregory Bott	06/02/2023	13:04	1	1	GYF	4.13 m
3	1	MH4 X	SA	DS	Gregory Bott	06/02/2023	13:17	1	1	SA, Unable to pass bend.	6.00 m
4	1	GULLY	MH4 B	US	Gregory Bott	06/02/2023	13:40	1	3	GYF	26.62 m
5	1	MH6 X	SA	DS	Gregory Bott	06/02/2023	14:50	1	3	SA, Restricted leverage	3.20 m
6	1	SA	MH6 A	US	Gregory Bott	06/02/2023	15:02	1	1	SA, Restricted leverage.	3.00 m
Total:											47.17 m

Inspection Summary by Profile

Profile	Total Length	No. Inspections
Circular 100mm	4.22 m	
Circular 100mm	4.13 m	
Circular 100mm	6.00 m	
Circular 100mm	26.62 m	
Circular 100mm =	40.97 m	4
Circular 225mm	3.00 m	
Circular 225mm =	3.00 m	1
Circular 375mm	3.20 m	
Circular 375mm =	3.20 m	1
Total =	47.17 m	6

Project Summary

Project Name
47144 - High street, Hitchin

Project Number

Project Date
06/02/2023

Defect Summary

Defect Summary				CCTV Drainage Survey Observation Count																				
				General				Structural Condition								Service Condition					Misc			
Sect. No.	Insp. No.	Upstream Node	Downstream Node	Insp. Length (m)	No. Grade 4/5 Obs.	Survey Abandoned	Camera Under Water	Cracks	Fractures	Broken	Deformed	Collapsed	Holes	Surface Damage	Displaced Joints	Open Joints	Roots	Infiltration	Encrustation	Silt	Grease	Obstruction	Water Level	Line Deviates
1	1	MH3 X	MH4 C	4.2	1														2					
2	1	GULLY	MH3 A	4.1															1					
3	1	MH4 X	SA	6.0		1																	2	1
4	1	GULLY	MH4 B	26.6											2				1	1				2
5	1	MH6 X	SA	3.2		1														1			2	
6	1	SA	MH6 A	3.0		1	1																1	
Total:				47.2	1	3	1												4	2			5	3

Defect Grade Description (Section)

Project Name		Project Number	Project Date
47144 - High street, Hitchin			06/02/2023
1:	Brick: Minor structural defects. Other: Minor structural defects, i.e. open or displaced joints without additional characteristics. Acceptable structural condition.		
2:	Brick: Circumferential cracking. Single longitudinal crack. Surface mortar loss (depth missing < 15 mm). Surface damage - spalling slight (breaking away of small fragments from the surface). Surface damage - wear slight (increased roughness). Other: Circumferential cracking. Surface damage - spalling slight (breaking away of small fragments from the surface). Surface damage - wear slight (increased roughness). Minimal collapse likelihood in the short term but potential for further deterioration.		
3:	Brick: Total mortar loss (depth missing > 50 mm) without other defects. More than one longitudinal crack (at a single location). Multiple cracking. Single bricks displaced. Deformation < 5%, no fracture and only moderate mortar loss. Surface damage - spalling medium (large areas of chipped brick). Surface damage - wear medium (entire surface of brick is missing). Other: Fracture with no deformation or deformation < 5%. Longitudinal cracking or multiple cracking. Minor loss of level. Severe joint defects i.e. Surface damage - spalling medium. Surface damage - wear medium. Collapse unlikely in the near future but further deterioration likely.		
4:	Brick: Total mortar loss (depth missing > 50mm) with deformation > 10%; deformation up to 10% and fractured; displaced or hanging brickwork; small number of missing bricks; dropped invert (drop > 20mm); moderate loss of level; surface damage - large spalling (entire surface of brick is missing); surface damage - large wear (entire surface of brick is missing). Other: Broken; deformation up to 10% and broken; fracture with deformation 5-10%; multiple fractures; serious loss of level; serious joint defects with voids or soil visible (open joint with > 50mm soil or void visible or joint displacement > 25% of diameter); surface damage - entire area of pipe surface is missing or severely worn. Collapse likely in the foreseeable future.		
5:	Brick: Already collapsed; missing Invert; deformation > 10% and fractured; displaced or hanging brickwork and deformation < 10%; extensive areas of missing brickwork. Other: Already collapsed; deformation > 10% and broken; extensive areas of pipe fabric missing; fractures with deformation > 10% Collapsed or collapse imminent.		

Section Profile - 06/02/2023 - 06/02/2023 12:47

Project Name 47144 - High street, Hitchin	Project Number	Project Date 06/02/2023
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Circular, 100 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
1	MH3 X	MH4 C	06/02/2023	High street	Cast iron	4.22 m	4.22 m
2	GULLY	MH3 A	06/02/2023	High street	Cast iron	4.13 m	4.13 m
3	MH4 X	SA	06/02/2023	High street	Cast iron	6.00 m	6.00 m
4	GULLY	MH4 B	06/02/2023	High street	Cast iron	26.62 m	26.62 m

Total: 4 Inspections x Circular 100 mm, 0 mm = 40.97 m Total Length and 40.97 m Inspected Length

Circular, 225 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
6	SA	MH6 A	06/02/2023	High street	Concrete	3.00 m	3.00 m

Total: 1 Inspection x Circular 225 mm, 0 mm = 3.00 m Total Length and 3.00 m Inspected Length

Circular, 375 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
5	MH6 X	SA	06/02/2023	High street	Concrete	3.20 m	3.20 m

Total: 1 Inspection x Circular 375 mm, 0 mm = 3.20 m Total Length and 3.20 m Inspected Length

Total: 6 Inspections = 47.17 m Total Length and 47.17 m Inspected Length

Section Summary

Project Name 47144 - High street, Hitchin	Project Number	Project Date 06/02/2023
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Number of sections	6
Total length of sections	47.17 m
Total length of inspected sections	47.17 m
Total length of not inspected sections	0.00 m
Number of abandoned inspections	3
Number of section inspection photos	5
Number of section inspection videos	6
Number of section inspection scans	0
Number of section inclination measurements	0

PLR:	06/02/2023 12:47	Upstream Node:	MH3 X
Inspection Direction:	Downstream	Downstream Node:	MH4 C
Inspected Length:	4.22 m	Dia/Height:	100 mm
Total Length:	4.22 m	Material:	Cast iron

No.	m+	Code	Observation
1	0.00	DEE	Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start
2	3.91	DEE	Attached deposits, encrustation from 8 o'clock to 9 o'clock, 30% cross-sectional area loss
3	4.22	MHF	Finish node, manhole, reference: MH4 C

PLR:	06/02/2023 13:04	Upstream Node:	GULLY
Inspection Direction:	Upstream	Downstream Node:	MH3 A
Inspected Length:	4.13 m	Dia/Height:	100 mm
Total Length:	4.13 m	Material:	Cast iron

No.	m+	Code	Observation
1	0.00	DEE	Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start
2	4.13	GYF	Finish node, gully, reference: GULLY

PLR:	06/02/2023 13:17	Upstream Node:	MH4 X
Inspection Direction:	Downstream	Downstream Node:	SA
Inspected Length:	6.00 m	Dia/Height:	100 mm
Total Length:	6.00 m	Material:	Cast iron

No.	m+	Code	Observation
1	0.00	WL	Water level, 10% of the vertical dimension
2	1.63	LD	Line deviates down
3	2.60	WL	Water level, 5% of the vertical dimension
4	6.00	SA	Survey abandoned

Section Summary

Project Name 47144 - High street, Hitchin	Project Number	Project Date 06/02/2023
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PLR:	06/02/2023 13:40	Upstream Node:	GULLY
Inspection Direction:	Upstream	Downstream Node:	MH4 B
Inspected Length:	26.62 m	Dia/Height:	100 mm
Total Length:	26.62 m	Material:	Cast iron

No.	m+	Code	Observation
1	0.00	DES	Settled deposits, fine, 5% cross-sectional area loss
2	0.00	DEE	Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start
3	9.74	MH	Start node, manhole, reference: MH2
4	9.83	JN	Junction at 3 o'clock, 100mm dia
5	9.83	JN	Junction at 9 o'clock, 100mm dia
6	17.61	JDM	Joint displaced, medium
7	21.39	JDM	Joint displaced, medium
8	21.52	MH	Start node, manhole, reference: MH1
9	21.62	JN	Junction at 9 o'clock, 100mm dia
10	22.28	LR	Line deviates right
11	22.72	LL	Line deviates left
12	26.62	GYF	Finish node, gully, reference: GULLY

PLR:	06/02/2023 14:50	Upstream Node:	MH6 X
Inspection Direction:	Downstream	Downstream Node:	SA
Inspected Length:	3.20 m	Dia/Height:	375 mm
Total Length:	3.20 m	Material:	Concrete

No.	m+	Code	Observation
1	0.00	WL	Water level, 10% of the vertical dimension
2	0.10	DES	Settled deposits, fine, 10% cross-sectional area loss
3	1.80	WL	Water level, 40% of the vertical dimension
4	3.20	SA	Survey abandoned

PLR:	06/02/2023 15:02	Upstream Node:	SA
Inspection Direction:	Upstream	Downstream Node:	MH6 A
Inspected Length:	3.00 m	Dia/Height:	225 mm
Total Length:	3.00 m	Material:	Concrete

No.	m+	Code	Observation
1	0.00	WL	Water level, 20% of the vertical dimension
2	2.72	CUW	Loss of vision, camera under water
3	3.00	SA	Survey abandoned

Completed section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
1	1	06/02/23	8:00	Not Specified	No Rain Or Snow	No	06/02/2023 12:47
Operator Gregory Bott		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Hitchin	Inspection Direction:	Downstream	Upstream Node:	MH3 X
Road:	High Street	Inspected Length:	4.22 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	4.22 m	Downstream Node:	MH4 C
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Flow Control:	No flow control	Material:	Cast iron		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:

Recommendations:

Scale: 1:50 Position [m] Code Observation MPEG Photo Grade

Depth: m
MH3 X


0.00

S01

DEE

Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start

00:00:00

3

3.91

DEE

Attached deposits, encrustation from 8 o'clock to 9 o'clock, 30% cross-sectional area loss

00:00:14

4

4.22

MHF

Finish node, manhole, reference: MH4 C

00:00:25

MH4 C
Depth: m

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	2	5.0	1.7	7.0	4.0

Completed section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
2	1	06/02/23	13:04	Not Specified	No Rain Or Snow	No	06/02/2023 13:04
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
Gregory Bott		Not Specified		Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:	Hitchin	Inspection Direction:	Upstream	Upstream Node:	GULLY
Road:	High Street	Inspected Length:	4.13 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	4.13 m	Downstream Node:	MH3 A
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Flow Control:	No flow control	Material:	Cast iron		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:

Recommendations:

Scale: 1:50 Position [m] Code Observation MPEG Photo Grade

Depth: m
MH3 A


0.00

S01

DEE

Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start

00:00:00

3

4.13

GYF

Finish node, gully, reference: GULLY

00:00:19

GULLY
Depth: m

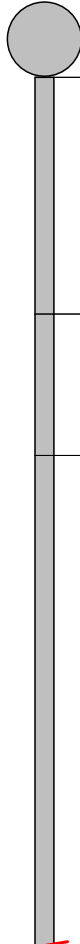
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
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Abandoned section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
3	1	06/02/23	13:17	Not Specified	No Rain Or Snow	No	06/02/2023 13:17
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
Gregory Bott		Not Specified		Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:	Hitchin	Inspection Direction:	Downstream	Upstream Node:	MH4 X
Road:	High Street	Inspected Length:	6.00 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	6.00 m	Downstream Node:	SA
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Flow Control:	No flow control	Material:	Cast iron		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:
Recommendations:

Scale:	1:52	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m MH4 X 							
		0.00	WL	Water level, 10% of the vertical dimension	00:00:00		
		1.63	LD	Line deviates down: Slight down.	00:01:21		
		2.60	WL	Water level, 5% of the vertical dimension	00:00:11		
		6.00	SA	Survey abandoned: Unable to pass bend.	00:00:34		

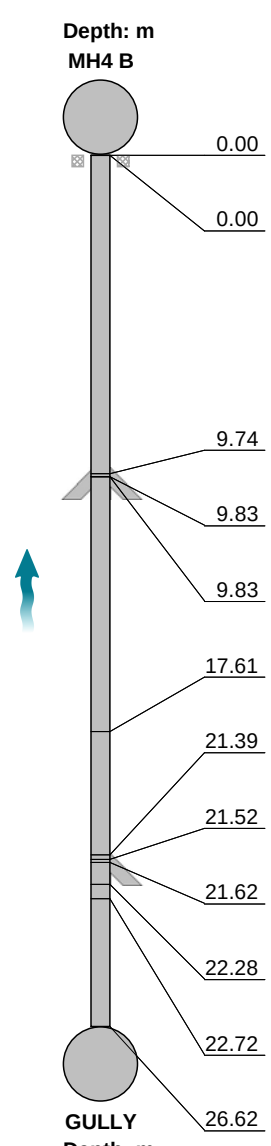
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Completed section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
4	1	06/02/23	13:40	Not Specified	No Rain Or Snow	No	06/02/2023 13:40
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
Gregory Bott		Not Specified		Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:	Hitchin	Inspection Direction:	Upstream	Upstream Node:	GULLY
Road:	High Street	Inspected Length:	26.62 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	26.62 m	Downstream Node:	MH4 B
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Flow Control:	No flow control	Material:	Cast iron		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:
Recommendations:

Scale: 1:231	Position [m]	Code	Observation	MPEG	Photo	Grade
						
	0.00	DES	Settled deposits, fine, 5% cross-sectional area loss	00:00:00		3
	0.00 S01	DEE	Attached deposits, encrustation from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, start	00:03:04		3
	9.74	MH	Start node, manhole, reference: MH2	00:00:38		
	9.83	JN	Junction at 3 o'clock, 100mm dia	00:00:38		
	9.83	JN	Junction at 9 o'clock, 100mm dia	00:00:38		
	17.61	JDM	Joint displaced, medium	00:01:29		1 / 3
	21.39	JDM	Joint displaced, medium	00:01:42		1 / 3
	21.52	MH	Start node, manhole, reference: MH1	00:01:44		
	21.62	JN	Junction at 9 o'clock, 100mm dia	00:01:44		
	22.28	LR	Line deviates right: Slight right.	00:02:27		
	22.72	LL	Line deviates left: Slight left.	00:02:50		
	26.62	GYF	Finish node, gully, reference: GULLY	00:03:04		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
2	1.0	0.1	2.0	1.0	4	2.0	0.3	8.0	3.0

Section Pictures - 06/02/2023 - 06/02/2023 13:40

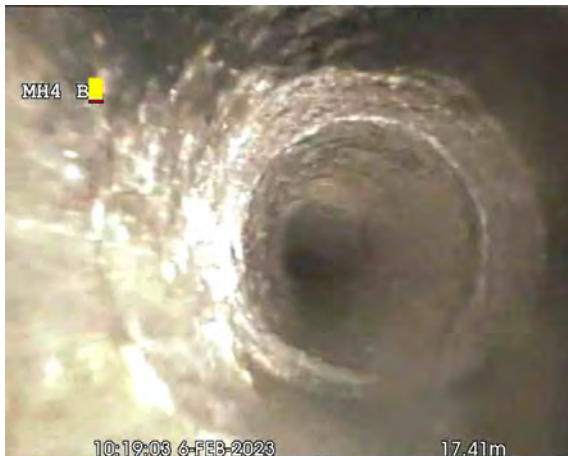
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4	Upstream	06/02/2023 13:40		



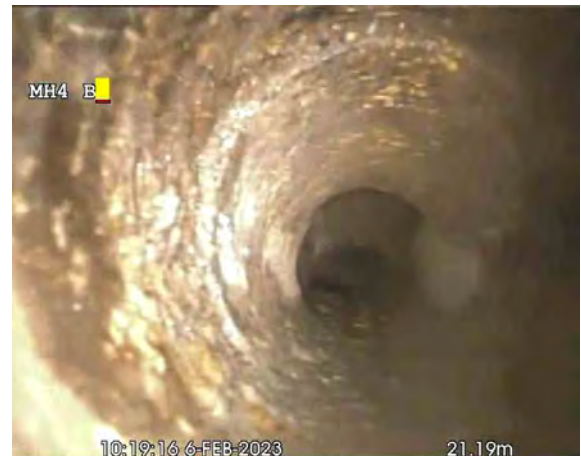
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Junction at 3 o'clock, 100mm dia



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Junction at 9 o'clock, 100mm dia



38aeaca9-983c-4004-b21c-cf4fda6b942a.jpg, 00:01:29, 17.61 m
Joint displaced, medium



54f4c6e0-fbf3-4311-9d3d-5cd871344818.jpg, 00:01:42, 21.39 m
Joint displaced, medium



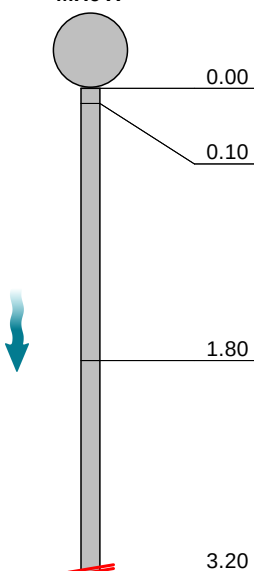
51395fd3-0329-4168-beb3-8c67e194c290.jpg, 00:01:44, 21.62 m
Junction at 9 o'clock, 100mm dia

Abandoned section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
5	1	06/02/23	14:50	Not Specified	No Rain Or Snow	No	06/02/2023 14:50
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
Gregory Bott		Not Specified		Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:	Hitchin	Inspection Direction:	Downstream	Upstream Node:	MH6 X
Road:	High Street	Inspected Length:	3.20 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	3.20 m	Downstream Node:	SA
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	375 mm		
Flow Control:	No flow control	Material:	Concrete		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:
Recommendations:

Scale:	1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m MH6 X 							
		0.00	WL	Water level, 10% of the vertical dimension	00:00:00		
		0.10	DES	Settled deposits, fine, 10% cross-sectional area loss	00:00:01		3
		1.80	WL	Water level, 40% of the vertical dimension	00:00:15		
		3.20	SA	Survey abandoned: Restricted leverage	00:01:10		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	2.0	0.6	2.0	3.0

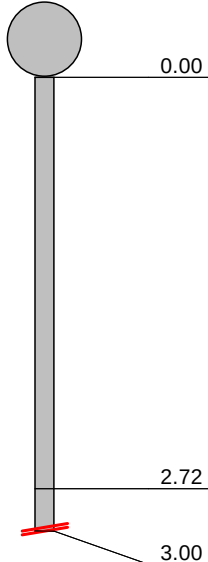
Abandoned section inspection

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
6	1	06/02/23	15:02	Not Specified	No Rain Or Snow	No	06/02/2023 15:02
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
Gregory Bott		Not Specified		Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:	Hitchin	Inspection Direction:	Upstream	Upstream Node:	SA
Road:	High Street	Inspected Length:	3.00 m	Upstream Pipe Depth:	
Location:	Footway	Total Length:	3.00 m	Downstream Node:	MH6 A
Surface Type:		Joint Length:		Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	225 mm		
Flow Control:	No flow control	Material:	Concrete		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:

Recommendations:

Scale:	1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m MH6 A 							
		0.00	WL	Water level, 20% of the vertical dimension	00:00:00		
		2.72	CUW	Loss of vision, camera under water	00:00:09		
		3.00	SA	Survey abandoned: Restricted leverage.	00:00:56		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Appendix D

Greenfield Runoff Calculations

Greenfield runoff rate estimation for sites

www.ukstds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{MED} estimation method:

BFI and SPR method:

HOST class:

BFI / BFIHOST:

Q_{MED} (l/s):

Q_{BAR} / Q_{MED} factor:

Hydrological characteristics

	Default	Edited
SAAR (mm):	600	600
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default Edited

Q_{BAR} (l/s):		0.09
1 in 1 year (l/s):		0.08
1 in 30 years (l/s):		0.21
1 in 100 year (l/s):		0.31
1 in 200 years (l/s):		0.37

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E

Causeway Flow Calculations



Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	15.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	x
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	1.000		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.075	5.00	70.350	450	-35.211	27.583	1.000
BR1	0.077	5.00	70.075		-11.380	27.752	0.150
S2			70.350	1200	-14.288	27.634	1.387
BR3	0.026	5.00	70.075		8.335	8.310	0.150
S3			66.350	450	-11.124	17.274	0.600
Attenuation Tank			66.350		3.247	17.264	1.500
BR2	0.026	5.00	70.075		61.543	30.227	0.150
BR4	0.068	5.00	70.075		61.079	17.764	0.150
J01			66.350	150	60.778	20.227	1.887
FCMH1			65.350	1200	72.602	20.836	1.200
Outfall			65.480	1200	81.762	1.521	1.490



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	20.924	0.600	69.350	68.963	0.387	54.0	150	5.25	50.0
2.000	BR1	S2	2.920	0.600	69.925	68.963	0.962	3.0	150	5.01	50.0
1.001	S2	S3	10.832	0.600	68.963	65.750	3.213	3.4	150	5.29	50.0
3.000	BR3	S3	21.424	0.600	69.925	65.750	4.175	5.1	150	5.08	50.0
1.002	S3	Attenuation Tank	14.371	0.600	65.750	65.004	0.746	19.3	150	5.39	50.0
1.003	Attenuation Tank	J01	57.607	0.600	64.850	64.463	0.387	148.9	150	6.56	46.7
4.000	BR2	J01	10.030	0.600	69.925	64.463	5.462	1.8	150	5.02	50.0
5.000	BR4	J01	2.482	0.600	69.925	64.463	5.462	0.5	150	5.00	50.0
1.004	J01	FCMH1	11.839	0.600	64.463	64.150	0.313	37.8	150	6.68	46.3
1.005	FCMH1	Outfall	21.377	0.600	64.150	63.990	0.160	133.6	150	7.09	44.9

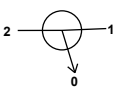
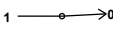
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.372	24.2	10.2	0.850	1.237	0.075	0.0	68	1.312
2.000	5.827	103.0	10.4	0.000	1.237	0.077	0.0	32	3.746
1.001	5.528	97.7	20.6	1.237	0.450	0.152	0.0	47	4.395
3.000	4.478	79.1	3.5	0.000	0.450	0.026	0.0	21	2.255
1.002	2.305	40.7	24.1	0.450	1.196	0.178	0.0	83	2.398
1.003	0.821	14.5	22.5	1.350	1.737	0.178	0.0	150	0.837
4.000	7.495	132.5	3.5	0.000	1.737	0.026	0.0	17	3.229
5.000	15.081	266.5	9.2	0.000	1.737	0.068	0.0	19	7.074
1.004	1.641	29.0	34.1	1.737	1.050	0.272	0.0	150	1.672
1.005	0.867	15.3	33.1	1.050	1.340	0.272	0.0	150	0.884

Pipeline Schedule

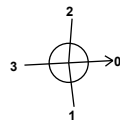
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	20.924	54.0	150	Circular	70.350	69.350	0.850	70.350	68.963	1.237
2.000	2.920	3.0	150	Circular	70.075	69.925	0.000	70.350	68.963	1.237
1.001	10.832	3.4	150	Circular	70.350	68.963	1.237	66.350	65.750	0.450
3.000	21.424	5.1	150	Circular	70.075	69.925	0.000	66.350	65.750	0.450
1.002	14.371	19.3	150	Circular	66.350	65.750	0.450	66.350	65.004	1.196
1.003	57.607	148.9	150	Circular	66.350	64.850	1.350	66.350	64.463	1.737
4.000	10.030	1.8	150	Circular	70.075	69.925	0.000	66.350	64.463	1.737
5.000	2.482	0.5	150	Circular	70.075	69.925	0.000	66.350	64.463	1.737
1.004	11.839	37.8	150	Circular	66.350	64.463	1.737	65.350	64.150	1.050
1.005	21.377	133.6	150	Circular	65.350	64.150	1.050	65.480	63.990	1.340

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	1200	Manhole	Adoptable
2.000	BR1		Junction		S2	1200	Manhole	Adoptable
1.001	S2	1200	Manhole	Adoptable	S3	450	Manhole	Adoptable
3.000	BR3		Junction		S3	450	Manhole	Adoptable
1.002	S3	450	Manhole	Adoptable	Attenuation Tank		Junction	
1.003	Attenuation Tank		Junction		J01	150	Manhole	Adoptable
4.000	BR2		Junction		J01	150	Manhole	Adoptable
5.000	BR4		Junction		J01	150	Manhole	Adoptable
1.004	J01	150	Manhole	Adoptable	FCMH1	1200	Manhole	Adoptable
1.005	FCMH1	1200	Manhole	Adoptable	Outfall	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	-35.211	27.583	70.350	1.000	450		0	1.000	69.350	150
BR1	-11.380	27.752	70.075	0.150			0	2.000	69.925	150
S2	-14.288	27.634	70.350	1.387	1200		1 2 0	2.000 1.000	68.963 68.963	150 150
BR3	8.335	8.310	70.075	0.150			0	1.001	68.963	150
S3	-11.124	17.274	66.350	0.600	450		1 2 0	3.000 1.001	65.750 65.750	150 150
Attenuation Tank	3.247	17.264	66.350	1.500			1 0	1.002	65.004	150
BR2	61.543	30.227	70.075	0.150			0	1.003	64.850	150
BR4	61.079	17.764	70.075	0.150			0	4.000	69.925	150
							0	5.000	69.925	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
J01	60.778	20.227	66.350	1.887	150		1	5.000	64.463	150
							2	4.000	64.463	150
							3	1.003	64.463	150
							0	1.004	64.463	150
FCMH1	72.602	20.836	65.350	1.200	1200		1	1.004	64.150	150
							0	1.005	64.150	150
Outfall	81.762	1.521	65.480	1.490	1200		1	1.005	63.990	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.950	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.950	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

60	120	180	240	360	480	600	720	960	1440
----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	0	0	0	100	40	0	0

Node BR1 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Design Depth (m)	0.150	Diameter (m)	0.073
Downstream Link	2.000	Invert Level (m)	69.925	Design Flow (l/s)	3.8	Discharge Coefficient	0.600

Node BR3 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Design Depth (m)	0.150	Diameter (m)	0.058
Downstream Link	3.000	Invert Level (m)	69.925	Design Flow (l/s)	2.5	Discharge Coefficient	0.600

Node BR4 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Design Depth (m)	0.150	Diameter (m)	0.075
Downstream Link	5.000	Invert Level (m)	69.925	Design Flow (l/s)	4.0	Discharge Coefficient	0.600

Node BR2 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Design Depth (m)	0.150	Diameter (m)	0.067
Downstream Link	4.000	Invert Level (m)	69.925	Design Flow (l/s)	3.2	Discharge Coefficient	0.600

Node FCMH1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.005	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0092-3800-1000-3800
Invert Level (m)	64.338	Min Outlet Diameter (m)	0.150
Design Depth (m)	1.000	Min Node Diameter (mm)	1200
Design Flow (l/s)	3.8		

Node BR1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	278.0	0.0	0.150	278.0	0.0

Node BR2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	63.0	0.0	0.150	63.0	0.0

Node BR3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	70.0	0.0	0.150	70.0	0.0

Node BR4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	222.0	0.0	0.150	222.0	0.0

Node Attenuation Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	64.750
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	456

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	342.0	0.0	0.500	342.0	0.0	0.501	0.0	0.0	1.600	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 60 minute summer	42.630	11.266	30 year 600 minute summer	20.405	5.581
2 year 60 minute winter	28.322	11.266	30 year 600 minute winter	13.942	5.581
2 year 120 minute summer	31.532	8.333	30 year 720 minute summer	17.814	4.774
2 year 120 minute winter	20.949	8.333	30 year 720 minute winter	11.972	4.774
2 year 180 minute summer	25.676	6.607	30 year 960 minute summer	14.149	3.726
2 year 180 minute winter	16.690	6.607	30 year 960 minute winter	9.372	3.726
2 year 240 minute summer	20.780	5.491	30 year 1440 minute summer	9.795	2.625
2 year 240 minute winter	13.806	5.491	30 year 1440 minute winter	6.583	2.625
2 year 360 minute summer	16.012	4.121	100 year 60 minute summer	151.577	40.057
2 year 360 minute winter	10.409	4.121	100 year 60 minute winter	100.704	40.057
2 year 480 minute summer	12.530	3.311	100 year 120 minute summer	93.608	24.738
2 year 480 minute winter	8.325	3.311	100 year 120 minute winter	62.191	24.738
2 year 600 minute summer	10.167	2.781	100 year 180 minute summer	71.099	18.296
2 year 600 minute winter	6.946	2.781	100 year 180 minute winter	46.216	18.296
2 year 720 minute summer	8.974	2.405	100 year 240 minute summer	55.387	14.637
2 year 720 minute winter	6.031	2.405	100 year 240 minute winter	36.798	14.637
2 year 960 minute summer	7.247	1.908	100 year 360 minute summer	40.975	10.544
2 year 960 minute winter	4.801	1.908	100 year 360 minute winter	26.635	10.544
2 year 1440 minute summer	5.132	1.376	100 year 480 minute summer	31.375	8.292
2 year 1440 minute winter	3.449	1.376	100 year 480 minute winter	20.845	8.292
30 year 60 minute summer	118.260	31.253	100 year 600 minute summer	25.075	6.859
30 year 60 minute winter	78.569	31.253	100 year 600 minute winter	17.133	6.859
30 year 120 minute summer	74.888	19.791	100 year 720 minute summer	21.875	5.863
30 year 120 minute winter	49.754	19.791	100 year 720 minute winter	14.702	5.863
30 year 180 minute summer	57.327	14.752	100 year 960 minute summer	17.331	4.564
30 year 180 minute winter	37.264	14.752	100 year 960 minute winter	11.480	4.564
30 year 240 minute summer	44.829	11.847	100 year 1440 minute summer	11.949	3.203
30 year 240 minute winter	29.784	11.847	100 year 1440 minute winter	8.031	3.203
30 year 360 minute summer	33.297	8.568	100 year +40% CC 60 minute summer	212.208	56.080
30 year 360 minute winter	21.644	8.568	100 year +40% CC 60 minute winter	140.986	56.080
30 year 480 minute summer	25.517	6.743	100 year +40% CC 120 minute summer	131.051	34.633
30 year 480 minute winter	16.953	6.743	100 year +40% CC 120 minute winter	87.067	34.633

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 180 minute summer	99.539	25.615	100 year +40% CC 600 minute summer	35.105	9.602
100 year +40% CC 180 minute winter	64.703	25.615	100 year +40% CC 600 minute winter	23.986	9.602
100 year +40% CC 240 minute summer	77.542	20.492	100 year +40% CC 720 minute summer	30.626	8.208
100 year +40% CC 240 minute winter	51.517	20.492	100 year +40% CC 720 minute winter	20.582	8.208
100 year +40% CC 360 minute summer	57.365	14.762	100 year +40% CC 960 minute summer	24.264	6.389
100 year +40% CC 360 minute winter	37.288	14.762	100 year +40% CC 960 minute winter	16.073	6.389
100 year +40% CC 480 minute summer	43.925	11.608	100 year +40% CC 1440 minute summer	16.729	4.484
100 year +40% CC 480 minute winter	29.183	11.608	100 year +40% CC 1440 minute winter	11.243	4.484

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S1	33	69.416	0.066	7.6	0.0105	0.0000	OK
360 minute summer	BR1	232	69.967	0.042	3.3	11.1797	0.0000	OK
60 minute summer	S2	33	68.991	0.028	7.8	0.0322	0.0000	OK
180 minute summer	BR3	112	69.965	0.040	1.6	2.6274	0.0000	OK
60 minute summer	S3	33	65.796	0.046	8.1	0.0073	0.0000	OK
480 minute summer	Attenuation Tank	296	64.891	0.041	3.6	13.0269	0.0000	OK
180 minute summer	BR2	112	69.965	0.040	1.6	2.3758	0.0000	OK
240 minute summer	BR4	160	69.968	0.043	3.7	9.0915	0.0000	OK
360 minute summer	J01	248	64.545	0.082	3.9	0.0015	0.0000	OK
360 minute summer	FCMH1	248	64.541	0.391	3.7	0.4425	0.0000	SURCHARGED
60 minute summer	Outfall	1	63.990	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S1	1.000	S2	7.6	1.597	0.314	0.1026	
360 minute summer	BR1	Orifice	S2	0.9				
60 minute summer	S2	1.001	S3	7.8	2.293	0.080	0.0374	
180 minute summer	BR3	Orifice	S3	0.7				
60 minute summer	S3	1.002	Attenuation Tank	8.1	1.778	0.198	0.0651	
480 minute summer	Attenuation Tank	1.003	J01	2.3	0.616	0.161	0.3407	
180 minute summer	BR2	Orifice	J01	0.8				
240 minute summer	BR4	Orifice	J01	1.0				
360 minute summer	J01	1.004	FCMH1	3.7	0.283	0.128	0.1626	
360 minute summer	FCMH1	Hydro-Brake®	Outfall	3.7				60.7

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S1	33	69.484	0.134	21.0	0.0212	0.0000	OK
180 minute summer	BR1	124	70.008	0.083	10.9	22.0293	0.0000	OK
60 minute summer	S2	33	69.011	0.048	22.0	0.0543	0.0000	OK
120 minute summer	BR3	78	70.009	0.084	4.9	5.5785	0.0000	OK
60 minute summer	S3	33	65.834	0.084	23.1	0.0133	0.0000	OK
360 minute summer	Attenuation Tank	368	65.027	0.177	9.5	57.3544	0.0000	SURCHARGED
120 minute summer	BR2	76	70.008	0.083	4.9	4.9783	0.0000	OK
180 minute summer	BR4	120	70.011	0.086	9.6	18.2413	0.0000	OK
360 minute summer	J01	360	65.020	0.557	6.8	0.0100	0.0000	SURCHARGED
360 minute summer	FCMH1	360	65.015	0.865	4.6	0.9788	0.0000	SURCHARGED
60 minute summer	Outfall	1	63.990	0.000	3.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S1	1.000	S2	21.0	1.905	0.866	0.2240	
180 minute summer	BR1	Orifice	S2	2.4				
60 minute summer	S2	1.001	S3	22.0	2.960	0.225	0.0809	
120 minute summer	BR3	Orifice	S3	1.6				
60 minute summer	S3	1.002	Attenuation Tank	23.0	2.332	0.566	0.1420	
360 minute summer	Attenuation Tank	1.003	J01	3.9	0.633	0.267	1.0142	
120 minute summer	BR2	Orifice	J01	2.1				
180 minute summer	BR4	Orifice	J01	2.6				
360 minute summer	J01	1.004	FCMH1	4.6	0.305	0.157	0.2084	
360 minute summer	FCMH1	Hydro-Brake®	Outfall	3.8				129.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S1	34	69.745	0.395	26.9	0.0627	0.0000	SURCHARGED
180 minute summer	BR1	124	70.028	0.103	13.5	27.1853	0.0000	OK
60 minute summer	S2	34	69.017	0.054	27.7	0.0612	0.0000	OK
120 minute summer	BR3	80	70.030	0.105	6.1	6.9745	0.0000	OK
60 minute summer	S3	34	65.848	0.098	29.2	0.0156	0.0000	OK
360 minute summer	Attenuation Tank	376	65.098	0.248	12.3	80.4724	0.0000	SURCHARGED
60 minute summer	BR2	42	70.030	0.105	9.3	6.2870	0.0000	OK
180 minute summer	BR4	120	70.032	0.107	11.9	22.4610	0.0000	OK
360 minute summer	J01	368	65.092	0.629	7.1	0.0113	0.0000	SURCHARGED
360 minute summer	FCMH1	368	65.087	0.937	4.6	1.0593	0.0000	FLOOD RISK
60 minute summer	Outfall	1	63.990	0.000	3.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S1	1.000	S2	26.0	1.956	1.072	0.2440	
180 minute summer	BR1	Orifice	S2	2.9				
60 minute summer	S2	1.001	S3	27.7	3.089	0.283	0.0970	
120 minute summer	BR3	Orifice	S3	1.9				
60 minute summer	S3	1.002	Attenuation Tank	29.2	2.452	0.716	0.1710	
360 minute summer	Attenuation Tank	1.003	J01	4.1	0.626	0.280	1.0142	
60 minute summer	BR2	Orifice	J01	2.5				
180 minute summer	BR4	Orifice	J01	3.1				
360 minute summer	J01	1.004	FCMH1	4.6	0.272	0.158	0.2084	
360 minute summer	FCMH1	Hydro-Brake®	Outfall	3.8				160.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S1	34	70.326	0.976	37.7	0.1551	0.0000	FLOOD RISK
180 minute summer	BR1	128	70.070	0.145	18.9	38.2886	0.0000	OK
60 minute summer	S2	34	69.028	0.065	38.4	0.0731	0.0000	OK
120 minute summer	BR3	80	70.075	0.150	8.6	9.9647	0.0000	OK
60 minute summer	S3	34	65.878	0.128	40.3	0.0203	0.0000	OK
480 minute summer	Attenuation Tank	488	65.283	0.433	15.0	129.9600	0.0000	SURCHARGED
60 minute summer	BR2	43	70.073	0.148	13.1	8.8810	0.0000	OK
180 minute summer	BR4	124	70.075	0.150	16.6	31.6324	0.0000	OK
480 minute summer	J01	488	65.274	0.811	5.9	0.0146	0.0000	SURCHARGED
480 minute summer	FCMH1	488	65.267	1.117	4.4	1.2631	0.0000	FLOOD RISK
60 minute summer	Outfall	1	63.990	0.000	3.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S1	1.000	S2	35.9	2.480	1.480	0.2601	
180 minute summer	BR1	Orifice	S2	3.7				
60 minute summer	S2	1.001	S3	38.4	3.219	0.393	0.1258	
120 minute summer	BR3	Orifice	S3	2.4				
60 minute summer	S3	1.002	Attenuation Tank	40.2	2.544	0.986	0.2412	
480 minute summer	Attenuation Tank	1.003	J01	3.5	0.634	0.240	1.0142	
60 minute summer	BR2	Orifice	J01	3.2				
180 minute summer	BR4	Orifice	J01	3.9				
480 minute summer	J01	1.004	FCMH1	4.4	0.284	0.150	0.2084	
480 minute summer	FCMH1	Hydro-Brake®	Outfall	3.8				236.1

Appendix F

SuDS Drainage Plan

