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Civil & Structural Engineering Consultants
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FLOOD RISK ASSESSMENT

ON

LAND SOUTH OF BARNSLEY ROAD, UPPER CUMBERWORTH

FOR

VIVLY HOMES

E25/8281/FR01

DECEMBER 2025

Haigh Huddleston Associates is the trading name of Haigh Huddleston Associates Limited
Registered Office: Unit 4, Midgley Business Park, Bar Lane, Midgley, Wakefield, WF4 4JJ
Registered in England Number 6458196

1.0 INTRODUCTION

1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance Planning Practise Guidance- Flood Risk and Coastal Change April 2022 and the proposals for drainage of this site when redeveloped as residential land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

2.1 The site is located in primarily open grassland to the south of Barnsley Road, Upper Cumberworth and is situated around OS Grid reference SE209085.

2.2 The site is irregularly shaped with the northern boundary formed by Barnsley Road and the south western boundary by Park Lane. To the west and east are residential properties and to the south is open field and ancient woodland. Park Dike is located in the woodland to the south of the site, approximately 17m from the southern corner and nearly 8m lower. The site area is approximately 5.2 ha, with 4.3ha of this to be developed and the remaining land to be POS.

2.3 The site itself is predominantly grassed, with little undergrowth. A small collection of single storey concrete and timber farm buildings are located in a small fenced off area adjacent Park Lane on the southern western boundary of the site. The site falls from a high point of 254.4m AOD in the western corner of the site to a low point of 225.8m AOD in the south eastern corner of the site at an average grade of 1 in 12. Barnsley Road on the northern boundary falls from west to east.

2.4 A grip is located on the south western boundaries of the site to prevent surface water run-off from the fields leaving the site and flooding adjacent land. This discharges to Park Dike to the south of the site via a 150mm diameter pipe.

2.4 No site investigation works have been undertaken on site to date, but the Geological Maps of Great Britain on the BGS website show the site is underlain by the Grenoside Sandstone Formation consisting of Sandstone (Fig 1).

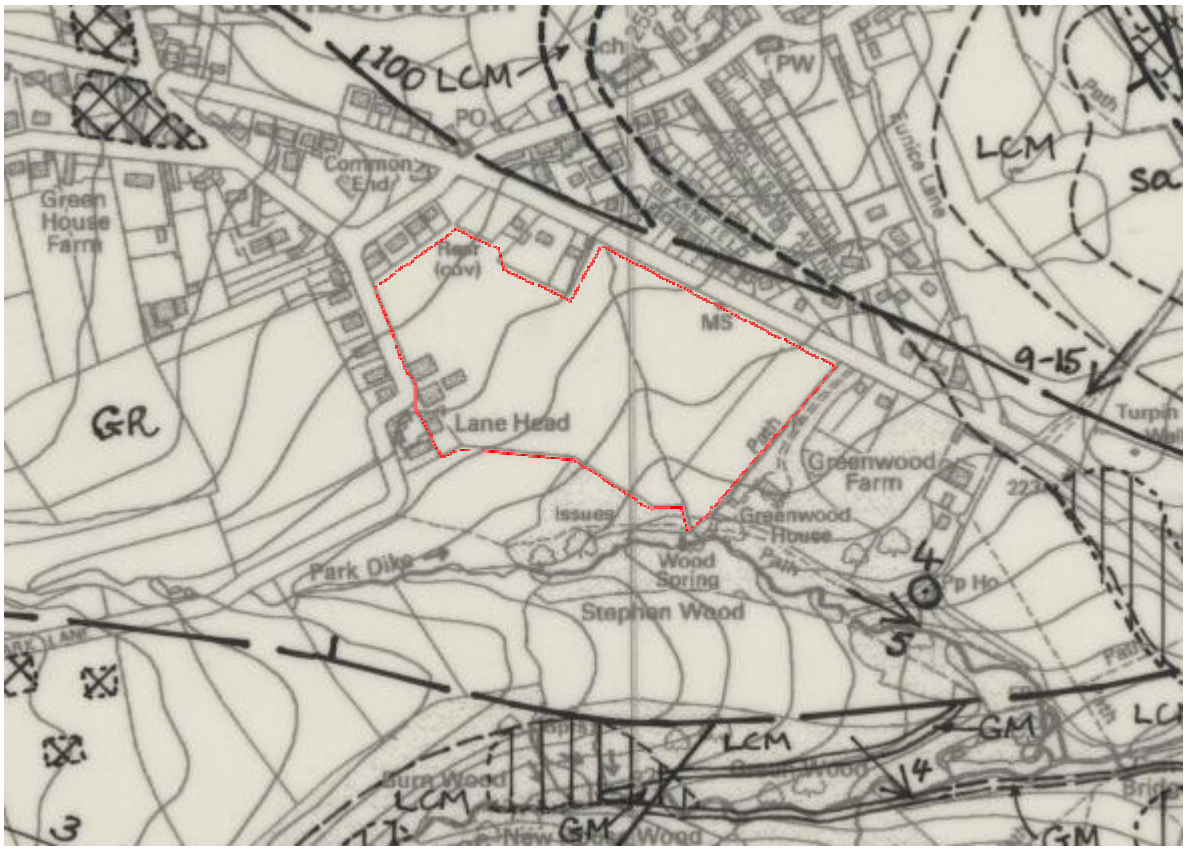


Fig 1 Extract from Geological Map SE 20 NW

3.0 PROPOSED DEVELOPMENT AND DRAINAGE CONSTRAINTS

3.1 It is understood that the proposed development is for a series of detached and semi-detached houses and apartment blocks (totalling 123 units) with associated car parking and access roads. An engineering feasibility site layout is attached in the appendices.

3.2 Currently, there is a grip on the lower south western boundaries of the fields with a 150mm diameter outfall pipe directly to Park Dike to the south of the site.

3.3 There are no recorded adopted surface water sewers located on or immediately adjacent the site. A 150mm diameter combined sewer is shown running within Park Lane on the south western boundary, which then enters the site from the southern corner to the north east boundary with Barnsley Road. This would appear to serve the existing buildings within the south western area of the site, and the properties off-site on the western side of Park Lane.

3.4 Although no site investigation works have been undertaken, the site is shown to be underlain by the Grenoside Sandstone formation, so there is the potential for infiltration methods to be a viable form of surface water disposal. However, due to the steep nature of the site, there is the possibility for re-emergence effecting lower down properties on the development, this would need to be considered within any design.

3.5 At present, in lieu of site investigation works, it is proposed to have a restricted discharge to Park Dike located to the south of the development. Due to the relative levels of the site to the dike, it will be possible to achieve a gravity connection to the beck. The final outfall connection to Park Dike will be through designated Ancient Woodland, and should be via a shallow stone channel or grip to minimize the disturbance to the existing trees. A new outfall to the water course will need to be agreed with the LLFA and landowner with the final alignment agreed on site.

3.6 The proposed foul sewer will need to connect to the existing 225mm combined sewer shown within Barnsley Road to the north of the site. Due to this being located elevated above the low point of the site, a pumping station will be required in the lower north eastern corner of the

site. A minimum pumped rate of 4.75 l/s will be required to achieve self cleansing velocity within the rising main, with a final gravity discharge to the existing combined system.

4.0 FLOOD RISK

4.1 On reviewing the Environment Agency websites flood risk maps, the site currently falls within flood zone 1: which is designated as low probability of flooding from sea or rivers less than 0.1% (ie 1 in 1000 year) probability of flooding see Fig 2.

The hierarchy of flood zones are described as:

Flood Zone 1: Low Probability. Land assessed as having a less than 1 in 1000 chance of river and sea flooding in any year (<0.1%).

Flood Zone 2: Medium Probability. Land assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% 0.1%) and between a 1 in 200 and 1 in 1000 chance of sea flooding (0.5% 0.1%) in any year.

Flood Zone 3: High Probability. Land assessed as having a 1 in 100 or greater chance of river flooding (>1%) and 1 in 200 or greater chance of sea flooding (>0.5%) in any year.

The site is therefore considered not to be at risk from fluvial flooding from rivers or sea for the 1 in 100 or 1 in 1000 year flood event. The proposed use of the site would be classified as More Vulnerable in Table 2: Flood Risk Vulnerability Classification in the Planning Practise Guidance- Flood Risk and Coastal Change April 2022. In accordance with that table the proposed development would be considered to be appropriate for the site.

4.2 The available EA plans indicate that there is no surface water flooding from rain falling on the site (Fig 2) and no flooding shown on the higher land to the west of the site.

4.3 The site does not appear to fall within an area subject to flooding from reservoirs according to the EA maps. We consider the risk of such a source of flooding would be low. The site does not fall within a flood warning zone.

4.4 Due to the size of the development being in excess of 1Ha, it would be necessary to prepare a site specific Flood Risk Assessment for the site.

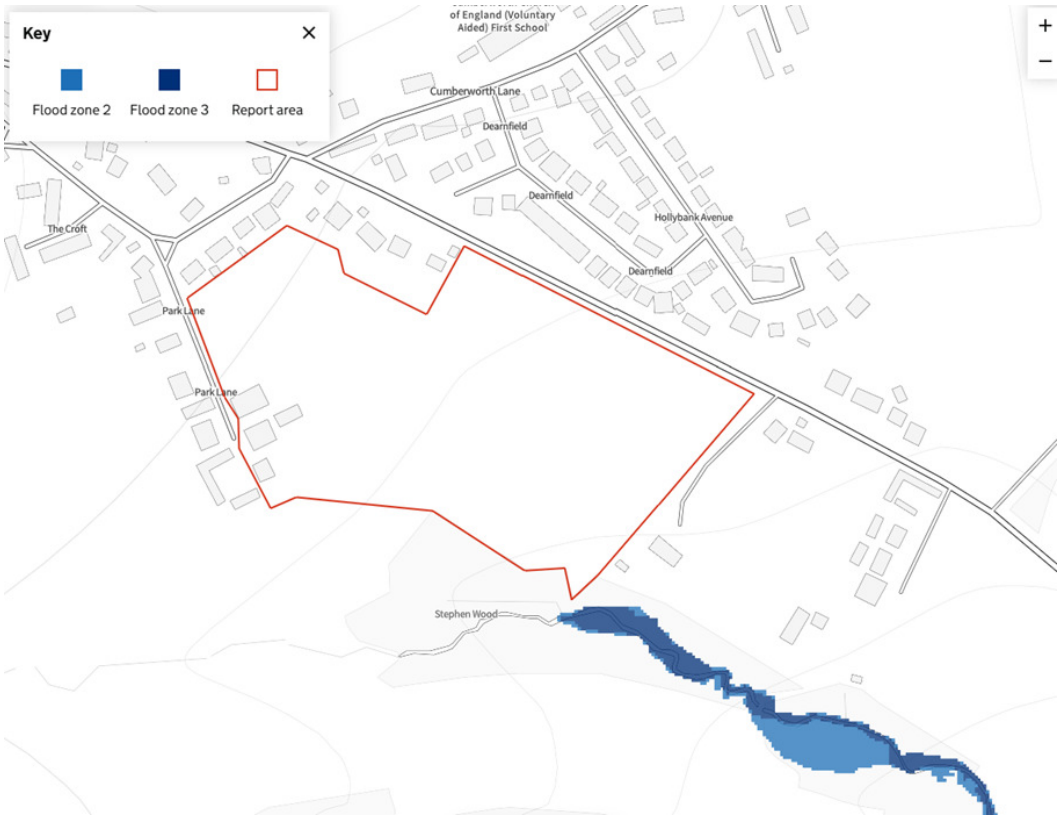


Fig 2 Flood Risk Map – Environment Agency Plan

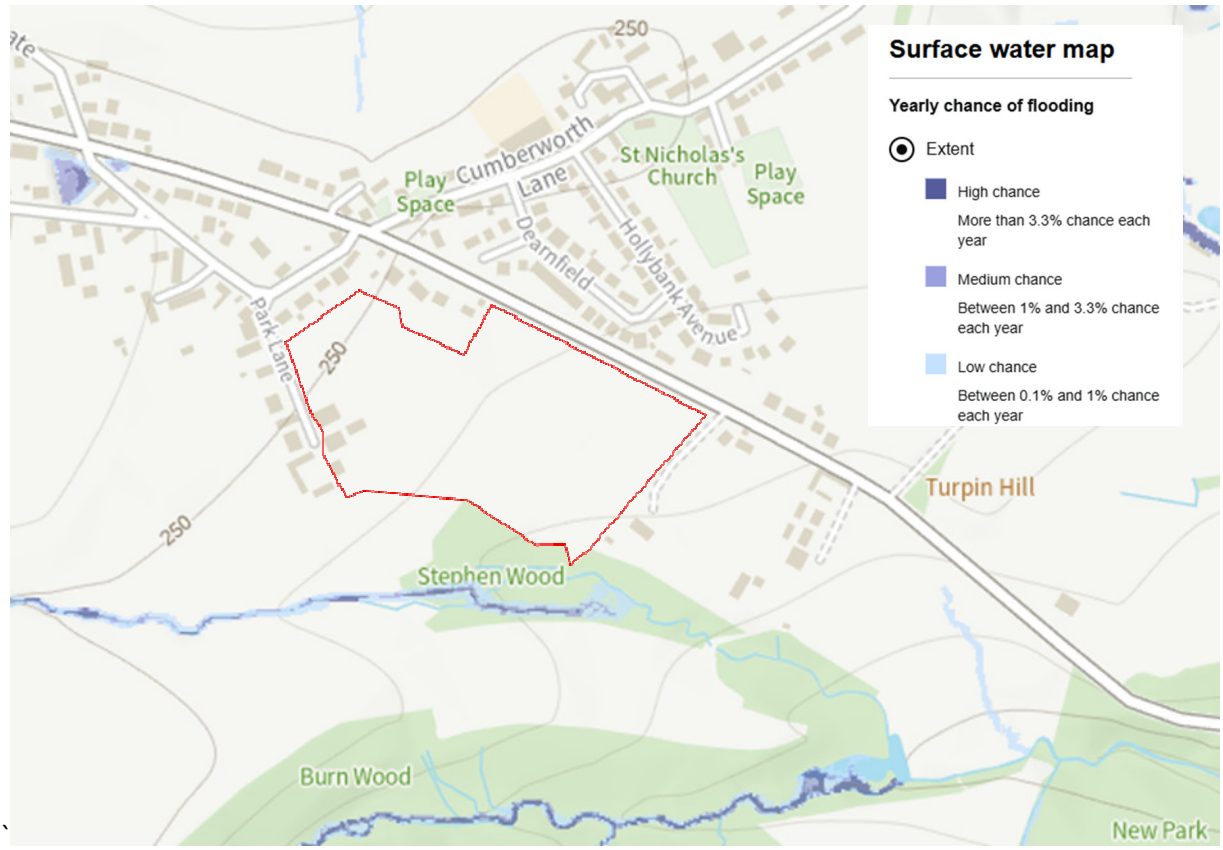


Fig 3 Surface Water Flood Risk Map – Environment Agency Plan

4.5 There are a number of potential flooding mechanisms that the Planning Practise Guidance- Flood Risk and Coastal Change April 2022 now requires to be evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. NPPG also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.

4.6 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test, and where necessary, the Exception test as outlined in Planning Practise Guidance- Flood Risk and Coastal Change April 2022, must also be applied to each development site. These aspects are not covered in this report but the proposed site being in Flood Zone 1, would mean these requirements are already met and do not apply.

4.7 The Planning Practise Guidance- Flood Risk and Coastal Change April 2022 requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are three main risks of flooding to the site. The alternative mechanisms are not applicable to this site.

- Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.
- The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

5.0 DISCUSSION OF FLOOD RISKS

5.1 Flood Risk from Watercourses, River & Tidal

5.1.1 The proposed development area does not fall within the 0.1% or the 1% probability Flood Risk Maps (Zone 2 and 3) as published by the Environment Agency. The site is therefore considered not to be at risk from fluvial flooding for the once in 100 year flood event. We therefore consider the risk of flooding of the site from River and Sea is acceptable for this type of development on this site.

5.2 Risk of Flooding from overland flows from adjacent land.

5.2.1 The site lies on an area land sloping from west to south east. Barnsley Road on the northern boundary falls from west to east. The land to the west generally falls to the north and the south east The land to the south falls towards Park Dike to the south, which flows to the east.

5.2.2 The flood maps only indicate small areas of flooding to the south of the site, adjacent Park Dike. This is at a lower level than the site. There is therefore considered to be little risk of flooding from overland flows from adjacent land.

5.3 Risk of Flooding from Rainwater Falling on Site

5.3.1 The existing risk of flooding from water falling on site is shown to be low with no areas of localised flooding indicated on the EA plans. The impermeable area of the site will increase significantly due to the development, and this would increase the run off from the site. This would increase the flood risk to down stream properties unless attenuation measures and restriction of flows took place.

5.3.2 The normal hierarchy for surface water discharge in accordance with current planning and SUDS policies is as follows:

1. The use of infiltration systems such as Soakaways.
2. Discharge to nearby rivers or watercourses with the use of attenuation.
3. Discharge to existing public sewer network with the use of attenuation.

5.3.3 Due to the steep nature of the existing site, and the risk of surface water re-emergence, it is considered that in this instance individual soakaways would not be a suitable form of surface water disposal in the long term, however there is the potential for using an infiltration basin in the lower section of the site. Site investigation works would be required to confirm the suitability of infiltration methods.

5.3.4 There are no significant existing buildings or paved areas on site, therefore the discharge rate from the site should be reduced to greenfield run-off rates. The 1 in 1 year run-off rate for the developed site area of 4.3ha is calculated as 25.4 l/s using IH124, with the calculations included in Appendix E. However, it is understood that KMBC work to a greenfield run-off rate of 5 l/s/ha of developed site area which equates to 21.5 l/s. Therefore, this lower rate has been considered as the design option for the treatment of the discharge of surface water and storage volumes calculated based upon this discharge rate.

5.3.5 Therefore, should infiltration methods prove unsuitable, the development should drain to the open watercourse Park Dike located to the south of the site via a gravity connection at a maximum discharge rate of 21.5 l/s with storage provided for the 1 in 100 year + 45% climate change allowance in accordance with KMBC policies.

5.3.6 With attenuation of flows there would have to be a storm-water storage facility. The use of above storage systems such as swales, detention basins or ponds, would provide the most sustainable urban drainage system. However due to the steep nature of the site, a detention basin would need significant land uptake to achieve the required banking to the base of the basin for a relatively small development, and potentially large commuted sums. With the recent implementation of the Codes for Adoption, there is greater scope for a regulatory body to adopt and maintain the above ground storage facilities than previously. However there is detailed criteria to be met to able this to take place. For the onsite sewerage system to be

adopted there would still be a need for underground tanks to provide sufficient attenuation storage for the site so that pipework does not surcharge for the 1 in 2 year event. Based on this criteria, the estimated volumes of storage required are shown in the attached calculation sheets. For this run off the storage volumes require 600 cu.m for the 30 year storm, and 1350 cu.m for the 100 year storm when 45% extra for climatic change is allowed.

5.3.7 The use of below ground storage facilities on their own, may not provide a suitable level of treatment of the run off from the site and biological systems, at source, may be needed to ensure contaminants are dealt with prior to discharge of site. The use of open swales and ponds would allow the use of reed beds and other organic systems to be employed. However due to the steep nature of the of the existing site, and allowable highway gradients raising site levels, the use of open water features are not currently considered feasible for the main development due to the large land uptake that would be required and further investigation would be required. However, an outfall swale from the flow control manhole through the existing woodland to Park Dike should be considered as this provide additional treatment to the surface water run-off as well as being less intrusive within the woodland.

5.3.8 Primary treatment for the roads would therefore be the use of trapped gullies for all hard standings. The use of filter drains adjacent to private drives or permeable paving on private drives would also provide a first stage treatment of run off from drives and allow a discharge into the top soils on site. Rainwater butts may also be provided to enable some recycling of run off from the roofs and paved areas. The use of green roofs is not considered appropriate in this development. Please note that Yorkshire Water, or similar approved body, will require an easement and access for future maintenance as part of the Section 104 Agreement.

5.3.9 The size of the storm water storage facilities would need to be determined accurately in the final detailed designs. These should be all in accordance with the current PPG. The volumes of storage can include flooding to roads and designated areas such as carpark areas or public open space for the 100 year storm with 45% allowance for climate change, but must ensure that no buildings are flooded.

5.3.10 The position and levels of the attenuation has been considered to ensure that any failure or blockage of the outfall will not affect any of the new or existing properties. The final discharge

rate will be reduced to a maximum of 21.5 l/s. Finally, the position of the attenuation tank has been determined to allow accessibility for future maintenance.

5.3.11 During the construction of the site, it is recommended that temporary works are established to prevent surface water run-off and possible pollution from the works affecting the existing woodland and watercourse located at a lower level to the south of the site and provide a controlled temporary discharge from the site.

5.4 **Impact on existing drainage systems.**

5.4.1 Attenuation has been provided for a significantly increased return period of 1 in 100 years plus 45% climate change with the discharge rate reduced to below the run-off rate for the 1 in 1 year storm events, in real terms this would lead to a reduced flood risk offsite due to the restricted flows off-site for these storm events. This will ensure that there should be no increase in the flood risk to properties off site or in the drainage networks downstream of the site.

6.0 FUTURE MAINTENANCE

6.1 It is proposed for the surface water system serving the development to be adopted by Yorkshire Water or similar approved body under a Section 104 Agreement, this will include the attenuation tanks, flow controls, pumping stations and outfall sewer. In particular, there will be a telemetry system installed within the dual pumping station to monitor it is operating correctly.

6.2 The maintenance of the attenuation tank should be in line with the SUDS manual (CIRIA C753, 2015) as detailed in table 21.3 below.

Operation and Maintenance Requirements for Attenuation Storage Tanks		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

6.3 The developer will be responsible to maintain the drainage systems on site until final adoption by the relevant authority ensuring that they are working effectively in the intervening period between construction and adoption.

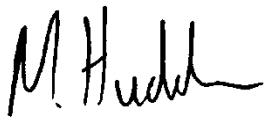
7.0 CONCLUSIONS

7.1 The area of the site to be developed for residential use currently falls within Flood Zone 1 as defined by the EA Flood maps. The area of the site to be developed is not at risk of flooding from river or tidal water up to a 1% return period. The flood risk is considered to be acceptable for residential development.

7.2 It is considered that the steep nature of the site means that infiltration methods would be an unsuitable form of surface water disposal. The use of attenuation systems to reduce the run-off from the site to will be required to ensure there is no increase in flood risk to the downstream catchment.

7.3 The risk of overland flows entering the site is considered to be low due to the topography of the area around the site. The floor levels of the proposed houses should be a minimum of 300mm above the adjacent road levels or existing ground level, with flood routing provided through the site to the south.

7.4 If the recommendations within this report are adopted for providing attenuation up to and including the 1 in 100 year + 45% climate change storm events and the flow from site restricted to a maximum of 21.5 l/s, there will be a reduction in the flood risk both to the proposed properties on site, as well as the existing properties downstream of the site.



MARTIN HUDDLESTON. MEng

APPENDIX A

LOCATION PLAN

Haigh Huddleston & Associates
Civil Structural Engineering Consultants
t 01924 574074
e martin@haighhuddleston.co.uk

Unit 4
Midgley Business Park
Bar Lane
Midgely
WF4 4JJ

Client :	Vivly Living
Job Title:	Barnsley Road, Upper Cumberworth
Job Number :	E25/8281

LOCATION PLAN

OS Grid Reference : SE209085
Easting : 420969
Northing : 408572

Topographical Survey carried out using GPS.

N

APPENDIX B

EA FLOOD MAP

Flood map for planning

Your reference	Location (easting/northing)	Created
8281 BARNSLEY ROAD	**420969/408551**	**24 November 2025 16:31**

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

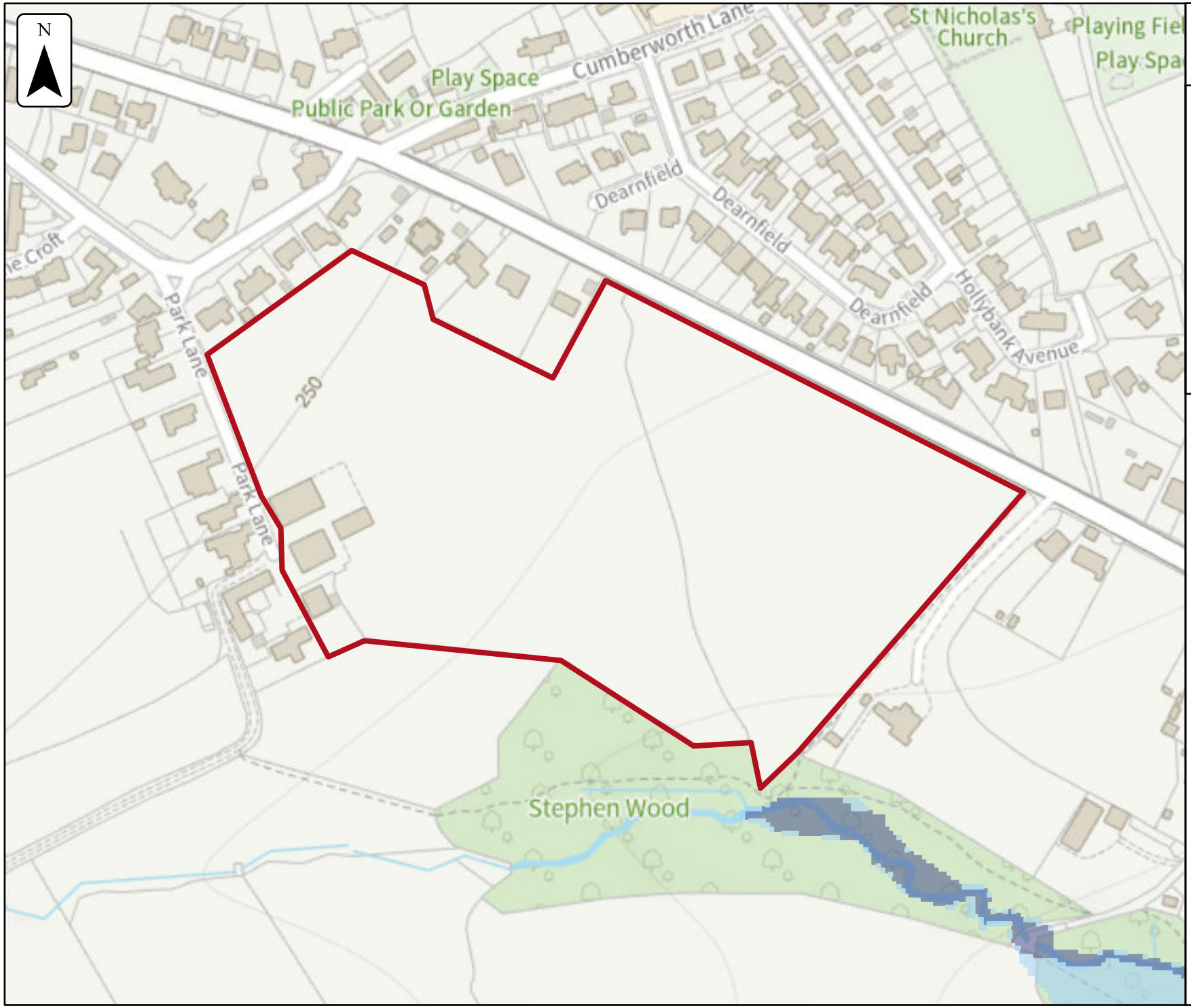
You will need to do a flood risk assessment if your site is **any of the following**:

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

Notes

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

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



Environment Agency

Flood map for planning

Your reference
8281 BARNSLEY ROAD

Location (easting/northing)
420969/408551

Scale
1:2,500

Created
24 Nov 2025 16:31

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

0 20 40 60 m

APPENDIX C

YORKSHIRE WATER
PRE-PLANNING ENQUIRY

YorkshireWater

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Haigh Huddleston & Associates
99-103 Leeds Road
Dewsbury
West Yorkshire
WF12 7BU

Your Ref:
Our Ref: A007042

For telephone enquiries ring:
George Mullaney on 0345 120 8482

13th March 2025

Dear Ms Huddleston,

Upper Cumberworth, Barnsley Road, Huddersfield HD8 8NN - Pre-Planning Sewerage Enquiry V798210

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Existing Infrastructure

There is a 150mm diameter public combined sewer recorded on the site. In this instance, building-over may take place under the control of Part H4 Building Regulations 2010. No trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

YorkshireWater

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

At present the sewer network does not have sufficient available capacity to support the size of development proposed. It is understood that the site is not allocated within the adopted Kirklees Local Plan and as such the site has not been considered within the current Yorkshire Water Asset Management Plan (AMP) period. Should the site come forward as part of a planning application Yorkshire Water (YWS) would likely not support the proposal.

Should the site benefit from the grant of permission, the closest practicable point of discharge for foul effluent would be the 225mm diameter combined public sewer in Barnsley Road to the north of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network.

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board* with a view to establishing a suitable watercourse (if any nearby) for discharge.

It is understood that a watercourse is located to the south of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire

YorkshireWater

Water. You may apply online or obtain an application form from our website (www.yorkshirewater.com/developers/sewerage/sewerage-connections/) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for Code for Adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the Code for Adoption, pursuant to an agreement under Section 104 of the Water Industry Act 1991. We are happy to offer pre-development technical advice on any prospective sites that you would like to put forward for adoption, prior to submission of your adoption application.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Sewer Adoption, Diversion and Requisition (telephone 0345 120 84 82) or email technical.sewerage@yorkshirewater.co.uk or visit - https://www.yorkshirewater.com/developers/sewerage/sewer-adoptions/ for further information.

All the above comments are based upon the information and records available at the present time and are valid for a period of 12 months. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

George Mullaney
Town Planning Technician

420902 : 408483

Map Name : SE2008SE

Title

Notes

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

Partial Key

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

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

Date Req : 13/03/2025, 15:53:07

Date Gen : 13/03/2025, 15:54:57

Source : Sewer Network Enquiry

UPN: Undefined

Originator: G Mullaney, ,

APPENDIX D

ENGINEERING FEASIBILITY PLAN

Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley. WF4 4JJ

t 01924 574074 e info@haighhuddleston.co.uk

Client
VIVLY LIVING

Project
UPPER CUMBERWORTH

Detail
PRELIMINARY FEASIBILITY

PRELIMINARY

Dwn	Chk'd	Date	Scale	Dwg No.
HN	--	DEC 25	1/500 @A1	E25/8281/001

Rev	Description	Date	Initials
-	-	-	-

APPENDIX E

GREENFIELD RUN-OFF ESTIMATION

PRELIMINARY DRAINAGE CALCULATIONS

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

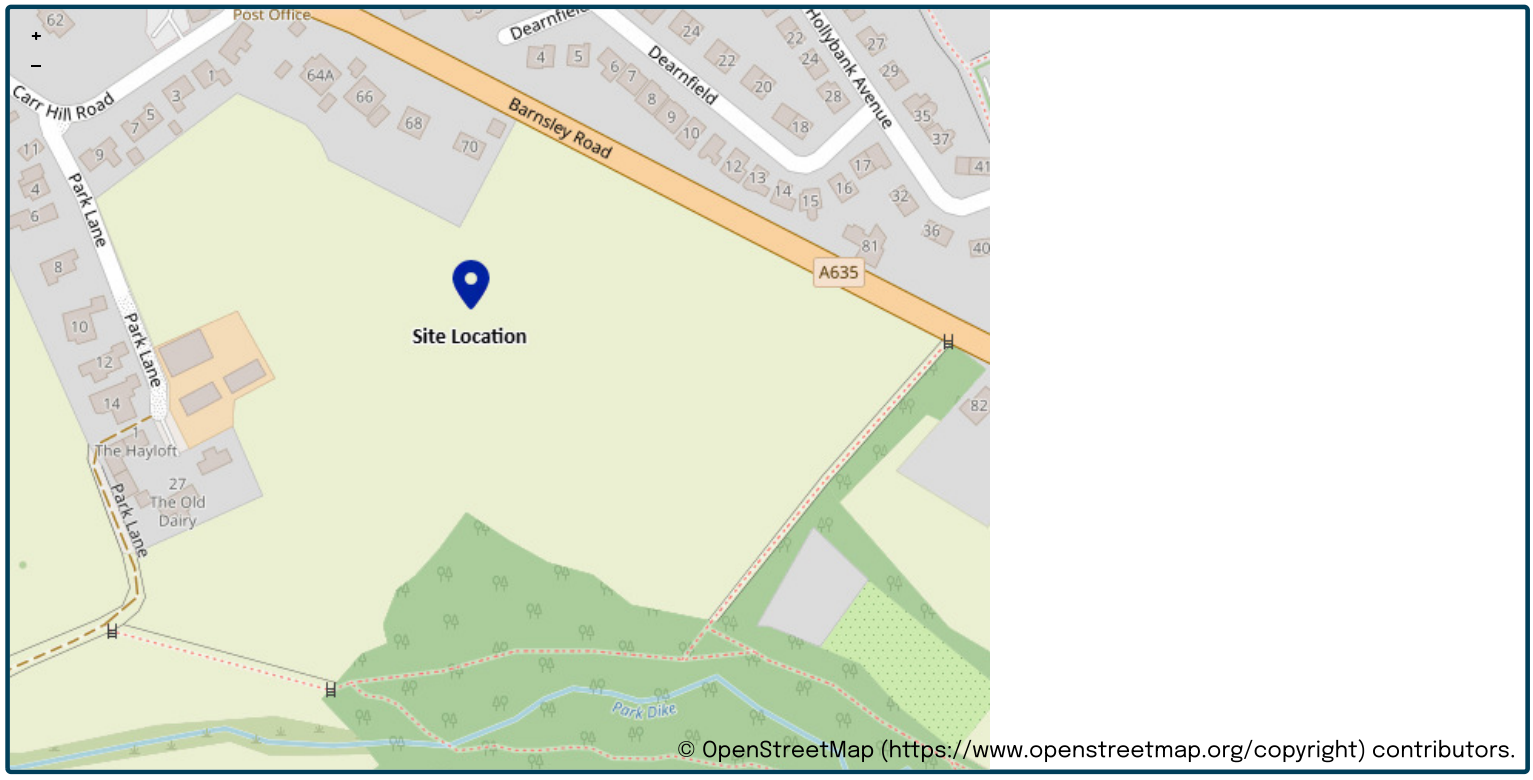
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	24/11/2025
Calculated by	M DEAN
Reference	8281
Model version	2.2.2

Location

Site name	CUMBERWORTH
Site location	BARNSLEY ROAD, UPPER CUMBERWORTH



Site easting (British National Grid)	420955
Site northing (British National Grid)	408564

Site details

Total site area (ha)	4.3 ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	946 mm		946
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		4
SPR	0.47		
QBar (IH124) (l/s)	29.5 l/s		

Growth curve factors

	My value		Map value
Hydrological region	3		3
1 year growth factor	0.86		
2 year growth factor	0.94		
10 year growth factor	1.45		
30 year growth factor	1.75		
100 year growth factor	2.08		
200 year growth factor	2.37		

Results

Method	IH124
Flow rate 1 year (l/s)	25.4 l/s
Flow rate 2 year (l/s)	27.8 l/s
Flow rate 10 years (l/s)	42.8 l/s
Flow rate 30 years (l/s)	51.7 l/s
Flow rate 100 years (l/s)	61.4 l/s
Flow rate 200 years (l/s)	70.0 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
1	0.011	5.00	249.740	1200	420841.569	408647.343	1.650	248.090
2	0.130	5.00	249.780	1500	420839.618	408640.002	1.766	248.014
3	0.018	5.00	248.531	1200	420860.409	408625.511	1.784	246.747
17	0.124	5.00	247.395	1200	420862.396	408585.017	1.426	245.969
4	0.123	5.00	246.500	1500	420881.199	408611.020	1.777	244.723
5	0.070	5.00	243.861	1500	420910.251	408600.326	1.718	242.143
6	0.105	5.00	240.982	1500	420941.986	408584.137	1.883	239.099
7	0.092	5.00	240.253	1500	420956.662	408571.209	2.011	238.242
8	0.154	5.00	239.680	1500	420983.296	408596.829	1.900	237.780
9	0.101	5.00	238.143	1500	421018.522	408570.439	1.738	236.405
10	0.108	5.00	236.347	1200	420997.445	408526.787	2.220	234.127
18	0.098	5.00	245.058	1200	420852.165	408535.459	2.058	243.000
19	0.028	5.00	242.251	1200	420881.684	408518.475	2.164	240.087
20	0.182	5.00	240.365	1200	420911.203	408501.492	1.619	238.746
23	0.104	5.00	240.928	1200	420938.569	408547.886	1.501	239.427
21	0.028	5.00	240.618	1200	420922.855	408520.165	2.085	238.533
22	0.024	5.00	238.880	1200	420949.462	408504.894	2.195	236.685
11	0.103	5.00	236.595	1200	420976.068	408489.622	2.691	233.904
12	0.082	5.00	232.503	1200	421017.494	408464.664	2.319	230.184
13			231.685	1500	421025.917	408467.994	1.863	229.822
24	0.138	5.00	237.861	1500	421085.858	408588.652	1.499	236.362
29	0.049	5.00	237.124	1200	421047.060	408558.126	1.461	235.663
25	0.078	5.00	236.405	1500	421065.865	408548.751	1.657	234.748
26			235.837	1500	421080.694	408540.953	1.787	234.050
27	0.227	5.00	235.580	1350	421081.805	408534.066	1.896	233.684
28	0.176	5.00	233.711	1500	421056.335	408504.377	2.635	231.076
14	0.000		231.534	1500	421035.046	408479.123	5.085	226.449
15	0.000		230.219	2100	421046.540	408469.544	4.319	225.900
16			229.855	1500	421051.070	408465.079	4.019	225.836

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	7.596	0.600	248.090	248.014	0.076	100.0	225	5.10	66.2
1.001	2	3	25.343	0.600	248.014	246.747	1.267	20.0	225	5.24	65.4
1.002	3	4	25.342	0.600	246.747	244.798	1.949	13.0	225	5.36	64.8
2.000	17	4	32.089	0.600	245.969	244.798	1.171	27.4	225	5.21	65.6
1.003	4	5	30.958	0.600	244.723	242.143	2.580	12.0	300	5.47	64.2
1.004	5	6	35.626	0.600	242.143	239.174	2.969	12.0	300	5.60	63.5
1.005	6	7	19.558	0.600	239.099	238.317	0.782	25.0	375	5.69	63.1
1.006	7	8	36.956	0.600	238.242	237.780	0.462	80.0	450	5.96	61.8
1.007	8	9	44.015	0.600	237.780	236.405	1.375	32.0	450	6.16	60.8
1.008	9	10	48.474	0.600	236.405	234.202	2.203	22.0	450	6.35	60.0
1.009	10	11	42.874	0.600	234.127	233.904	0.223	192.0	525	6.79	58.1
3.000	18	19	34.056	0.600	243.000	240.162	2.838	12.0	225	5.15	65.9
3.001	19	20	34.056	0.600	240.087	238.746	1.341	25.4	300	5.33	64.9
3.002	20	21	22.010	0.600	238.746	238.533	0.213	103.5	300	5.57	63.7
4.000	23	21	31.865	0.600	239.427	238.608	0.819	38.9	225	5.25	65.4
3.003	21	22	30.678	0.600	238.533	236.685	1.848	16.6	300	5.70	63.0
3.004	22	11	30.678	0.600	236.685	234.129	2.556	12.0	300	5.81	62.5
1.010	11	12	48.363	0.600	233.904	230.184	3.720	13.0	525	6.92	57.6
1.011	12	13	9.057	0.600	230.184	229.822	0.362	25.0	525	6.96	57.5
1.012	13	14	14.394	0.600	229.822	229.502	0.320	45.0	525	7.03	57.2
5.000	24	25	44.630	0.600	236.362	234.823	1.539	29.0	225	5.31	65.1
6.000	29	25	21.012	0.600	235.663	234.823	0.840	25.0	225	5.13	66.0
5.001	25	26	16.754	0.600	234.748	234.050	0.698	24.0	300	5.39	64.6
5.002	26	27	6.976	0.600	234.050	233.759	0.291	24.0	300	5.43	64.4

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	1.307	52.0	2.0	1.425	1.541	0.011	0.0	29	0.626
1.001	2.939	116.8	25.0	1.541	1.559	0.141	0.0	71	2.358
1.002	3.648	145.1	27.9	1.559	1.477	0.159	0.0	66	2.829
2.000	2.509	99.8	22.0	1.201	1.477	0.124	0.0	72	2.026
1.003	4.562	322.5	70.7	1.477	1.418	0.406	0.0	95	3.686
1.004	4.562	322.5	82.0	1.418	1.508	0.476	0.0	103	3.834
1.005	3.636	401.6	99.4	1.508	1.561	0.581	0.0	126	3.032
1.006	2.274	361.7	112.7	1.561	1.450	0.673	0.0	172	2.018
1.007	3.603	573.1	136.4	1.450	1.288	0.827	0.0	149	2.981
1.008	4.349	691.6	151.0	1.288	1.695	0.928	0.0	142	3.511
1.009	1.613	349.1	163.2	1.695	2.166	1.036	0.0	253	1.587
3.000	3.798	151.0	17.5	1.833	1.864	0.098	0.0	51	2.557
3.001	3.132	221.4	22.2	1.864	1.319	0.126	0.0	64	2.026
3.002	1.545	109.2	53.2	1.319	1.785	0.308	0.0	148	1.536
4.000	2.104	83.6	18.4	1.276	1.785	0.104	0.0	72	1.698
3.003	3.877	274.0	75.2	1.785	1.895	0.440	0.0	107	3.323
3.004	4.562	322.5	78.6	1.895	2.166	0.464	0.0	100	3.790
1.010	6.235	1349.7	250.3	2.166	1.794	1.603	0.0	152	4.820
1.011	4.492	972.5	262.5	1.794	1.338	1.685	0.0	185	3.841
1.012	3.345	724.1	261.2	1.338	1.507	1.685	0.0	218	3.086
5.000	2.438	96.9	24.3	1.274	1.357	0.138	0.0	77	2.042
6.000	2.627	104.5	8.8	1.236	1.357	0.049	0.0	44	1.604
5.001	3.222	227.8	46.4	1.357	1.487	0.265	0.0	91	2.543
5.002	3.222	227.8	46.3	1.487	1.521	0.265	0.0	91	2.543

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)
5.003	27	28	39.117	0.600	233.684	231.076	2.608	15.0	375	5.57	63.7
5.004	28	14	33.030	0.600	231.076	229.652	1.424	23.2	375	5.71	63.0
1.013	14	15	14.962	0.600	226.449	225.950	0.499	30.0	525	7.09	57.0
1.014	15	16	6.361	0.600	225.900	225.836	0.064	100.0	525	7.14	56.8

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)
5.003	4.698	518.9	85.0	1.521	2.260	0.492	0.0	102	3.507
5.004	3.775	416.9	114.0	2.260	1.507	0.668	0.0	134	3.238
1.013	4.100	887.5	363.2	4.560	3.744	2.353	0.0	234	3.904
1.014	2.240	484.8	362.0	3.794	3.494	2.353	0.0	340	2.445

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	7.596	100.0	225	Circular_Default Sewer Type	249.740	248.090	1.425	249.780	248.014	1.541
1.001	25.343	20.0	225	Circular_Default Sewer Type	249.780	248.014	1.541	248.531	246.747	1.559
1.002	25.342	13.0	225	Circular_Default Sewer Type	248.531	246.747	1.559	246.500	244.798	1.477
2.000	32.089	27.4	225	Circular_Default Sewer Type	247.395	245.969	1.201	246.500	244.798	1.477
1.003	30.958	12.0	300	Circular_Default Sewer Type	246.500	244.723	1.477	243.861	242.143	1.418
1.004	35.626	12.0	300	Circular_Default Sewer Type	243.861	242.143	1.418	240.982	239.174	1.508
1.005	19.558	25.0	375	Circular_Default Sewer Type	240.982	239.099	1.508	240.253	238.317	1.561
1.006	36.956	80.0	450	Circular_Default Sewer Type	240.253	238.242	1.561	239.680	237.780	1.450
1.007	44.015	32.0	450	Circular_Default Sewer Type	239.680	237.780	1.450	238.143	236.405	1.288
1.008	48.474	22.0	450	Circular_Default Sewer Type	238.143	236.405	1.288	236.347	234.202	1.695
1.009	42.874	192.0	525	Circular_Default Sewer Type	236.347	234.127	1.695	236.595	233.904	2.166
3.000	34.056	12.0	225	Circular_Default Sewer Type	245.058	243.000	1.833	242.251	240.162	1.864
3.001	34.056	25.4	300	Circular_Default Sewer Type	242.251	240.087	1.864	240.365	238.746	1.319
3.002	22.010	103.5	300	Circular_Default Sewer Type	240.365	238.746	1.319	240.618	238.533	1.785
4.000	31.865	38.9	225	Circular_Default Sewer Type	240.928	239.427	1.276	240.618	238.608	1.785
3.003	30.678	16.6	300	Circular_Default Sewer Type	240.618	238.533	1.785	238.880	236.685	1.895

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1500	Manhole	Adoptable
1.001	2	1500	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1500	Manhole	Adoptable
2.000	17	1200	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.003	4	1500	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.004	5	1500	Manhole	Adoptable	6	1500	Manhole	Adoptable
1.005	6	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.006	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable
1.007	8	1500	Manhole	Adoptable	9	1500	Manhole	Adoptable
1.008	9	1500	Manhole	Adoptable	10	1200	Manhole	Adoptable
1.009	10	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
3.000	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
3.001	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
3.002	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
4.000	23	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
3.003	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable

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)
3.004	30.678	12.0	300	Circular_Default Sewer Type	238.880	236.685	1.895	236.595	234.129	2.166
1.010	48.363	13.0	525	Circular_Default Sewer Type	236.595	233.904	2.166	232.503	230.184	1.794
1.011	9.057	25.0	525	Circular_Default Sewer Type	232.503	230.184	1.794	231.685	229.822	1.338
1.012	14.394	45.0	525	Circular_Default Sewer Type	231.685	229.822	1.338	231.534	229.502	1.507
5.000	44.630	29.0	225	Circular_Default Sewer Type	237.861	236.362	1.274	236.405	234.823	1.357
6.000	21.012	25.0	225	Circular_Default Sewer Type	237.124	235.663	1.236	236.405	234.823	1.357
5.001	16.754	24.0	300	Circular_Default Sewer Type	236.405	234.748	1.357	235.837	234.050	1.487
5.002	6.976	24.0	300	Circular_Default Sewer Type	235.837	234.050	1.487	235.580	233.759	1.521
5.003	39.117	15.0	375	Circular_Default Sewer Type	235.580	233.684	1.521	233.711	231.076	2.260
5.004	33.030	23.2	375	Circular_Default Sewer Type	233.711	231.076	2.260	231.534	229.652	1.507
1.013	14.962	30.0	525	Circular_Default Sewer Type	231.534	226.449	4.560	230.219	225.950	3.744
1.014	6.361	100.0	525	Circular_Default Sewer Type	230.219	225.900	3.794	229.855	225.836	3.494

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.004	22	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
1.010	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
1.011	12	1200	Manhole	Adoptable	13	1500	Manhole	Adoptable
1.012	13	1500	Manhole	Adoptable	14	1500	Manhole	Adoptable
5.000	24	1500	Manhole	Adoptable	25	1500	Manhole	Adoptable
6.000	29	1200	Manhole	Adoptable	25	1500	Manhole	Adoptable
5.001	25	1500	Manhole	Adoptable	26	1500	Manhole	Adoptable
5.002	26	1500	Manhole	Adoptable	27	1350	Manhole	Adoptable
5.003	27	1350	Manhole	Adoptable	28	1500	Manhole	Adoptable
5.004	28	1500	Manhole	Adoptable	14	1500	Manhole	Adoptable
1.013	14	1500	Manhole	Adoptable	15	2100	Manhole	Adoptable
1.014	15	2100	Manhole	Adoptable	16	1500	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
Rainfall Events	Singular	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	0.0
M5-60 (mm)	19.000	Starting Level (m)	
Ratio-R	0.400	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Normal		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m^3)	

Node 15 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	225.900	Product Number	CTL-SHE-0184-2150-2400-2150
Design Depth (m)	2.400	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	21.5	Min Node Diameter (mm)	2100

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	248.119	0.029	1.9	0.0330	0.0000	OK
15 minute winter	2	10	248.086	0.072	24.3	0.1271	0.0000	OK
15 minute winter	3	10	246.815	0.068	27.2	0.0765	0.0000	OK
15 minute winter	17	10	246.041	0.072	21.4	0.0814	0.0000	OK
15 minute winter	4	10	244.818	0.095	69.3	0.1682	0.0000	OK
15 minute winter	5	10	242.248	0.105	81.0	0.1862	0.0000	OK
15 minute winter	6	10	239.235	0.136	98.2	0.2406	0.0000	OK
15 minute winter	7	10	238.425	0.183	113.4	0.3236	0.0000	OK
15 minute winter	8	11	237.938	0.158	138.9	0.2790	0.0000	OK
15 minute winter	9	11	236.549	0.144	156.4	0.2537	0.0000	OK
15 minute winter	10	11	234.401	0.274	174.6	0.3097	0.0000	OK
15 minute winter	18	10	243.051	0.051	16.9	0.0580	0.0000	OK
15 minute winter	19	10	240.150	0.062	21.5	0.0707	0.0000	OK
15 minute winter	20	10	238.903	0.157	52.8	0.1779	0.0000	OK
15 minute winter	23	10	239.499	0.072	18.0	0.0814	0.0000	OK
15 minute winter	21	10	238.644	0.111	74.3	0.1258	0.0000	OK
15 minute winter	22	11	236.790	0.104	77.9	0.1182	0.0000	OK
15 minute winter	11	11	234.061	0.157	270.8	0.1772	0.0000	OK
15 minute winter	12	11	230.429	0.245	284.4	0.2770	0.0000	OK
15 minute winter	13	11	230.094	0.272	284.4	0.4806	0.0000	OK
15 minute winter	24	10	236.439	0.077	23.9	0.1355	0.0000	OK
15 minute winter	29	10	235.707	0.044	8.5	0.0498	0.0000	OK
15 minute winter	25	10	234.842	0.094	45.2	0.1660	0.0000	OK
15 minute winter	26	10	234.154	0.104	45.0	0.1830	0.0000	OK
15 minute winter	27	10	233.785	0.101	83.8	0.1438	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.9	0.283	0.036	0.0529	
15 minute winter	2	1.001	3	24.1	2.306	0.207	0.2655	
15 minute winter	3	1.002	4	26.9	2.749	0.186	0.2483	
15 minute winter	17	2.000	4	21.1	1.968	0.211	0.3437	
15 minute winter	4	1.003	5	69.0	3.346	0.214	0.6385	
15 minute winter	5	1.004	6	80.1	3.737	0.248	0.7642	
15 minute winter	6	1.005	7	97.5	2.880	0.243	0.6647	
15 minute winter	7	1.006	8	113.6	2.069	0.314	2.0299	
15 minute winter	8	1.007	9	140.0	3.009	0.244	2.0486	
15 minute winter	9	1.008	10	157.0	2.838	0.227	2.6913	
15 minute winter	10	1.009	11	175.6	2.109	0.503	3.5981	
15 minute winter	18	3.000	19	16.7	2.489	0.110	0.2282	
15 minute winter	19	3.001	20	21.3	0.912	0.096	0.8174	
15 minute winter	20	3.002	21	51.9	1.707	0.475	0.6730	
15 minute winter	23	4.000	21	17.7	1.650	0.211	0.3410	
15 minute winter	21	3.003	22	73.8	3.254	0.269	0.6964	
15 minute winter	22	3.004	11	78.4	3.703	0.243	0.6493	
15 minute winter	11	1.010	12	271.1	3.573	0.201	3.6923	
15 minute winter	12	1.011	13	284.4	2.689	0.292	0.9582	
15 minute winter	13	1.012	14	284.0	2.835	0.392	1.4430	
15 minute winter	24	5.000	25	23.4	1.993	0.241	0.5237	
15 minute winter	29	6.000	25	8.4	1.562	0.080	0.1127	
15 minute winter	25	5.001	26	45.0	2.231	0.198	0.3383	
15 minute winter	26	5.002	27	44.6	2.287	0.196	0.1364	
15 minute winter	27	5.003	28	83.3	2.749	0.161	1.1917	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	28	10	231.215	0.139	113.7	0.2461	0.0000	OK
15 minute winter	14	11	226.749	0.300	395.9	0.5294	0.0000	OK
180 minute winter	15	148	226.408	0.508	95.7	275.5005	0.0000	OK
180 minute winter	16	148	225.933	0.097	20.4	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)
15 minute winter	28	5.004	14	111.9	3.143	0.268	1.1801	
15 minute winter	14	1.013	15	395.8	3.539	0.446	1.6729	
180 minute winter	15	1.014	16	20.4	1.149	0.392	0.1128	362.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	248.130	0.040	3.6	0.0450	0.0000	OK
15 minute winter	2	10	248.117	0.103	46.1	0.1816	0.0000	OK
15 minute winter	3	10	246.844	0.097	51.7	0.1092	0.0000	OK
15 minute winter	17	10	246.072	0.103	40.5	0.1165	0.0000	OK
15 minute winter	4	10	244.859	0.136	131.4	0.2409	0.0000	OK
15 minute winter	5	10	242.296	0.153	153.8	0.2707	0.0000	OK
15 minute winter	6	10	239.298	0.199	186.5	0.3518	0.0000	OK
15 minute winter	7	10	238.513	0.271	215.9	0.4791	0.0000	OK
15 minute winter	8	11	238.010	0.230	264.3	0.4055	0.0000	OK
15 minute winter	9	11	236.608	0.203	296.3	0.3583	0.0000	OK
15 minute winter	10	11	234.535	0.408	331.0	0.4611	0.0000	OK
15 minute winter	18	10	243.072	0.072	32.1	0.0811	0.0000	OK
15 minute winter	19	10	240.174	0.086	40.9	0.0978	0.0000	OK
15 minute winter	20	10	238.989	0.243	100.2	0.2748	0.0000	OK
15 minute winter	23	10	239.530	0.103	34.1	0.1164	0.0000	OK
15 minute winter	21	10	238.696	0.163	141.2	0.1840	0.0000	OK
15 minute winter	22	11	236.837	0.152	148.2	0.1714	0.0000	OK
15 minute winter	11	11	234.124	0.220	513.4	0.2490	0.0000	OK
15 minute winter	12	11	230.592	0.408	539.8	0.4610	0.0000	OK
15 minute winter	13	11	230.256	0.434	540.9	0.7669	0.0000	OK
15 minute winter	24	10	236.472	0.110	45.1	0.1945	0.0000	OK
15 minute winter	29	10	235.724	0.061	16.1	0.0692	0.0000	OK
15 minute winter	25	10	234.884	0.136	85.9	0.2397	0.0000	OK
15 minute winter	26	10	234.205	0.154	85.4	0.2730	0.0000	OK
15 minute winter	27	10	233.824	0.140	159.0	0.2008	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	3.6	0.331	0.069	0.0849	
15 minute winter	2	1.001	3	45.8	2.700	0.392	0.4298	
15 minute winter	3	1.002	4	51.1	3.251	0.353	0.3988	
15 minute winter	17	2.000	4	40.0	2.327	0.401	0.5523	
15 minute winter	4	1.003	5	130.9	3.892	0.406	1.0416	
15 minute winter	5	1.004	6	152.2	4.383	0.472	1.2376	
15 minute winter	6	1.005	7	185.9	3.171	0.463	1.1513	
15 minute winter	7	1.006	8	214.8	2.386	0.594	3.3451	
15 minute winter	8	1.007	9	265.1	3.523	0.463	3.3127	
15 minute winter	9	1.008	10	297.6	3.029	0.430	4.7242	
15 minute winter	10	1.009	11	333.2	2.474	0.954	5.6973	
15 minute winter	18	3.000	19	31.7	2.976	0.210	0.3632	
15 minute winter	19	3.001	20	40.7	1.027	0.184	1.3266	
15 minute winter	20	3.002	21	98.4	1.956	0.901	1.1018	
15 minute winter	23	4.000	21	33.6	1.952	0.401	0.5480	
15 minute winter	21	3.003	22	140.3	3.764	0.512	1.1433	
15 minute winter	22	3.004	11	148.4	4.340	0.460	1.0488	
15 minute winter	11	1.010	12	514.5	3.850	0.381	6.4256	
15 minute winter	12	1.011	13	540.9	2.916	0.556	1.6793	
15 minute winter	13	1.012	14	541.0	3.216	0.747	2.4005	
15 minute winter	24	5.000	25	44.4	2.354	0.458	0.8416	
15 minute winter	29	6.000	25	16.0	1.849	0.153	0.1820	
15 minute winter	25	5.001	26	85.4	2.532	0.375	0.5653	
15 minute winter	26	5.002	27	84.7	2.631	0.372	0.2249	
15 minute winter	27	5.003	28	158.4	3.193	0.305	1.9435	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	28	10	231.281	0.205	216.0	0.3629	0.0000	OK
15 minute winter	14	11	227.061	0.612	752.8	1.0805	0.0000	SURCHARGED
240 minute winter	15	232	226.890	0.990	144.2	599.9607	0.0000	SURCHARGED
360 minute summer	16	224	225.936	0.100	21.5	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)
15 minute winter	28	5.004	14	213.0	3.662	0.511	1.9272	
15 minute winter	14	1.013	15	753.4	3.837	0.849	2.7994	
240 minute winter	15	1.014	16	21.5	1.164	0.413	0.1174	529.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	248.135	0.045	4.7	0.0512	0.0000	OK
15 minute winter	2	10	248.134	0.120	59.8	0.2127	0.0000	OK
15 minute winter	3	10	246.860	0.113	67.0	0.1275	0.0000	OK
15 minute winter	17	10	246.090	0.121	52.5	0.1364	0.0000	OK
15 minute winter	4	10	244.883	0.160	170.3	0.2822	0.0000	OK
15 minute winter	5	10	242.325	0.181	199.4	0.3207	0.0000	OK
15 minute winter	6	10	239.335	0.236	241.8	0.4177	0.0000	OK
15 minute winter	7	10	238.569	0.327	279.9	0.5773	0.0000	OK
15 minute winter	8	10	238.052	0.272	342.7	0.4807	0.0000	OK
15 minute winter	9	11	236.641	0.236	383.8	0.4165	0.0000	OK
15 minute winter	10	11	234.696	0.568	428.7	0.6429	0.0000	SURCHARGED
15 minute winter	18	10	243.083	0.083	41.5	0.0934	0.0000	OK
15 minute winter	19	10	240.186	0.099	53.1	0.1119	0.0000	OK
15 minute winter	20	11	239.148	0.402	129.9	0.4543	0.0000	SURCHARGED
15 minute winter	23	10	239.548	0.121	44.0	0.1366	0.0000	OK
15 minute winter	21	11	238.725	0.192	179.8	0.2171	0.0000	OK
15 minute winter	22	11	236.864	0.179	190.6	0.2027	0.0000	OK
15 minute winter	11	11	234.156	0.252	654.5	0.2850	0.0000	OK
15 minute winter	12	11	230.904	0.720	686.1	0.8139	0.0000	SURCHARGED
15 minute winter	13	11	230.471	0.649	680.8	1.1462	0.0000	SURCHARGED
15 minute winter	24	10	236.491	0.129	58.5	0.2286	0.0000	OK
15 minute winter	29	10	235.731	0.068	20.8	0.0765	0.0000	OK
15 minute winter	25	10	234.908	0.160	111.3	0.2825	0.0000	OK
15 minute winter	26	10	234.235	0.185	110.7	0.3261	0.0000	OK
15 minute winter	27	10	233.846	0.162	206.0	0.2314	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	4.6	0.351	0.089	0.1036	
15 minute winter	2	1.001	3	59.4	2.861	0.508	0.5259	
15 minute winter	3	1.002	4	66.3	3.462	0.457	0.4854	
15 minute winter	17	2.000	4	51.9	2.475	0.520	0.6730	
15 minute winter	4	1.003	5	169.7	4.104	0.526	1.2797	
15 minute winter	5	1.004	6	197.3	4.640	0.612	1.5157	
15 minute winter	6	1.005	7	241.0	3.201	0.600	1.4845	
15 minute winter	7	1.006	8	278.2	2.502	0.769	4.1292	
15 minute winter	8	1.007	9	343.3	3.728	0.599	4.0525	
15 minute winter	9	1.008	10	385.5	3.047	0.557	5.8769	
15 minute winter	10	1.009	11	421.6	2.511	1.208	6.8266	
15 minute winter	18	3.000	19	41.2	3.192	0.273	0.4394	
15 minute winter	19	3.001	20	52.8	1.027	0.238	1.5438	
15 minute winter	20	3.002	21	126.7	1.956	1.160	1.2989	
15 minute winter	23	4.000	21	43.7	2.067	0.522	0.6731	
15 minute winter	21	3.003	22	180.9	3.954	0.660	1.4038	
15 minute winter	22	3.004	11	191.6	4.587	0.594	1.2815	
15 minute winter	11	1.010	12	653.2	3.890	0.484	7.7006	
15 minute winter	12	1.011	13	680.8	3.152	0.700	1.9566	
15 minute winter	13	1.012	14	678.9	3.286	0.938	2.7925	
15 minute winter	24	5.000	25	57.5	2.501	0.594	1.0271	
15 minute winter	29	6.000	25	20.7	1.838	0.198	0.2490	
15 minute winter	25	5.001	26	110.7	2.646	0.486	0.7005	
15 minute winter	26	5.002	27	109.8	2.770	0.482	0.2766	
15 minute winter	27	5.003	28	205.2	3.357	0.396	2.3855	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	28	10	231.322	0.246	279.8	0.4341	0.0000	OK
15 minute winter	14	11	227.525	1.076	953.1	1.9011	0.0000	SURCHARGED
240 minute winter	15	240	227.259	1.359	187.7	848.8223	0.0000	SURCHARGED
30 minute summer	16	61	225.936	0.100	21.5	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)
15 minute winter	28	5.004	14	276.1	3.861	0.662	2.3686	
15 minute winter	14	1.013	15	953.2	4.413	1.074	3.2323	
240 minute winter	15	1.014	16	21.5	1.164	0.413	0.1175	523.4

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	248.167	0.077	6.8	0.0874	0.0000	OK
15 minute winter	2	10	248.169	0.155	86.3	0.2734	0.0000	OK
15 minute winter	3	10	246.891	0.144	96.9	0.1632	0.0000	OK
15 minute winter	17	10	246.125	0.156	76.2	0.1761	0.0000	OK
15 minute winter	4	10	244.932	0.209	247.3	0.3688	0.0000	OK
15 minute winter	5	11	242.377	0.234	289.2	0.4136	0.0000	OK
15 minute winter	6	11	239.753	0.654	348.1	1.1557	0.0000	SURCHARGED
15 minute winter	7	11	238.901	0.659	400.4	1.1641	0.0000	SURCHARGED
15 minute winter	8	11	238.134	0.354	491.1	0.6246	0.0000	OK
15 minute winter	9	11	236.770	0.365	551.2	0.6447	0.0000	OK
15 minute winter	10	11	235.217	1.090	609.9	1.2329	0.0000	SURCHARGED
15 minute winter	18	10	243.102	0.102	60.2	0.1153	0.0000	OK
15 minute winter	19	10	240.208	0.121	76.9	0.1365	0.0000	OK
15 minute winter	20	11	239.594	0.848	188.4	0.9591	0.0000	SURCHARGED
15 minute winter	23	10	239.576	0.149	63.9	0.1689	0.0000	OK
15 minute winter	21	11	238.847	0.314	262.4	0.3548	0.0000	SURCHARGED
15 minute winter	22	10	236.921	0.236	273.9	0.2674	0.0000	OK
15 minute winter	11	11	234.296	0.392	934.6	0.4430	0.0000	OK
15 minute winter	12	11	231.967	1.783	978.1	2.0170	0.0000	SURCHARGED
15 minute winter	13	11	231.094	1.272	967.1	2.2468	0.0000	SURCHARGED
15 minute winter	24	10	236.532	0.170	84.8	0.2998	0.0000	OK
15 minute winter	29	10	235.745	0.082	30.2	0.0930	0.0000	OK
15 minute winter	25	10	234.958	0.210	161.2	0.3712	0.0000	OK
15 minute winter	26	10	234.298	0.248	160.5	0.4382	0.0000	OK
15 minute winter	27	10	233.885	0.201	298.7	0.2871	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	6.5	0.380	0.124	0.1563	
15 minute winter	2	1.001	3	85.9	3.066	0.735	0.7096	
15 minute winter	3	1.002	4	96.4	3.747	0.665	0.6523	
15 minute winter	17	2.000	4	75.3	2.672	0.755	0.9037	
15 minute winter	4	1.003	5	246.1	4.455	0.763	1.7087	
15 minute winter	5	1.004	6	283.6	4.666	0.879	2.3051	
15 minute winter	6	1.005	7	347.1	3.293	0.864	2.1572	
15 minute winter	7	1.006	8	401.8	2.594	1.111	5.3962	
15 minute winter	8	1.007	9	492.6	3.777	0.860	5.9697	
15 minute winter	9	1.008	10	547.2	3.509	0.791	7.1768	
15 minute winter	10	1.009	11	604.1	2.898	1.730	8.3355	
15 minute winter	18	3.000	19	59.7	3.512	0.396	0.5793	
15 minute winter	19	3.001	20	76.5	1.348	0.346	1.6503	
15 minute winter	20	3.002	21	181.6	2.579	1.663	1.5499	
15 minute winter	23	4.000	21	63.7	2.092	0.761	1.0507	
15 minute winter	21	3.003	22	259.1	4.066	0.945	1.9843	
15 minute winter	22	3.004	11	270.8	4.870	0.840	1.7097	
15 minute winter	11	1.010	12	930.5	4.464	0.689	9.4026	
15 minute winter	12	1.011	13	967.1	4.477	0.994	1.9566	
15 minute winter	13	1.012	14	964.6	4.466	1.332	3.0781	
15 minute winter	24	5.000	25	83.3	2.682	0.859	1.3871	
15 minute winter	29	6.000	25	30.0	1.849	0.287	0.3991	
15 minute winter	25	5.001	26	160.5	2.780	0.704	0.9632	
15 minute winter	26	5.002	27	159.1	2.947	0.699	0.3738	
15 minute winter	27	5.003	28	297.7	3.493	0.574	3.3064	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	28	11	231.569	0.493	405.8	0.8705	0.0000	SURCHARGED
15 minute winter	14	12	228.685	2.236	1347.5	3.9509	0.0000	SURCHARGED
360 minute winter	15	352	228.392	2.491	199.2	1349.3000	0.0000	SURCHARGED
15 minute winter	16	155	225.936	0.100	21.5	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)
15 minute winter	28	5.004	14	392.5	3.963	0.941	3.2619	
15 minute winter	14	1.013	15	1343.7	6.221	1.514	3.2323	
360 minute winter	15	1.014	16	21.5	1.163	0.413	0.1174	621.3