Flood Risk Assessment & Drainage Strategy:

Low Copelaw Access Road

Client: Durham County Council

Project:

December 2022

Contents

Rev/Amdt	Date	Produced By	Description of Amendment
A	11/01/2023	D.Taylor	Issued for planning

1.0 Introduction

Durham County Council Drainage team (DC) were appointed to produce a drainage design and strategy for alterations to the signalised junction at central avenue and construction of a new access road into the low copelaw estate and facilities.

Scope

The purpose of the drainage strategy is to demonstrate that the proposed development will not increase flood risk to the local area, the strategy consists of a concept design which manages the surface water (SW) on the site to the requirements set out by NPPF.

Methodology

The report is made up of information collated from searches and consultation with the regulatory bodies. The drainage team have engaged with the Local Authority planning department (LA) from the early stages to ensure requirements are met prior to submitting the drainage strategy for planning approval. It must be noted that this strategy is not valid following a change to the site layout DCC cannot guarantee the reliability of information obtained from other bodies, if this information becomes outdated then the findings and conclusions of this report may be subject to change.

Objectives

In accordance with the National Planning Policy Framework (NPPF), and other industry guidance (CIRIA), the objectives of this assessment are as follows:

- Identify the potential sources of flood water at the site.
- Provide information on existing surface water management.
- Examine the circumstances under which the site may flood accounting for climate change.
- Assess all information collected and provide recommendations for any additional drainage or management systems required to compensate for additional flood risks posed by the new dwellings, or to reduce overall flood risk for the property where feasible.

2.0 Existing Site

The development is on the A167 at the signalised junction into Central Avenue, realignment of the access road into the Low Copelaw Estate.

Site Area

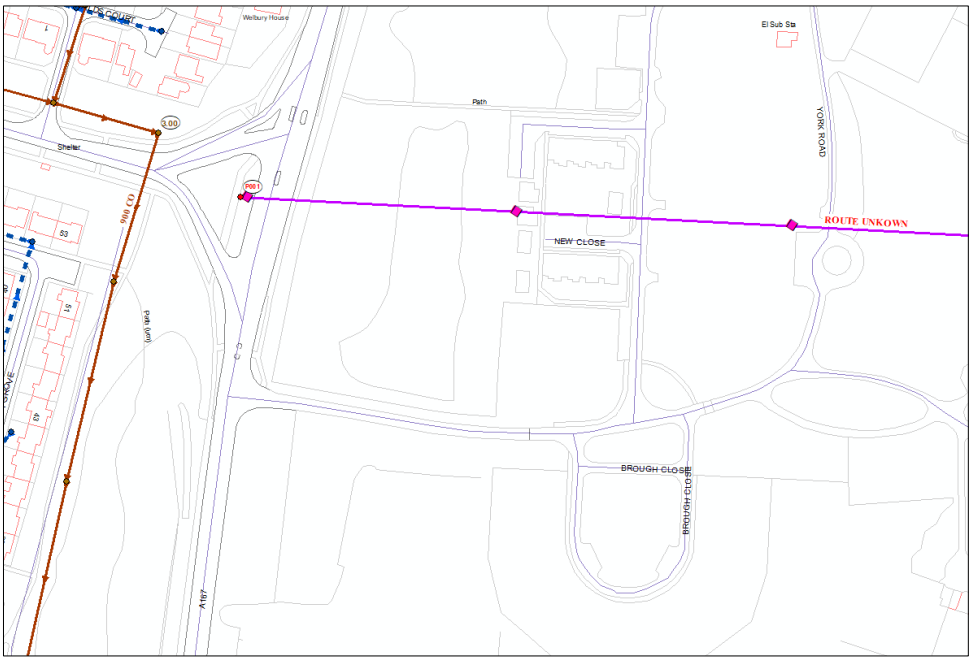
Site falls under the 1ha category with an area of 0.8 hectares (ha)

Topography

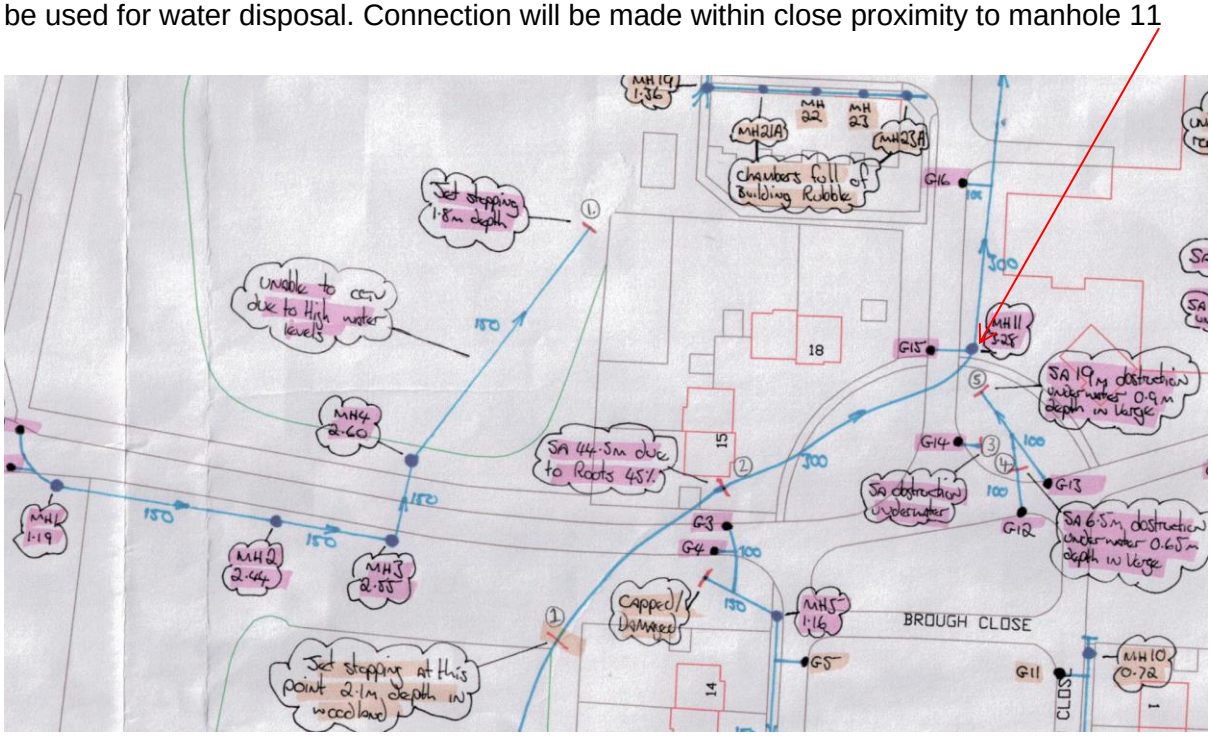
The site slopes gradually from west to east, levels range typically from 94m-92mAOD

Drainage

There is an existing rising main running through the site, location is shown as indicative thus should be considered during excavation and protected for permanent measures.

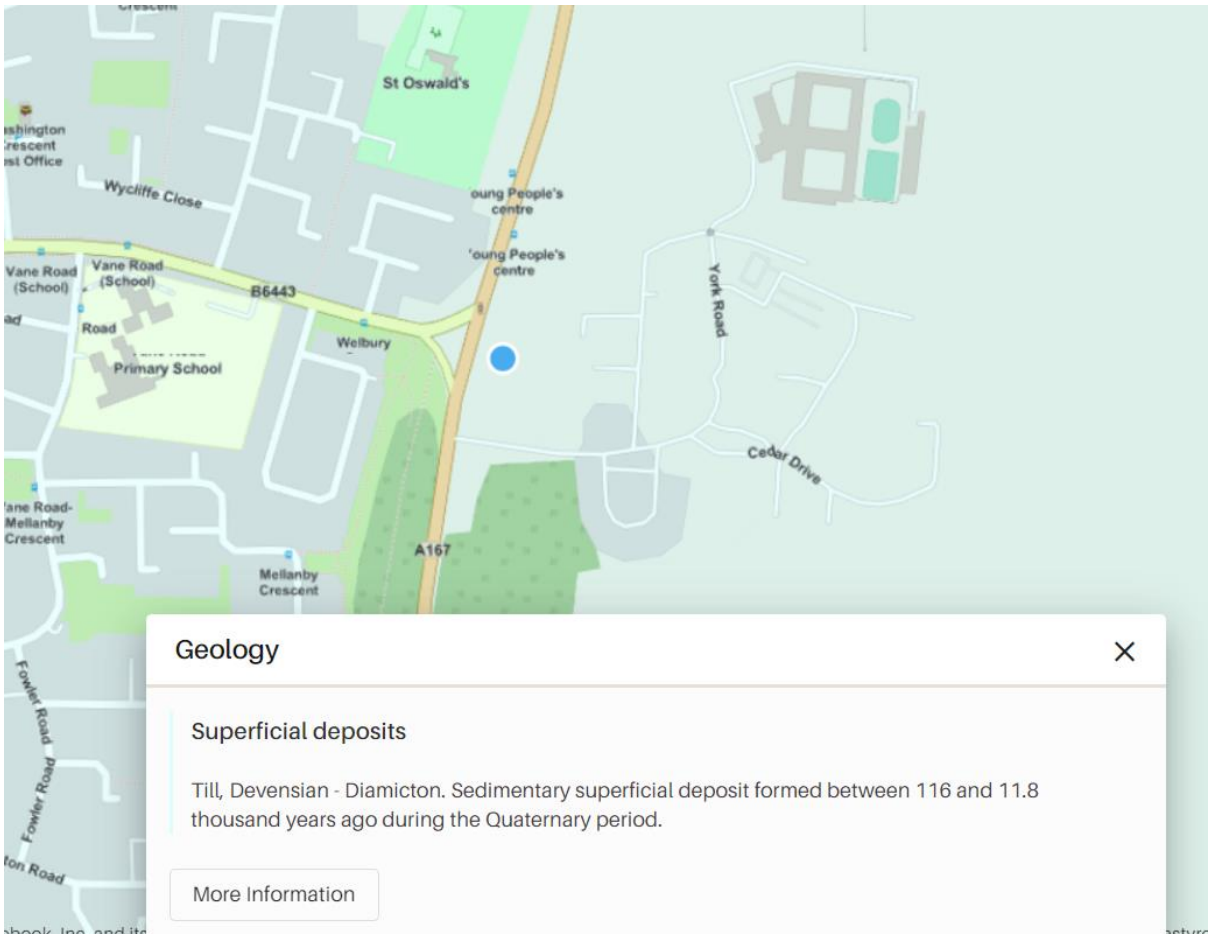


Private drainage serves the existing buildings and roads, the 300mm surface water pipe will be used for water disposal. Connection will be made within close proximity to manhole 11



Ground Investigation

Detailed GI has not yet been undertaken, however the British Geological Survey maps show the ground type to be Till & Devensian. This type of strata does not promote the use of soakaways therefore infiltration will be ruled out for the primary source of SW disposal.



Flood Risk

Current Policy

Planning policy guidance with regard to flood risk in England is currently documented in the NPPF and its associated technical guidance, which was amended in March 2018 and supersedes Planning Policy Statement 25(PPS25) Development and Flood Risk. Whilst PPS25 has now been withdrawn, it is generally recognised by both the Environment Agency (EA) and local authorities to continue to represent good practice and much of the NPPF guidance is taken from this document.The purpose of the technical guidance is to ensure that flood risk is taken into account at all stages of the planning process through appraisal, management, and reduction of flood risks at all levels. Its overall aims are as follows:

a) To identify land areas with risks associated with flooding.

b) To avoid non-essential development in areas of potential flood risk and to manage any residual risks associated with development where it is either unavoidable, or of great benefit, accounting for climate change.

c) To protect land from development where it is required for current or future flood management and;

d) To reduce flood risk, where possible, in developments by using sustainable drainage systems.

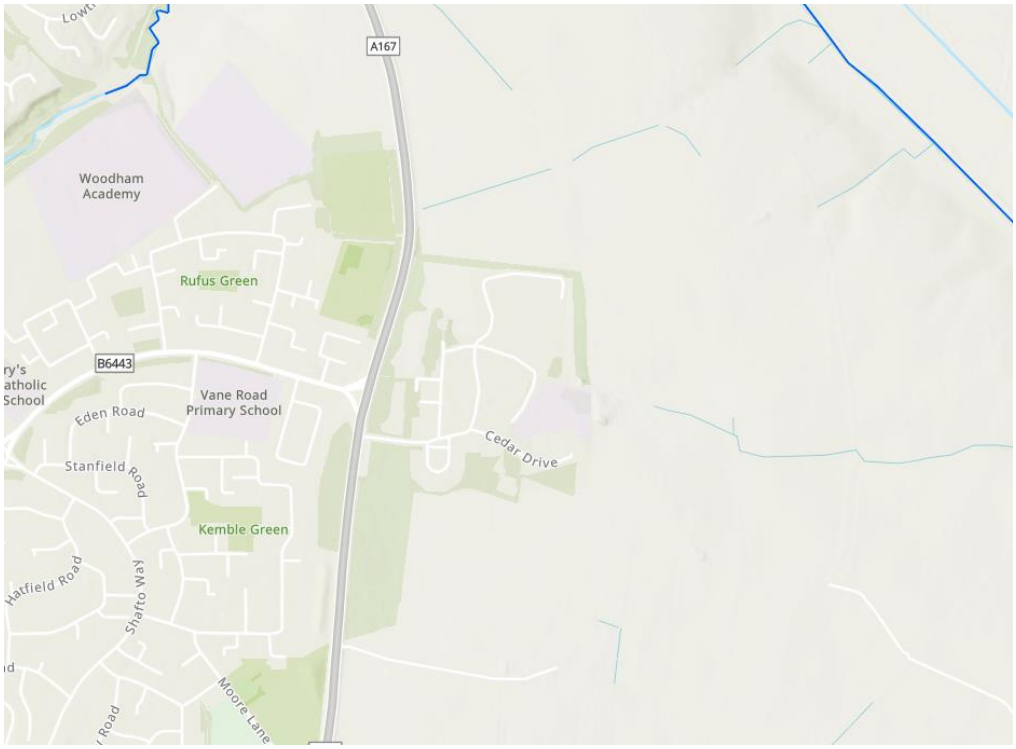
Under this strategy, areas of land throughout England and Wales are designated according to the potential flood risks from rivers or the sea, ignoring any existing flood defences, into zones 1, 2, 3a and 3b respectively. The areas are defined by maps compiled by the EA into representative zones of increasing flood risk; Zone 1 poses the lowest potential risk whilst Zone 3b, an active floodplain, poses the greatest risk. Where planning permission is being sought for a particular site within one of the zones, the owner/ developer has a duty to demonstrate that the proposed development will be safeguarded from flooding and ensure that the development does not exacerbate flooding elsewhere. To do this the developer must provide an appropriate level of FRA for regulatory approval, which demonstrates the following:

a) Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and

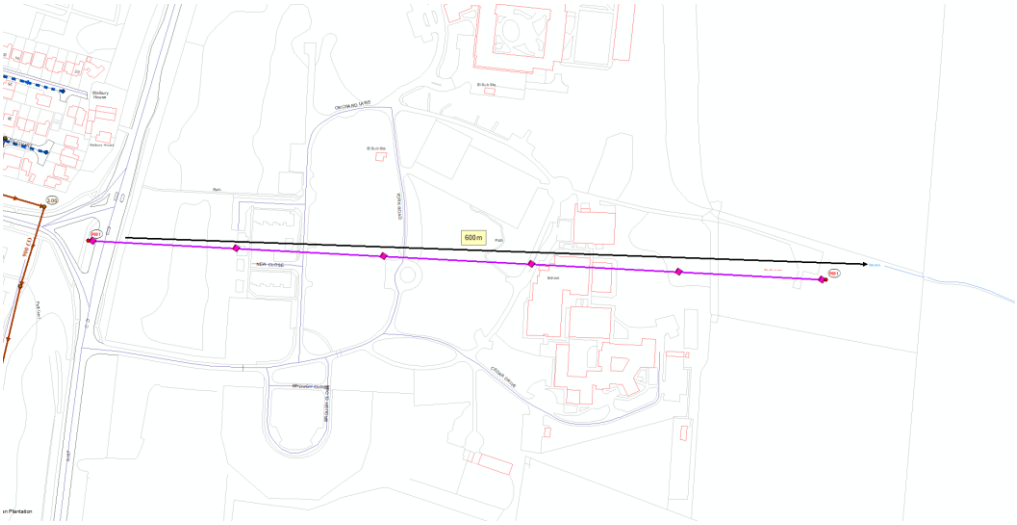
b) Development is appropriately flood resilient and resistant including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning and it gives priority to the use of sustainable drainage systems.

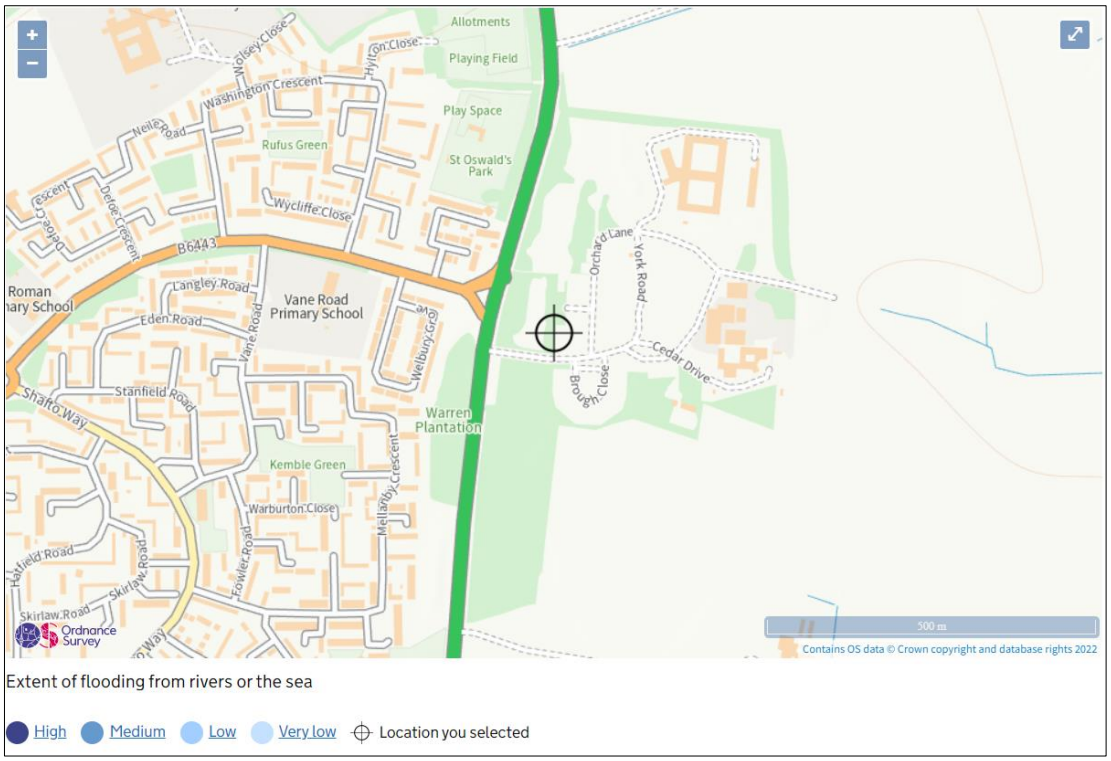
Flood Risk – Rivers

Woodham Burn is a statutory main river 1500m east of the site, the river is substantial distance from the site thus poses no immediate risk as the land falls within Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). This is considered low risk.

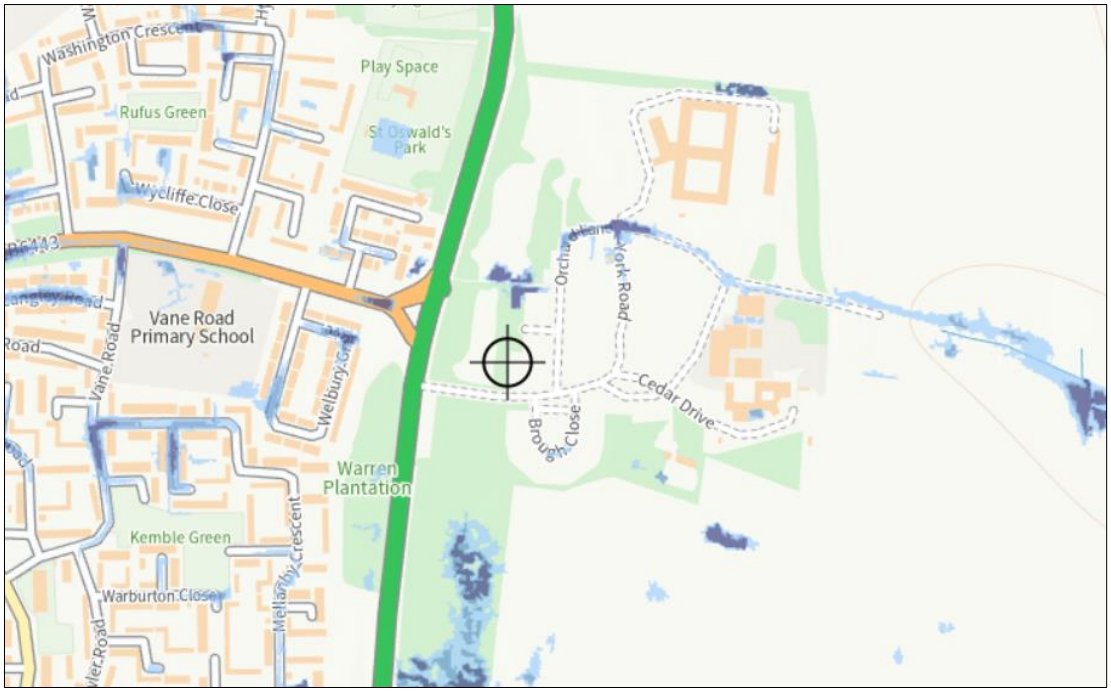


There is a local watercourse 600m east which is a contributory to the Woodham Burn, the private onsite drainage connects the watercourse at the site boundary





The SW flood maps provided by Environment Agency do not illustrate any risk from surface water at the location of the junction works and proposed access road.



3.0 Proposed Development

The drainage strategy has been prepared to support the planning application for a new access road & suds basin.

Drainage Strategy (Surface Water)

The Building Regulations Part H sets out a hierarchy for the disposal of surface water and in order of priority the options are:-

1. Soakaway or other infiltration system.

2. Watercourse.

3. Sewer.

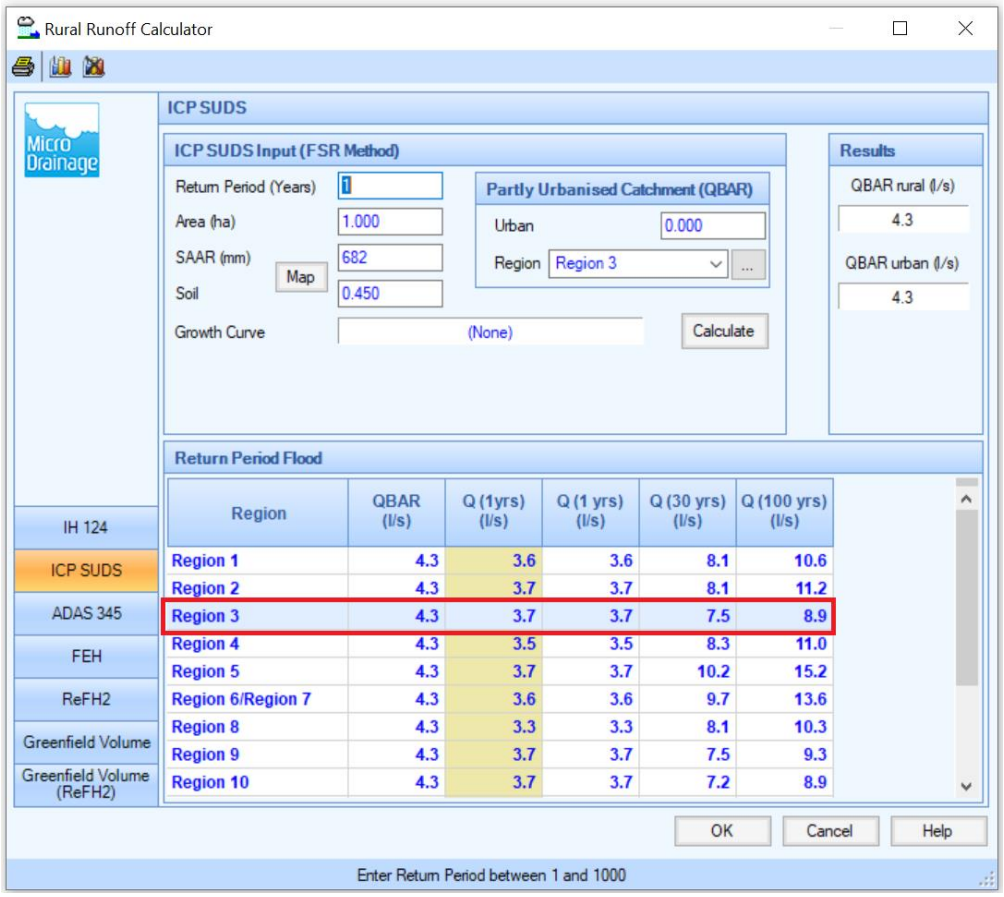
In addition, both the Environment Agency and the NPPF recommend that surface water run-off from proposed developments should maximize the use of SuDS. The development is within Flood Zone 1, therefore the drainage strategy focuses on the management of surface water. The surface water strategy for the development site will be written in accordance with CIRIA guidance, Sewers for Adoption – 7th Edition and The Building Regulations Part H.

The impermeable area of the proposed development has been calculated as 0.26ha. BGS maps show clay therefore not suitable for direct infiltration of surface, this will be confirmed by infiltration tests following planning consent.

The hierarchy then promotes use of a watercourse, there is an ordinary watercourse in the southeastern corner of the larger development, there is a private carrier drain which connects to the watercourse, this will be used for SW disposal.

As the proposed development will be positioned on greenfield land, under new policy set to encourage the use of SuDS, it is a requirement to restrict the site to greenfield run-off rate, this will manage the flow rates to match the conditions prior to development.

MicroDrainage has been used to calculate the QBAR rate of 4.3 litres/sec/ha.



Region	QBAR (l/s)	Q (1yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	4.3	3.6	3.6	8.1	10.6
Region 2	4.3	3.7	3.7	8.1	11.2
Region 3	4.3	3.7	3.7	7.5	8.9
Region 4	4.3	3.5	3.5	8.3	11.0
Region 5	4.3	3.7	3.7	10.2	15.2
Region 6/Region 7	4.3	3.6	3.6	9.7	13.6
Region 8	4.3	3.3	3.3	8.1	10.3
Region 9	4.3	3.7	3.7	7.5	9.3
Region 10	4.3	3.7	3.7	7.2	8.9

The surface water system for the development will be designed to ensure no flooding of any part of the site during a rainfall event with a return period of 1 in 100 years +40% CC with a maximum discharge of 4l/s. The council's policy states that the 1:100 year storms must be catered for within the system and the flooded volumes for the events including climate change must be managed on site.

Due to the location of suds basin being close to the site boundary, the proposed layout doesn't allow for flood flows above the 1:100 year event to be retained within the road, for this reason the proposed attenuation caters for all storms including the 1:100 year + 40% CC.

The surface water & SuDS will be made up of multiple components, this includes the following:

- The access road will be drained traditionally via gullies, beany kerbs and carrier drains

- Storage volume for the road will be 125cum suds basin. The proposed SW will be restricted to 4l/s via a Hydrobrake optimum, the outlet from the Hydrobrake chamber will discharge into the existing site drainage.

Foul Water Drainage

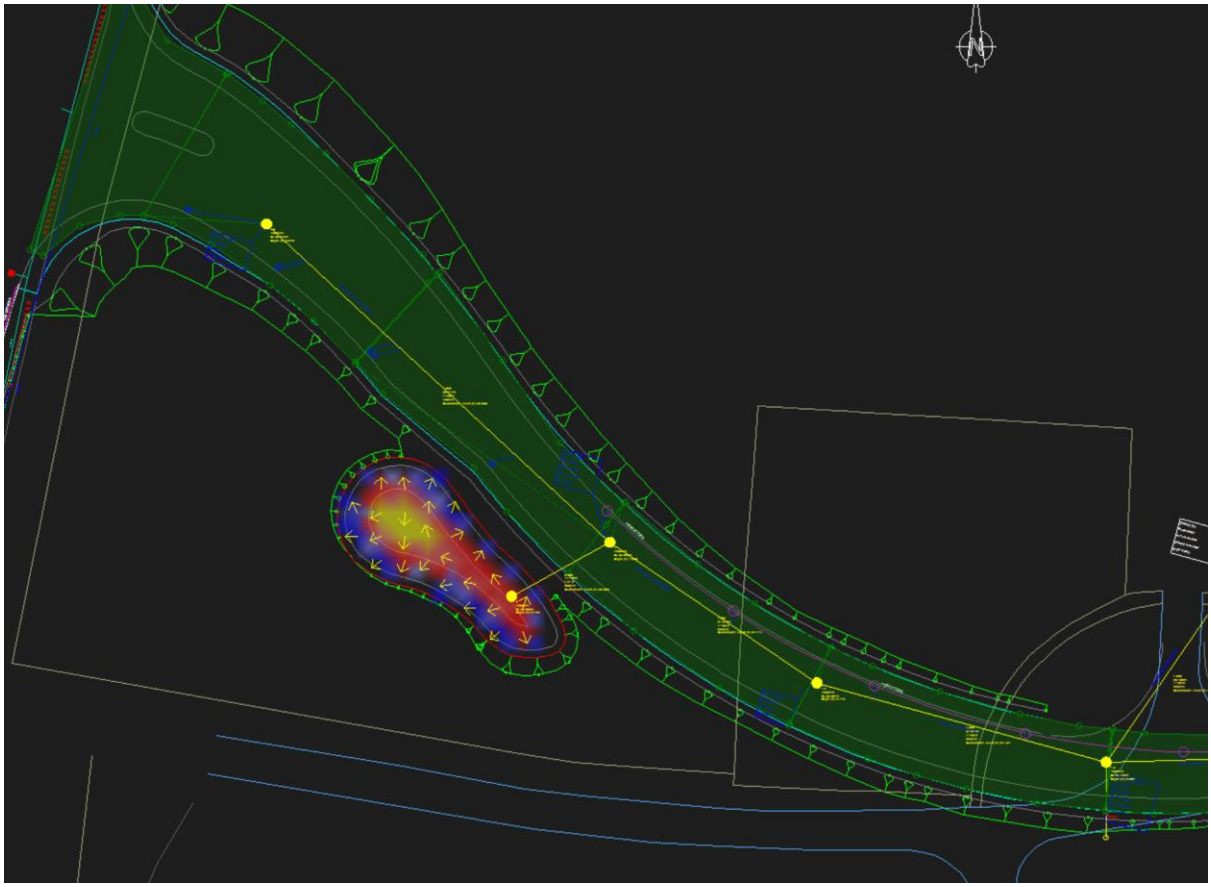
None required

4.0 Maintenance & Adoption

The scheme has been designed with maintenance in mind, the drainage proposed should require minimal maintenance over the life of the project. The Suds basin will be installed within the grassed area as shown on the site drainage plan, this land will remain in ownership of DCC and be maintained under the highway's inspection regime.

5.0 Exceedance Routes

The drainage system has been designed to cater for the 1:100year +40%CC. The exceedance routes have been checked for a scenario such like a blockage or Hydrobrake failure, the scenario was modelled by replacing the Hydrobrake with a 1mm orifice plate to effectively remove the outlet from the system. The basin is at the lowest part of the site so all flood water will fill the basin, this contains the water up to 1:200y+40%CC.



6.0 Conclusion

Existing Site

The development lies on greenfied land, to coincide with local planning policies the proposal is to restrict the surface water to the QBAR flow rate, ICP SuDS calculates this at 4l/s. The site area is measured at 0.8ha.

BGS maps show a clay superficial layer, the base of the basin will be unlined and uncompacted to encourage natural infiltration but for the purpose of this report and calculations it has been assumed no infiltration.

Northumbrian Water records shows a rising main passing through the site which is not suitable for SW disposal. See Appendix B for a copy of NWL records.

Proposed Surface Water

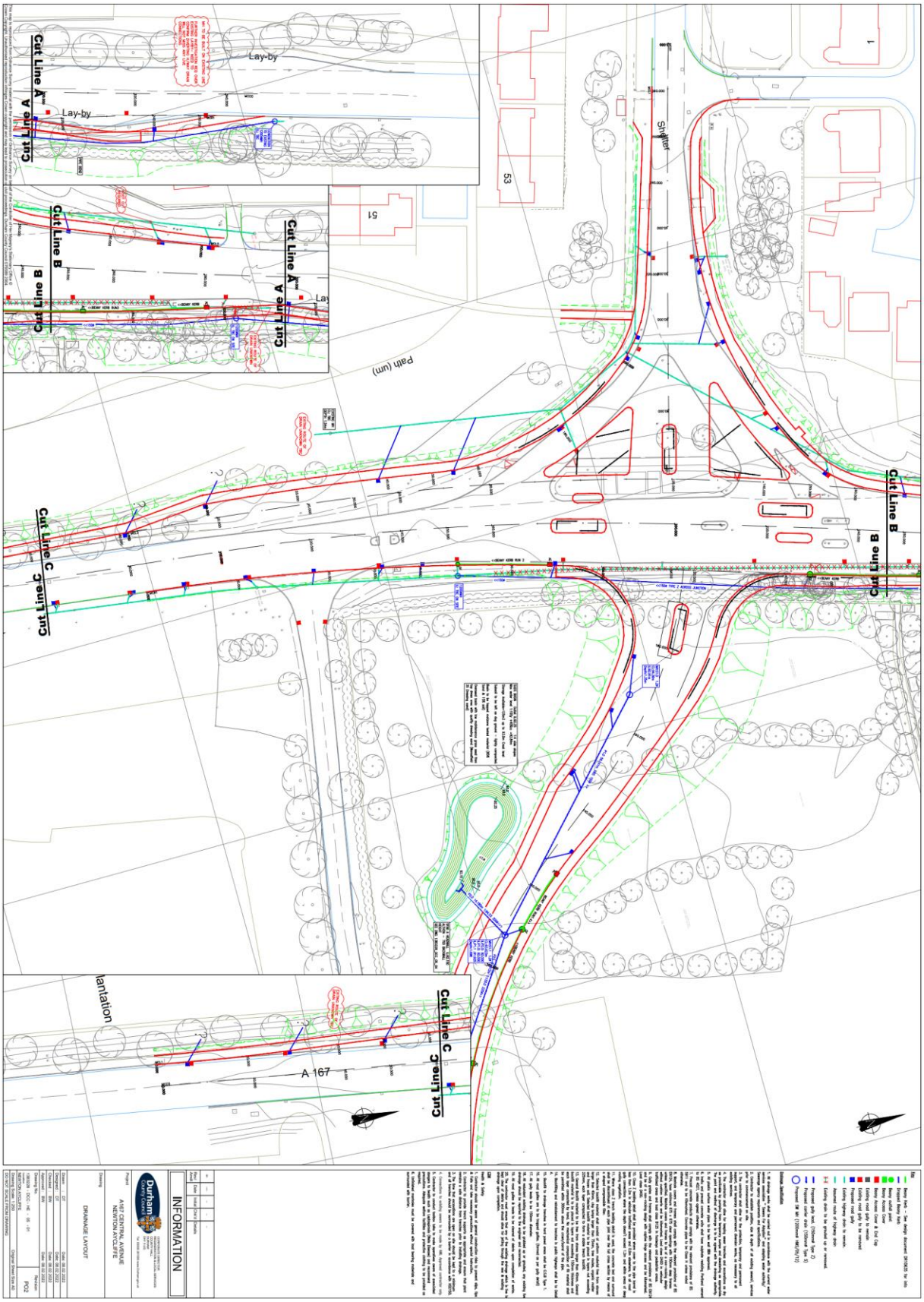
Sustainable drainage systems will be used to manage water quality and quantity, a landscaped basin will be used to treat water and reduce pollutants leaving the attenuation. The water quantity aspect will be managed with 125m3 storage within the basin, max discharge flows will be managed with a Hydrobrake optimum.

Proposed Foul Water Sewer

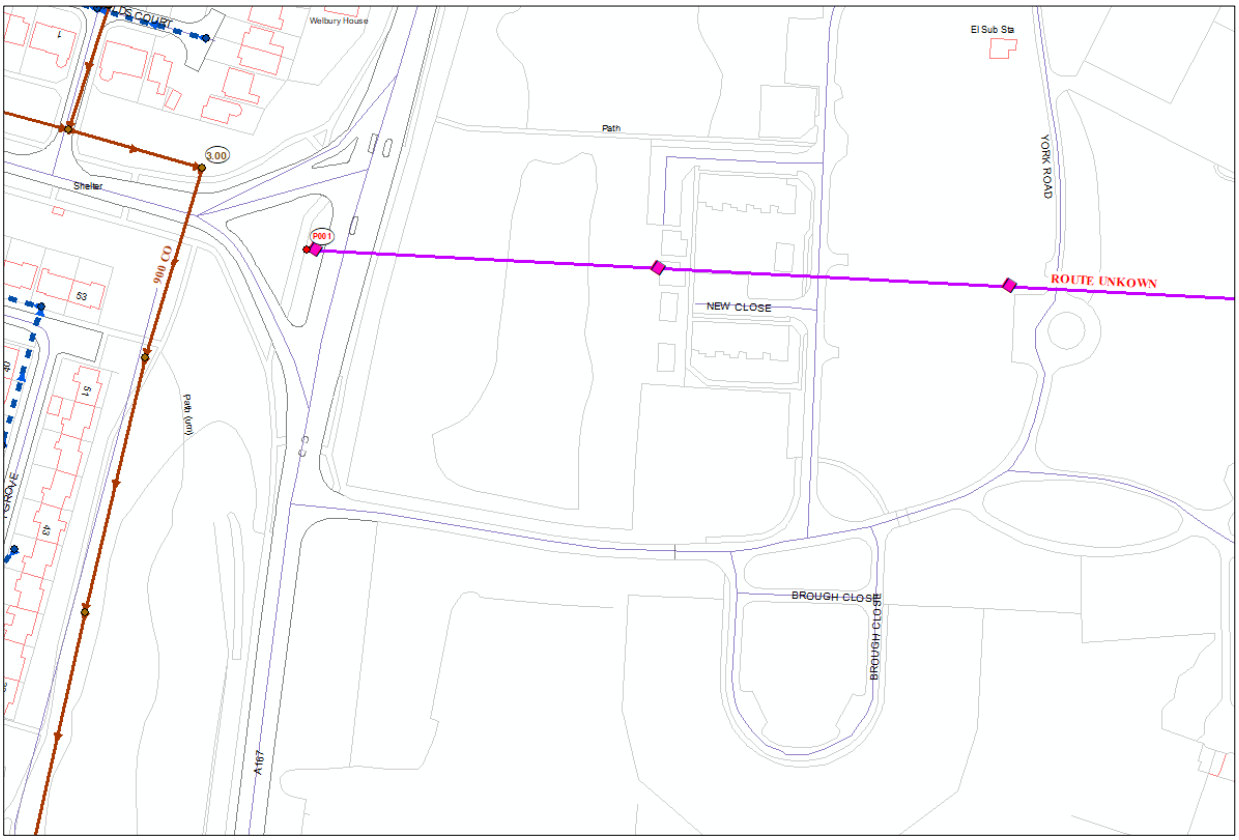
None required

5.0 Appendices

A. Proposed drainage layout



B. NWL sewer records



C. Micro drainage results.

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Innovyze	Network 2020.1	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	59.141	0.394	150.1	0.041	5.00	0.0	0.600	o	150	Pipe/Conduit
2.000	14.180	0.275	51.6	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit
1.001	31.612	0.211	150.0	0.107	0.00	0.0	0.600	o	225	Pipe/Conduit
1.002	37.911	0.253	150.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit
3.000	28.339	0.189	150.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit
1.003	28.190	0.188	150.0	0.078	0.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	92.394	0.041	0.0	0.82	14.5
2.000	92.275	0.000	0.0	2.19	155.1
1.001	91.925	0.148	0.0	1.07	42.4
1.002	91.714	0.186	0.0	1.07	42.4
3.000	92.820	0.000	0.0	0.82	14.5
1.003	91.461	0.264	0.0	1.07	42.4

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.041	0.041	0.041
2.000	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.046	0.046	0.046
	User	-	100	0.060	0.060	0.107
1.002	User	-	100	0.038	0.038	0.038
3.000	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.043	0.043	0.043
	User	-	100	0.035	0.035	0.078
				Total	Total	Total
				0.264	0.264	0.264

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		94.239	91.273	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.345		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 1.3, DS/PN: 1.003, Volume (m³): 5.0

Unit Reference	MD-SHE-0098-5000-1539-5000
Design Head (m)	1.539
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	91.461
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.539	5.0
Flush-Flo™	0.428	4.8
Kick-Flo®	0.871	3.8
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.5	3.000	6.8	7.000	10.2
0.200	4.4	1.400	4.8	3.500	7.3	7.500	10.5
0.300	4.7	1.600	5.1	4.000	7.8	8.000	10.9
0.400	4.8	1.800	5.4	4.500	8.3	8.500	11.2
0.500	4.8	2.000	5.6	5.000	8.7	9.000	11.5
0.600	4.7	2.200	5.9	5.500	9.1	9.500	11.8
0.800	4.2	2.400	6.1	6.000	9.5		
1.000	4.1	2.600	6.4	6.500	9.8		

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Storage Structures for Storm

Tank or Pond Manhole: 2, DS/PN: 2.000

Invert Level (m) 92.275

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	93.6	0.700	277.0

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.341
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1.0	15 Winter	100	+40%	30/15 Summer				93.267
2.000	2	180 Winter	100	+40%	100/15 Summer				92.840
1.001	1.1	180 Winter	100	+40%	1/15 Summer				92.841
1.002	1.2	15 Summer	100	+40%	1/15 Summer				93.254
3.000	2.0	15 Summer	100	+40%	100/15 Summer				93.453
1.003	1.3	15 Summer	100	+40%	1/15 Summer				93.451

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1.0	0.723	0.000	1.16			16.4	FLOOD RISK	
2.000	2	0.265	0.000	0.03			4.5	FLOOD RISK	
1.001	1.1	0.691	0.000	0.12			4.6	SURCHARGED	
1.002	1.2	1.315	0.000	0.29			11.5	SURCHARGED	
3.000	2.0	0.483	0.000	0.35			4.9	SURCHARGED	
1.003	1.3	1.765	0.000	0.14			5.6	SURCHARGED	