DRAINAGE STRATEGY

PROPERTY ADDRESS
Rainford Avenue
Manchester
M20 1BR

CLIENT
Southway Housing

REPORT REFERENCE
4248-ADS-01-XX-RP-C-500-[V2]

Author: Mark Sin
Date: 30th December 2022
Reviewer: Dominic Sparkes
Date: 9th January 2023

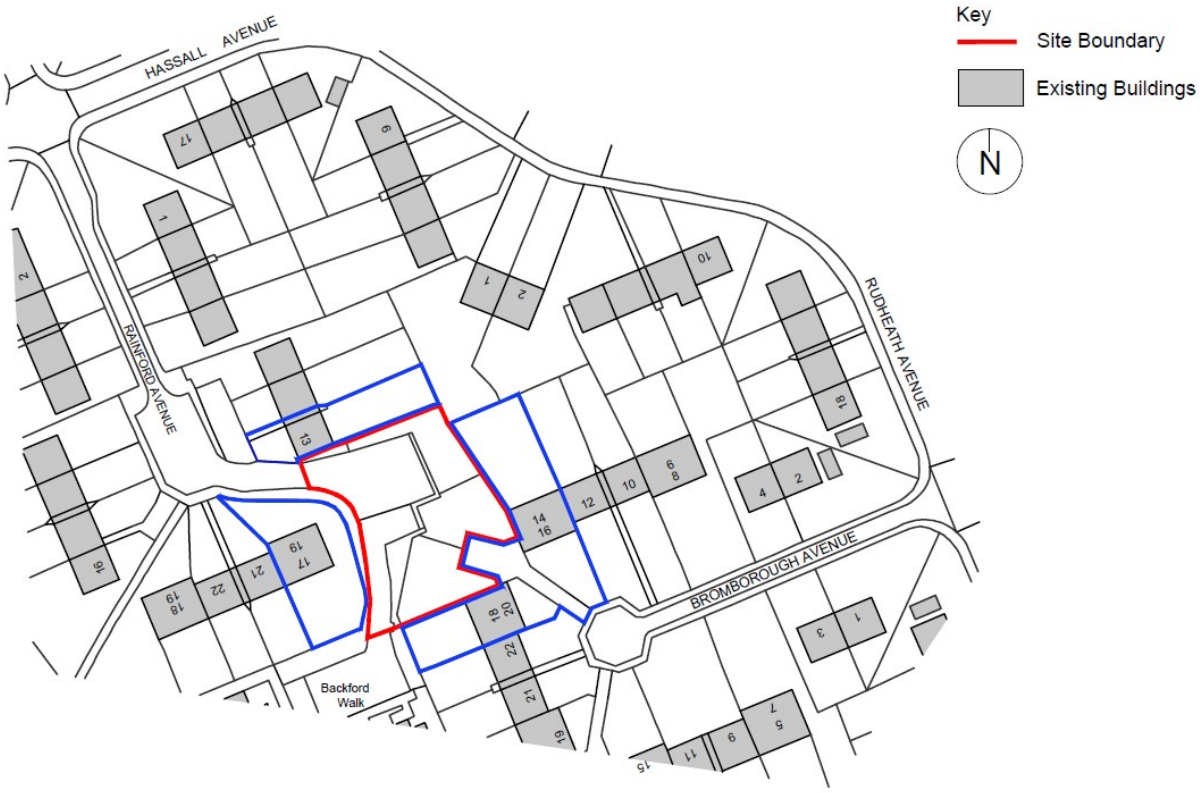
ads structural

EXECUTIVE SUMMARY

Item	Assessment		Criteria
1.	Site Classification		GREENFIELD
2.	Site Area		625 m^2
3.	Existing Areas	• Impermeable • Landscaping	325 m^2 (Contributing) 300 m^2 (Non-Contributing)
4.	Rainfall		FSR
5.	Existing surface water run off rate		2.5 l/s (Qbar)
6.	Proposed Contributing Areas	• Impermeable • Landscaping	200 m^2 (Contributing) 425 m^2 (Non-Contributing)
7.	Proposed surface water peak flow run off rate		1.9 l/sec
8.	Pre-Development Run off volume	M100-240 + 40% CCF	50 m^3
9.	Post-Development run off volume	M100-240 + 40% CCF	14 m^3
10.	Surface water discharge		Discharge to public sewers via new adopted Manhole, subject to agreement.
11.	Flooding / Storage assessment		M100-15 to M100-1440 + 40% CCF
12.	Total Storage required		3.6 m^3
13.	Storage System	Attenuation Pipes Manholes	2.16 m3 0.50 m3 0.94 m3
14.	Interceptor		Not provided.
15.	Foul water discharge		Discharge to public sewers via new adopted Manhole, subject to agreement.

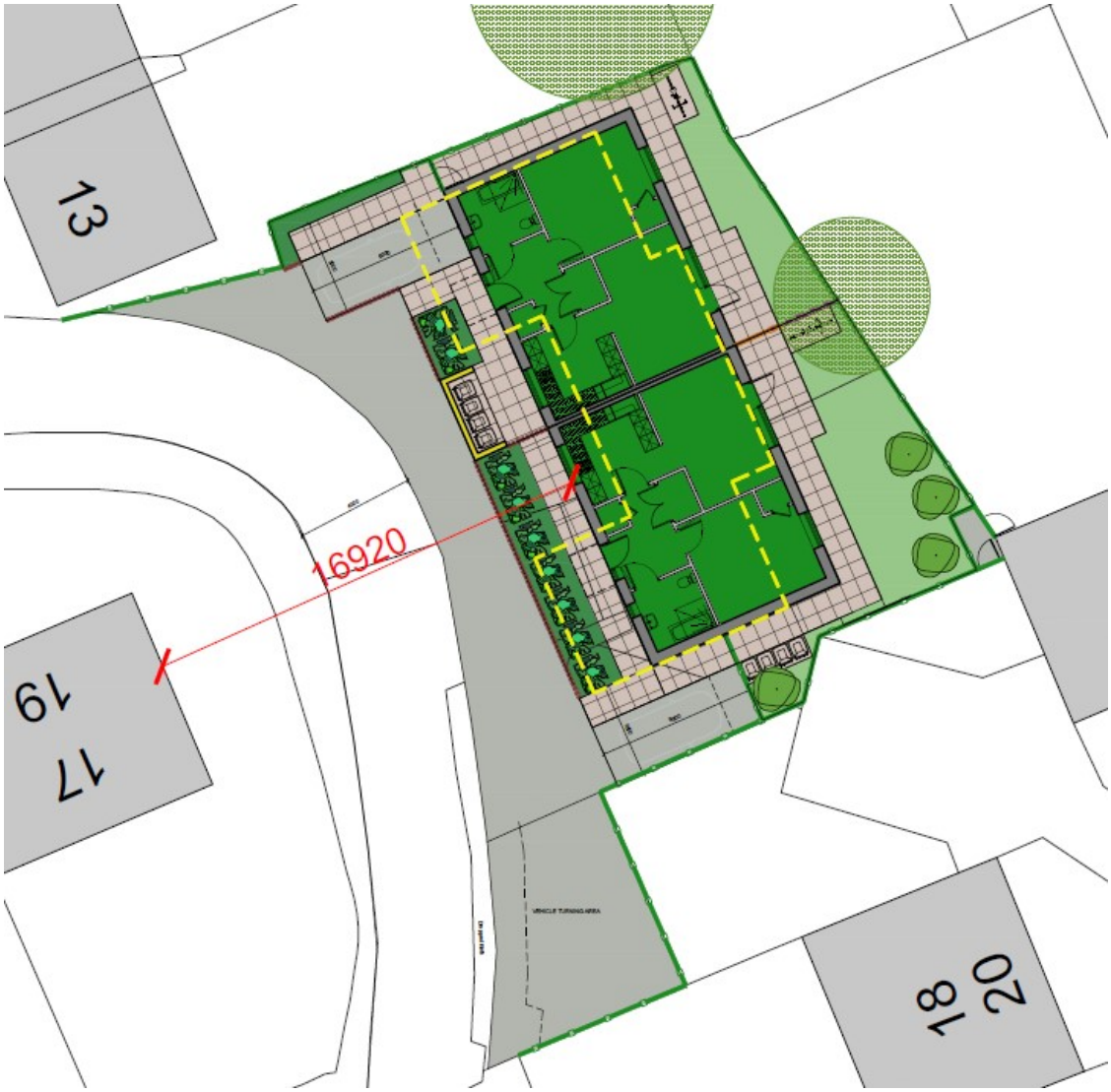
1. Introduction

1.1. ADS structural have been appointed to prepare a drainage strategy in support of a proposed residential development off Rainford Avenue.



1.2. The site is an irregular shaped plot, about 25 by 25 metres, located to the southeast of Rainford Avenue in Manchester and at OS Grid reference 384093, 393530.

1.3. It is proposed to build two houses with associated parking spaces and gardens.



1.4. The purpose of the report is to appraise the Local Planning Authority of the drainage implications of the proposed development.

2. Proposed Drainage Strategy

2.1. In order to demonstrate the development is of low risk the report should show:

- That it will be feasible to balance surface water run-off to the Greenfield run-off rate (or existing run-off rate in terms of a brownfield development with a 50% betterment) for all events up to the 1 in 100-year storm (including a 40% allowance for climate change) and set out how this will be achieved

- How sustainable drainage techniques (SuDS) will be used with any obstacles to their use clearly justified

2.2. The surface water drainage developments for any development site should aspire to be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the development

2.3. For a new development is may be necessary to provide surface water storage and/or infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site.

2.4. The Environment agency require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100-year event) the developed rate of run-off into a watercourse should be no greater that the undeveloped rate of run-off for the same event. In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site. Water authorities take a similar approach to that of the environment agency; however, they ask that flows be restricted to include up to the 3.33% annual probability (1 in 30 year) whilst demonstrating that the 1 in 100-year event does not pose a threat to the locality (known as designing for exceedance).

2.5. Climate change (CC) will be taken into account by increasing the rainfall intensity by 40% in line with the Environment Agency and NPPF Technical Guidance.

3. Existing Site Drainage

3.1. The site is currently undeveloped land which will be considered as greenfield. Greenfield run off calculations have been undertaken and can be found within Appendix A.

3.2. United Utilities records can be found within Appendix B.

3.3. There are two combined sewer manholes within the limits of our site, located on the road.

3.4. As mentioned previously, there is an existing working drainage network on the site. The topographical survey and Water searches can be found within Appendix B.

3.5. The Existing Brownfield and Greenfield run off rates for the site are as follows,

Return period	Peak flow (l/s)		
	Brownfield	Greenfield	Combined
QBar	N/A	0.23 l/s	**0.23 l/s**
1 in 1-year	N/A	0.20 l/s	**0.20 l/s**
1 in 30-year	N/A	0.39 l/s	**0.39 l/s**
1 in 100-year	N/A	0.48 l/s	**0.48 l/s**

4. Consideration of the Sustainable Drainage Systems and Water Quality

4.1. Following the Hierarchy of Sustainable Drainage Systems (SUDS) the following options must be considered.

- Soakways for roof run-off and permeable surfacing for roads, drives, car parks and private access roads.
- Discharge to local watercourse.
- Discharge to local sewer.
- Discharge to adjacent land drains and ponds.

4.2. The first option to be considered must be infiltration into the ground. Even when there are alternative sewer connections or water courses available, infiltration must be utilised unless it is unfeasible. Having reviewed a Phase 1 report by Worms Eye and historic borehole information for local area we wouldn't consider infiltration to be a viable solution. The closest borehole indicates clay at a 0.40m deep which is unsuitable for infiltration.

4.3. The second option to be considered must be discharge to a local watercourse. There are no known watercourses within the vicinity of the site.

4.4. The third option is discharge to a public surface water sewer. There is a drainage network within Rainford Avenue. Therefore, we propose to discharge the roof areas and vehicle turning area into this network

4.5. In order to prevent an increase in flood risk to adjacent land and downstream of the site it will be necessary to restrict the surface water discharge from the proposed development to the existing rates.

4.6. Current guidance promotes sustainable water management through the use of SuDS. SuDS measures should be used to control the surface water runoff from the proposed development site therefore managing the flood risk to the site and surrounding areas from surface water run-off.

A hierarchy of techniques is identified:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g., minimise areas of hard standing).
- Source Control - control of runoff at or very near its source (such as the use of rainwater harvesting, permeable paving, soakaways and/or green roofs).
- Site Control - management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site, swales and/or infiltration trenches).
- Regional Control - management of runoff from several sites, typically in a detention pond, basins, tanks and/or wetland.

It is generally accepted that the implementation of SUDS as opposed to conventional drainage systems, provides several benefits by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream.
- reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites.

- improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources.
- reducing potable water demand through rainwater harvesting.
- improving amenity through the provision of public open spaces and wildlife habitat.
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

The most appropriate attenuation system will need to satisfy three main characteristics,

1. provide the required volume of storage.
2. minimise the loss of developable land.
3. where possible provide local amenity.

The application of the SuDS Manual requires that the runoff from sites is not only restricted to meet the pre-development runoff characteristics but also that SuDS systems are utilised to improve the quality of the runoff prior to outfall to watercourses. The SuDS Manual and Environment Agency guidance applies a sustainability hierarchy to the several types of SuDS systems, this is summarised in Table A below.

ads structural

Table A - Sustainability Hierarchy

	SuDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
Most Sustainable	Green / Living roofs / Living walls	X	X	X
	Basins and ponds - Constructed wetlands - Balancing ponds	 X X	 X X	 X X
	Filter strips and swales	X	X	X
	Infiltration Devices - Soakaways	 X	 X	 X
	Permeable Surfaces & Filter Drains - Gravelled areas - Solid paving blocks - Permeable paving	X	X	
Least Sustainable	Tanked systems - Over-sized pipes/tanks - Cellular storage	 X		

Systems at the top of the hierarchy provide a combination of attenuation, treatment and ecology and are deemed the most sustainable options. There are always specific scenarios where systems are more suitable than others and at this stage it is not possible to guide the development towards a particular strategy.

The usual approach is to consider the 'SUDS train' where each of the above options are considered in turn until a suitable solution is found. Thus, source control techniques such as soakaways, rainwater harvesting and/or infiltration trenches, if suitable on a site, are considered preferable to permeable conveyance and passive treatment systems such as tanks or ponds. The various options are considered in outlined in Table B below.

Table B - SuDS Techniques

SuDS Technique	Comments	Suitability for Development
Green / Living Roofs / Living Wall	A green roof is a multi-layered system that covers the top of a building with soil and vegetation, and which can provide a degree of rainstorm attenuation and a reduction in site runoff. Can be used to reduce the volume and rate of runoff so that other SuDS techniques in the scheme can be significantly reduced in size.	Not suitable for commercial developments.
Basins / Ponds	Provides storage of runoff and flow attenuation. Vegetated surfaces can be used to support the prevention of runoff from the site for small rainfall events (interception) and improve water quality associated with the removal of sediment and buoyant materials.	Not the required area available, especially given the side slopes need to be 1 in 4 max. Without the space the volume attenuated would be very small to be virtually insignificant.
Filter Strips / Swales	Good removal of urban pollutants, reduces runoff rates and volumes.	Not enough open/green space for their workable inclusion or being able to tie in with depths of connecting buried pipes.
Infiltration Devices (e.g. soakaways)	Reduces total runoff volume from the development.	Soakaways are not suitable due to site ground conditions.
Permeable Surfaces and Filter Drains	Permeable surfaces together with their associated substructures are efficient means of intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium.	The majority of the hard landscaped areas are to be tarmac used for light vehicles. These could be constructed with permeable surfacing, however, as there is no infiltration potential it would merely be a storage option with only 30% voids.
Tanked systems	Ideal for sites with insufficient space for basins etc., provide a volume of below ground storage with a high void ratio.	Potential to be installed under the car park.
Flow reduction	Manages and reduces the flood risk to the local surface water sewers and watercourses.	Hydrobrakes can be installed downstream of attenuation tanks and control flows to the natural greenfield run off rates.

5. Proposed Drainage Design

5.1. An initial review would suggest that if the site is to be drained via a traditional piped system, a gravity system could be provided such that no rising mains would be required.

5.2. Whilst not the most sustainable solution, at this stage it's one that we are confident could be delivered at detailed design. It is worth noting that permeable driveways and external landscaping will be provided were at all possible to provide infiltration. Whilst all SUDS techniques will be fully appraised at detailed design stage, this section of the reports simply stands to ensure a sustainable solution is theoretically deliverable.

5.3. In order to ensure a robust approach, it has been assumed that 100% of the rainwater falling on the proposed impermeable areas enters the system. It is therefore considered that the analysis undertaken is robust. It may be possible at detailed design stage to ensure at the very least some of the pavement areas are laid in such a manner that surface water falls into adjacent soft landscaping areas or infiltration techniques used via a permeable paving system.

5.4. In order to comply with Environment Agency requirements, peak rates of run-off will be restricted to the existing Greenfield run-off rate and storage will be provided up to and including the 1 in 100-year storm event plus an allowance of 40% increase for climate change. This is above and beyond the requirements of a United Utilities adopted drainage system which requires storage up to and including the 1 in 30-year storm event.

5.5. Having reviewed the proposed site layout, prior to a planning application, an assessment of the proposed impermeable area has been carried out and is calculated as being approximately 200 m2 (0.02 ha).

5.6. Restricting flows from the site to Qbar 0.23l/s would result in an aperture within the flow control of less than 0.050m, in turn increasing the risk of flooding via blockage and siltation.

5.7. Calculations have been undertaken at this stage to model and analyse a proposed surface water drainage network. It can be demonstrated that the peak flows from our system do not exceed the predevelopment run off rates for the 1 in 1, 1 in 30 and 1 in 100+40% CC events. The peak flow for the 1 in 100 yr. +40% CC is restricted to 1.9 l/s via flow control unit.

5.8. We intend to provide attenuation storage via stone beneath the driveways / planters. The proposed attenuation provided is 3.6 m3.

5.9. The storages to be provided is to cater for storms up to and including the 1 in 100 yr. 6-hour storm event +40% CCF. The calculations are shown within Appendix C in addition to pipe sizing and flood analysis of the underground gravity system.

5.10. Peak run of volumes will not exceed the predevelopment run off volumes.

5.11. Foul water runs will discharge to the public foul sewer.

5.12. General arrangement drainage drawings have been provided showing proposed FFL's, cover levels, invert levels, pipe sizes, tank sizes and outfall locations. The information can be found within Appendix D.

5.13. The drawing shows the surface & foul water on separate systems. The surface & foul water will outfall to a public sewer, via an existing combined manhole within Rainford Avenue as show on the UU drainage records within Appendix B.

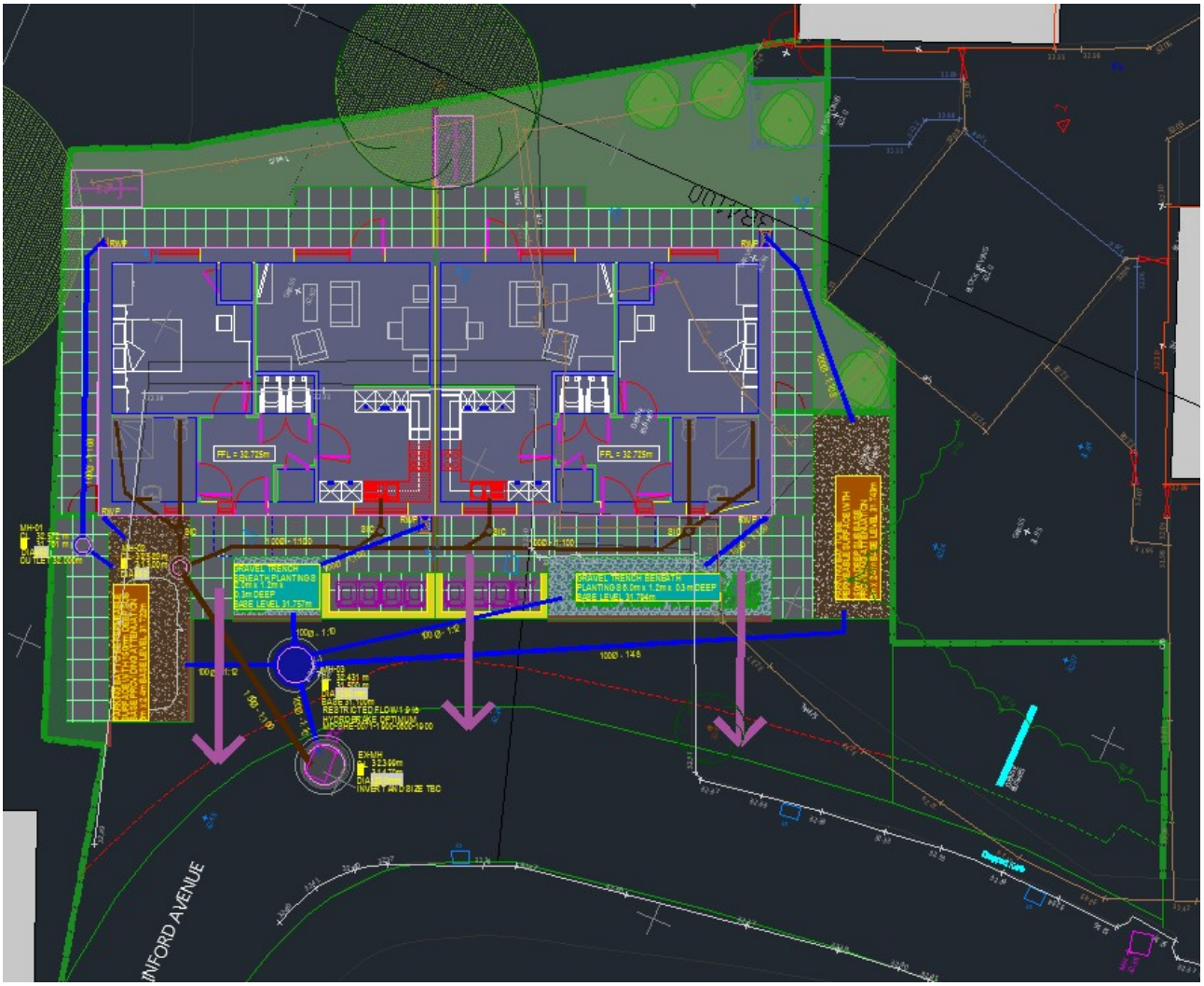
6. Exceedance Route

6.1 The drainage network has been modelled and can accommodate the 100 year + 40% climate change event and is shown to have sufficient capacity to accommodate flows below ground level with no flooding.

6.2 As such there are no exceedance routes with the risk to the proposed development and surrounding developments being low.

6.3 In the unlikely event of total system failure surface water flows are expected to flow west out of the site onto Rainford Avenue, where it will be intercepted by highway drainage.

Total System Failure Exceedance Route



7. Foul Drainage

7.1. It is proposed that the foul drainage be discharged into the existing sewer within Rainford Avenue.

7.2. During the detailed design stage, consultation may be made with United Utilities to discuss the implications of connecting into their system.

8. Summary

- The site is currently a greenfield site with no established drainage scheme.
- Storage will be provided up to and including the 1 in 100-year + climate change event within the site boundary. The attenuation will be in the form of oversized surface water sewer pipes.
- The drainage proposals will be designed in accordance with the techniques set out within the SUDS manual.
- Future Maintenance of the system will be secured in the perpetuity, through the use of a planning condition.
- Foul drainage will connect directly into the adopted sewers (subject to United Utilities approval).

9. Conclusion

9.1. The strategy outlined above shows a viable sustainable drainage solution is achievable within the constraints of the site. Detailed design of the system following a successful planning application can be delivered to meet the NPPF, Environment Agency, Local Authority and United Utilities requirements.

Report Prepared By:

Mark Sin

Report Reviewed By:

Dominic Sparkes

For and on behalf of
ADS Structural Limited.

ads structural

APPENDIX A
GREENFIELD RUN-OFF CALCULATIONS

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Southway Rainford Avenue
Site location:	Rainford Avenue

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.43835° N
Longitude:	2.24092° W
Reference:	
Date:	2019-08-27 08:31

Methodology	IH124

Site characteristics

Total site area (ha)	0.1

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	852	852
Hydrological region	10	10
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Notes:

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

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.23	0.23
1 in 1 year (l/s)	0.2	0.2
1 in 30 years (l/s)	0.39	0.39
1 in 100 years (l/s)	0.48	0.48

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 http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. 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 use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX B
SEWER RECORDS

APPENDIX C
CALCULATION FOR STORAGE