

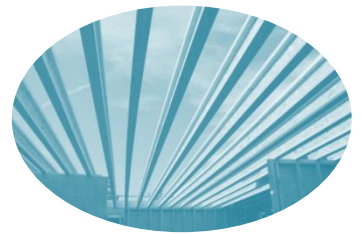
Flood Risk  
Report



Highmoor Farm, Clitheroe



V H Land Partnerships



18522



August 2019



## CONTENTS PAGE

<b>CONTENTS PAGE</b>	<b>1</b>
<b>1.0 INTRODUCTION</b>	<b>2</b>
Sources of Data	2
Existing Site	2
Proposed Development	3
Flood Risk Planning Policy	3
Other Relevant Policy and Guidance	5
<b>2.0 POTENTIAL SOURCES OF FLOOD RISK</b>	<b>6</b>
Fluvial Flood Risk	6
Groundwater Flood Risk	7
Flood Risk from Reservoirs & Large Waterbodies	7
Flood Risk from Sewers	8
Pluvial Flood Risk	8
Effect of Development on Wider Catchment	9
<b>3.0 FLOOD RISK MITIGATION</b>	<b>10</b>
Site Arrangements	10
Surface Water Drainage	11
Foul Water Drainage	11
<b>4.0 CONCLUSIONS AND RECOMMENDATIONS</b>	<b>12</b>

## TABLES

Table 1.1 - Site Summary
Table 2.1 - Pre-Mitigation Sources of Flood Risk
Table 4.1 - Summary of Flood Risk Assessment

## FIGURES

Figure 1.1 - Site Location
Figure 1.2 - Environment Agency Flood Zone Mapping
Figure 2.1 - Environment Agency Reservoir Failure Flood Risk Map
Figure 2.2 - Risk of Flooding from Surface Water Mapping

## APPENDICES

Appendix A – Site Location Plan
Appendix B – IH124 & Storage Calculations

## 1.0 INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of V H Land Partnerships, in respect of a planning application for the proposed residential development at Highmoor Farm, Clitheroe.

**Table 1.1 - Site Summary**

<b>Site Name</b>	Highmoor Farm
<b>Location</b>	Land forming part of Highmoor Park, Clitheroe, BB7 1JB
<b>NGR (approx.)</b>	375176, 441565
<b>Application Site Area (ha)</b>	5.361ha (Assumed 50% developable area)
<b>Development Type</b>	Residential
<b>NPPF Vulnerability</b>	Low
<b>EA Flood Zone</b>	Flood Zone 1
<b>EA Office</b>	Lancashire
<b>Local Planning Authority</b>	Ribble Valley Borough Council

### Sources of Data

- 1.2 The report is based on the following information:
- (i) Site Location Plan by Vernon & Co (**Appendix A**)
  - (ii) Environment Agency information
  - (iii) Lancashire Strategic Flood Risk Assessment

### Existing Site

- 1.3 The site in question is located near the Lancashire town of Clitheroe. The site lies to the east of the town and is approximately 5.361ha in size. The developable area lies 0.855km away from Clitheroe town centre. The west of the site is bounded by residential areas, whereas the other boundaries of the site are agricultural land.
- 1.4 Upon inspection it can be seen that the high point of the site is where the farm is. The site falls away to the north and south of the farm.
- 1.5 There are two watercourses which run along the north and south boundaries of the site. The watercourse at the south of the site flows towards Shaw Brook. The watercourse at the north of the site flows towards Mearley Brook.



**Figure 1.1 - Site Location**

### **Proposed Development**

- 1.6 The proposed development is set to consist of a new residential scheme designed with access roads, driveways and landscaped areas. The development will also comprise of relevant infrastructure to help drain the site.

### **Flood Risk Planning Policy**

#### *National Planning Policy Framework*

- 1.7 The NPPF<sup>1</sup> sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance is also available online<sup>2</sup>.
- 1.8 The Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible, and stresses the importance of preventing increases in flood risk off site to the wider catchment area.
- 1.9 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment.

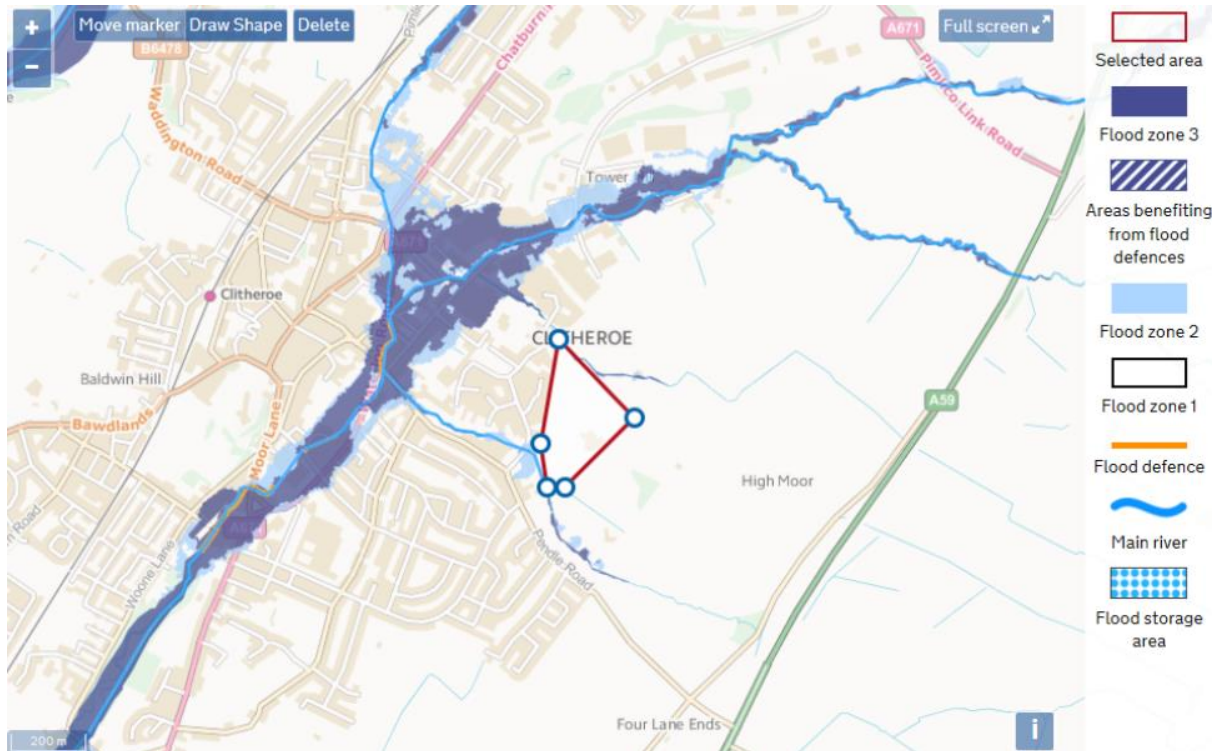
<sup>1</sup> National Planning Policy Framework, CLG, July 2018

<sup>2</sup> Planning Practice Guidance. <http://planningguidance.planningportal.gov.uk/>.

1.10 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance.

*Flood Zones*

1.11 The Flood Zone Map for Planning has been prepared by the Environment Agency. This identifies areas potentially at risk of flooding from fluvial or tidal sources. An extract from the mapping is included as **Figure 1.2**.



**Figure 1.2 - Environment Agency Flood Zone Mapping**

1.12 The site is shown to be located entirely within Flood Zone 1 (Low Probability) therefore the site is considered to be at low risk of flooding. Flood Zone 1 is defined as land assessed as having less than a 0.1% annual probability of flooding from fluvial and tidal sources.

1.13 Table 2 of the Planning Practice Guidance classifies land use. Under these classifications the proposed residential development is considered to be ‘More Vulnerable’ to the potential impacts of flooding.

1.14 Table 3 of the Planning Practice Guidance identifies that any development is considered appropriate within Flood Zone 1.

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception test required	✓	✓
Flood Zone 3a	Exception test required	✓	x	Exception test required	✓
Flood Zone 3b	Exception test required	✓	x	x	x

### Other Relevant Policy and Guidance

#### *Strategic Flood Risk Assessment*

- 1.15 The Lancashire Strategic Flood Risk Assessment<sup>3</sup> (SFRA) was prepared to review flood risks on a much wider scale to assess the potential for new development within the study area. The SFRA was used as an evidence base for Local Development Frameworks for each Local Planning Authority.
- 1.16 The SFRA therefore aims to bring together all available flood risk information for a variety of sources to provide a robust assessment. The SFRA therefore is useful for this site-specific FRA by highlighting available data and instances of known flooding in the area. Although written under the guidance of Planning Policy Statement 25, the SFRA is still considered to include relevant information.

## 2.0 POTENTIAL SOURCES OF FLOOD RISK

2.1 The table below identifies the potential sources of flood risk to the site, and the impacts which the development could have in the wider catchment prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 3.0**.

**Table 2.1 - Pre-Mitigation Sources of Flood Risk**

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial			X		The site is located in flood zone 1.
Tidal				X	There are no tidal influences effecting the site.
Canals				X	None present.
Groundwater			X		Ground conditions are not conducive to fluctuating groundwater levels.
Reservoirs and waterbodies				X	The site is shown to fall outside of the catchment for reservoir and waterbodies flooding.
Sewers			X		The site in question is higher than the surrounding sewers therefore there is a very low risk.
Pluvial runoff		X			An area of the site is within a high-risk area of surface water flooding.
Effect of Development on Wider Catchment			X		The impermeable area of the site is being increased however the surface water will be attenuated at greenfield run-off rates.

### Fluvial Flood Risk

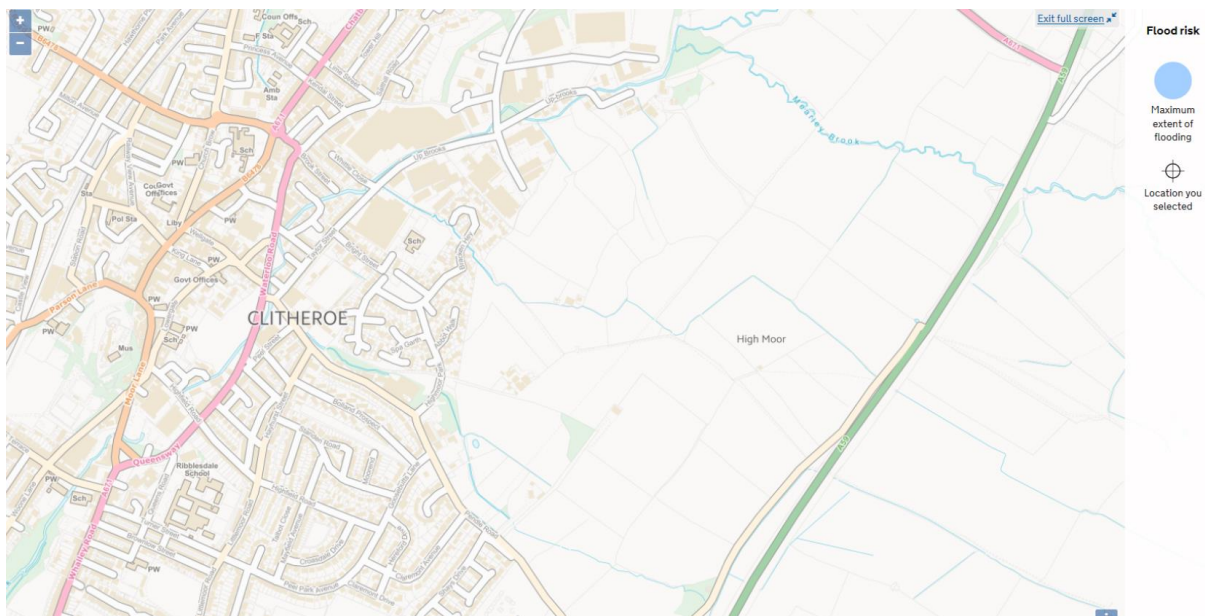
- 2.2 As previously mentioned, the site is shown to be within Flood Zone 1 and therefore poses a low risk to the proposed development.
- 2.3 The risk of flooding posed to the proposed development is low. This is because there is only two watercourses near the site that can pose a threat. However, the watercourses are at low points compared to the site and therefore pose a minimal risk.
- 2.4 Mitigation measures to address the residual risk posed by the watercourses surrounding the site are discussed within **Section 3.0** of this report.

### Groundwater Flood Risk

- 2.5 Subject to completion of site investigation to confirm we would assume that natural ground water level is located well below the site surface and the nature of the strata means it is unlikely that there will be perched water above this level.
- 2.6 We therefore do not consider there is a risk of groundwater flooding affecting the development subject to final confirmation upon completion of suitable site investigation.

### Flood Risk from Reservoirs & Large Waterbodies

- 2.7 Reservoir failure flood risk mapping has been prepared by the Environment Agency, this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide. An extract from the mapping is included as **Figure 2.1**.



**Figure 2.1 - Environment Agency Reservoir Failure Flood Risk Map**

- 2.8 Mapping demonstrates the site and possible access routes are far removed from the flood extent associated with flooding from large reservoirs. A review of Ordnance Survey mapping shows that no areas or reservoir flooding encroach the site.
- 2.9 As such, there is considered to be no risk from reservoir flooding.

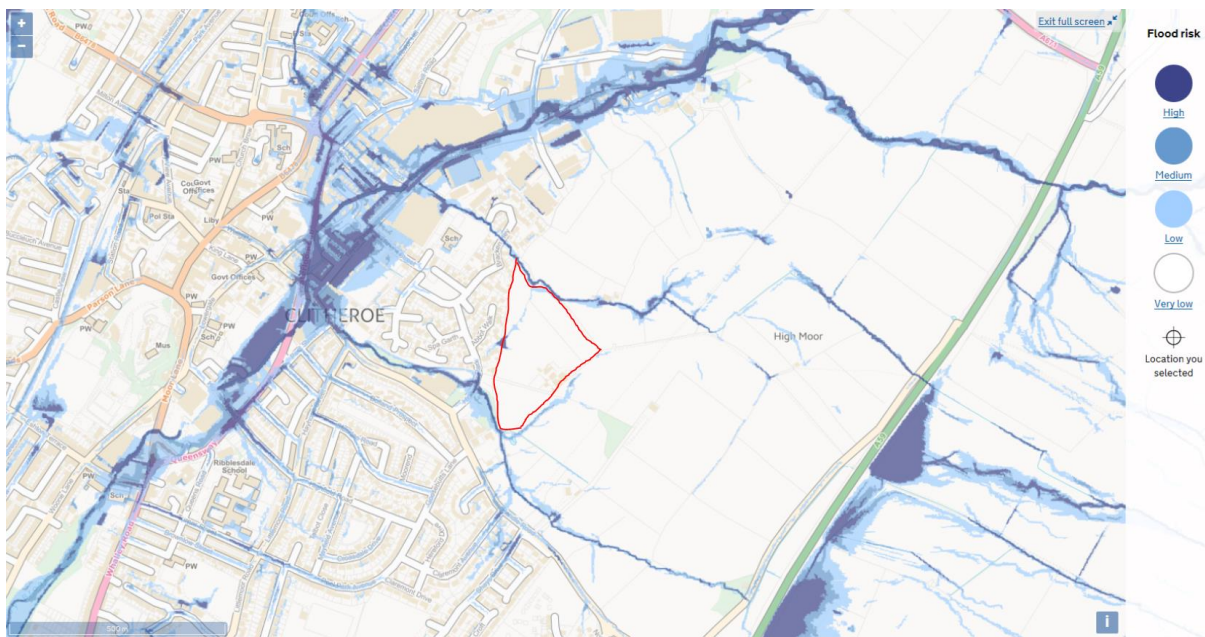


### Flood Risk from Sewers

- 2.10 The site in question lies above any main roads which is potentially where any United Utilities sewers will lie.
- 2.11 As such, it is considered that there is no risk of flooding from sewers.

### Pluvial Flood Risk

- 2.12 Risk of flooding from surface water mapping has been prepared by the Environment Agency, this shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. An extract from the mapping is included as **Figure 2.2**



**Figure 2.2 - Risk of Flooding from Surface Water Mapping**

- 2.13 The mapping produced by the Environment Agency shows that there are several small areas of the site that are at risk of surface water flooding. These areas will be attenuated and therefore be drained correctly. It is also noted that the site boundary has been adjusted to be removed from any areas of surface water flooding from the north and south of the site.
- 2.14 Therefore, the risk posed by this threat is considered negligible.

## **Effect of Development on Wider Catchment**

### *Development Drainage*

- 2.15 The current site is considered to be greenfield. Therefore, the amount of impermeable area that is going to be introduced onto the site will cause a large-scale change. Furthermore, this will increase the amount of potential surface water run-off coming from the site. However, this increase will pose a minimal risk to the wider catchment as the surface water will be attenuated and all surface water will be drained into suitable systems at greenfield run off rates.

### **3.0 FLOOD RISK MITIGATION**

- 3.1 **Section 2.0** has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be considered within the proposed development detail design to address and reduce the risk of flooding to within acceptable levels.

#### **Site Arrangements**

##### *Sequential Arrangement*

- 3.2 The Flood Zone mapping shows the site to be located within flood zone 1

##### *Finished Levels*

- 3.3 Given the site's location within Flood Zone 1, there are no specific requirements for finished floor levels with regard to flood risk. These levels may be set in accordance with wider design requirements.
- 3.4 Nevertheless, it is recommended that a nominal elevation above immediately surrounding ground levels should be provided to deter any potential overland flows from entering the proposed buildings.

### **Surface Water Drainage**

- 3.5 The site is currently greenfield and the impermeable area on the site is being increased and therefore a suitable drainage strategy will be designed for the site.
- Usual drainage hierarchy applies. The method of infiltration must be assessed first however, Geological maps show that the site is based on mudstone which commonly has poor infiltration rates. Therefore, it is assumed that discharging surface water via infiltration is not viable for this site, subject to site testing.
  - Secondly, there are two watercourses near the site. Due to the topography of the site the northern half of the site will discharge to the northern watercourse. Likewise, the southern half of the site will discharge to the southern watercourse.
  - By using the IH124 method for 1.34ha (each half) of the site, which is being developed, the discharge rate has been calculated at 8.9l/s.
  - By assuming 50% of the developable area will be impermeable the amount of storage required for the site is 855.8m<sup>3</sup>. This will cater for the 1 in 100-year storm + 30% climate change. There will need to be this value of storage for each half of the development.
  - A suitable flow control device will be used to restrict the site to the previously mentioned discharge rate. Again, both parts of the site will require its own flow control device.

### **Foul Water Drainage**

- 3.6 It is assumed that there is a United Utilities foul sewer in Highmoor road. Upon inspection it is believed that the southern area of the site will be able to discharge via a gravity connection into the Highmoor road foul sewer. After reviewing the site, it is likely that the northern area of the site will need pumping into the foul sewers in Bracken Hay where there is evidence of sewers. The pumping compound required would be 14m x 10m with a 15m no build zone around it. Following this, a third-party agreement would be required to make the connection. Both connections would be subject to S106 agreements with United Utilities.

#### 4.0 CONCLUSIONS AND RECOMMENDATIONS

- 4.1 This Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of V H Land Partnerships.
- 4.2 This report demonstrates that the proposed development is not at significant flood risk, and simple mitigation measures have been recommended to address any residual risks that may remain. The identified risks and mitigation measures are summarised within **Table 4.1**.

**Table 4.1 - Summary of Flood Risk Assessment**

Flood Source	Proposed Mitigation Measure
Fluvial	Site is shown to be in Flood Zone 1.
Impact of the Development	Strategic surface water drainage strategy prepared for wider development will ensure a sustainable approach to surface water management.

- 4.3 In compliance with the requirements of National Planning Policy Framework, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the site.

#### **PREPARED BY**



Tom Andrews



















On Behalf of Topping Engineers

# Appendix A

## Site Location Plan



**KEY:**

-  PRIMARY VEHICLE ROUTES
-  SECONDARY VEHICLE ROUTES
-  PRIVATE DRIVES
-  PROPOSED RESIDENTIAL DEVELOPMENT
-  REAR BOUNDARIES TO DWELLINGS
-  PROPOSED TREES & HEDGEROWS
-  EXISTING HEDGEROWS / TREES TO BE RETAINED
-  KEY NODAL SPACES WITHIN DEVELOPMENT
-  KEY DWELLINGS IN PROMINENT POSITIONS
-  PROPOSED PEDESTRIAN ROUTES
-  EXISTING PUBLIC RIGHT OF WAY
-  1 PRIMARY VEHICLE ACCESS POINTS FROM HIGHMOOR PARK
-  2 RENOVATED COTTAGES
-  3 EXISTING ROADS / TRACK
-  4 AREA OF PUBLIC OPEN SPACE
-  5 PROPOSED ATTENUATION BASIN
-  6 FRONTAGE OVER RETAINED COTTAGES, RESPECTING THE SETTING
-  7 POTENTIAL CONNECTION TO FUTURE DEVELOPMENT

**DEVELOPMENT SUMMARY:**  
 GROSS SITE AREA: 12.34 AC / 5 HA  
 NETT DEVELOPABLE AREA: 8.97 AC / 3.63 HA  
 DWELLINGS ACHIEVABLE @ 30 - 35 DPH : 109 - 127



## Appendix B

### IH124 and Storage Check



Windsor House  
Cornwall Road  
Harrogate HG1 2PW



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Micro Drainage

Source Control 2017.1.2


IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	1000	Region Number	Region 10

**Results      l/s**

QBAR Rural	333.4
QBAR Urban	333.4
Q100 years	693.5
Q1 year	290.1
Q2 years	310.5
Q5 years	396.8
Q10 years	460.1
Q20 years	524.2
Q25 years	546.8
Q30 years	565.3
Q50 years	616.8
Q100 years	693.5
Q200 years	786.8
Q250 years	816.9
Q1000 years	1013.6

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Windsor House Cornwall Road Harrogate HG1 2PW		
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Micro Drainage		Source Control 2017.1.2

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 825 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	98.292	0.292	0.0	8.8	8.8	207.9	O K
30 min Summer	98.416	0.416	0.0	8.9	8.9	296.5	O K
60 min Summer	98.563	0.563	0.0	8.9	8.9	401.4	O K
120 min Summer	98.730	0.730	0.0	8.9	8.9	520.1	O K
180 min Summer	98.829	0.829	0.0	8.9	8.9	590.8	O K
240 min Summer	98.891	0.891	0.0	8.9	8.9	634.7	O K
360 min Summer	98.962	0.962	0.0	8.9	8.9	685.6	O K
480 min Summer	99.003	1.003	0.0	8.9	8.9	714.7	O K
600 min Summer	99.025	1.025	0.0	8.9	8.9	730.0	O K
720 min Summer	99.034	1.034	0.0	8.9	8.9	736.9	O K
960 min Summer	99.043	1.043	0.0	8.9	8.9	742.9	O K
1440 min Summer	99.035	1.035	0.0	8.9	8.9	737.6	O K
2160 min Summer	98.999	0.999	0.0	8.9	8.9	711.5	O K
2880 min Summer	98.950	0.950	0.0	8.9	8.9	676.8	O K
4320 min Summer	98.843	0.843	0.0	8.9	8.9	600.6	O K
5760 min Summer	98.713	0.713	0.0	8.9	8.9	508.3	O K
7200 min Summer	98.595	0.595	0.0	8.9	8.9	423.7	O K
8640 min Summer	98.497	0.497	0.0	8.9	8.9	354.5	O K
10080 min Summer	98.417	0.417	0.0	8.9	8.9	296.8	O K
15 min Winter	98.328	0.328	0.0	8.9	8.9	233.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	86.439	0.0	206.8	29
30 min Summer	61.922	0.0	299.1	44
60 min Summer	42.451	0.0	421.0	72
120 min Summer	28.192	0.0	560.2	132
180 min Summer	21.829	0.0	650.8	190
240 min Summer	18.035	0.0	717.0	248
360 min Summer	13.660	0.0	814.3	366
480 min Summer	11.213	0.0	890.8	484
600 min Summer	9.609	0.0	953.4	600
720 min Summer	8.464	0.0	1006.7	684
960 min Summer	6.918	0.0	1093.6	800
1440 min Summer	5.189	0.0	1211.6	1058
2160 min Summer	3.879	0.0	1398.6	1476
2880 min Summer	3.148	0.0	1512.8	1900
4320 min Summer	2.344	0.0	1686.9	2732
5760 min Summer	1.904	0.0	1834.9	3520
7200 min Summer	1.621	0.0	1952.5	4248
8640 min Summer	1.423	0.0	2054.8	4928
10080 min Summer	1.275	0.0	2144.9	5640
15 min Winter	86.439	0.0	232.5	29

Windsor House  
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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E (l/s)	Max Outflow Volume (m³)	Status
30 min Winter	98.468	0.468	0.0	8.9	8.9	333.6	O K
60 min Winter	98.635	0.635	0.0	8.9	8.9	452.4	O K
120 min Winter	98.826	0.826	0.0	8.9	8.9	588.7	O K
180 min Winter	98.937	0.937	0.0	8.9	8.9	668.0	O K
240 min Winter	99.009	1.009	0.0	8.9	8.9	718.8	O K
360 min Winter	99.095	1.095	0.0	8.9	8.9	779.9	O K
480 min Winter	99.147	1.147	0.0	8.9	8.9	816.9	O K
600 min Winter	99.177	1.177	0.0	8.9	8.9	838.6	O K
720 min Winter	99.194	1.194	0.0	8.9	8.9	850.4	O K
960 min Winter	99.201	1.201	0.0	8.9	8.9	855.8	O K
1440 min Winter	99.186	1.186	0.0	8.9	8.9	845.3	O K
2160 min Winter	99.128	1.128	0.0	8.9	8.9	804.0	O K
2880 min Winter	99.051	1.051	0.0	8.9	8.9	748.6	O K
4320 min Winter	98.879	0.879	0.0	8.9	8.9	626.2	O K
5760 min Winter	98.664	0.664	0.0	8.9	8.9	472.8	O K
7200 min Winter	98.488	0.488	0.0	8.9	8.9	347.7	O K
8640 min Winter	98.357	0.357	0.0	8.9	8.9	254.7	O K
10080 min Winter	98.267	0.267	0.0	8.7	8.7	190.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.922	0.0	335.5	43
60 min Winter	42.451	0.0	471.9	72
120 min Winter	28.192	0.0	627.6	130
180 min Winter	21.829	0.0	729.0	186
240 min Winter	18.035	0.0	803.0	244
360 min Winter	13.660	0.0	911.7	358
480 min Winter	11.213	0.0	996.9	472
600 min Winter	9.609	0.0	1066.4	584
720 min Winter	8.464	0.0	1125.1	694
960 min Winter	6.918	0.0	1219.0	896
1440 min Winter	5.189	0.0	1311.1	1120
2160 min Winter	3.879	0.0	1566.5	1588
2880 min Winter	3.148	0.0	1694.3	2052
4320 min Winter	2.344	0.0	1888.5	2952
5760 min Winter	1.904	0.0	2055.4	3744
7200 min Winter	1.621	0.0	2187.2	4400
8640 min Winter	1.423	0.0	2302.0	5024
10080 min Winter	1.275	0.0	2403.6	5656

Windsor House  
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 Harrogate HG1 2PW



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Micro Drainage Source Control 2017.1.2

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.000 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	750.0	750.0	1.300	0.0	954.0
1.200	750.0	954.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0135-8900-1200-8900  
 Design Head (m) 1.200  
 Design Flow (l/s) 8.9  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 135  
 Invert Level (m) 98.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	8.9
Flush-Flo™	0.357	8.9
Kick-Flo®	0.771	7.2
Mean Flow over Head Range	-	7.7

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	4.9	1.200	8.9	3.000	13.7	7.000	20.6
0.200	8.4	1.400	9.6	3.500	14.8	7.500	21.2
0.300	8.8	1.600	10.2	4.000	15.7	8.000	21.9
0.400	8.8	1.800	10.8	4.500	16.6	8.500	22.6
0.500	8.7	2.000	11.3	5.000	17.5	9.000	23.2
0.600	8.4	2.200	11.8	5.500	18.3	9.500	23.8
0.800	7.4	2.400	12.3	6.000	19.1		
1.000	8.2	2.600	12.8	6.500	19.8		