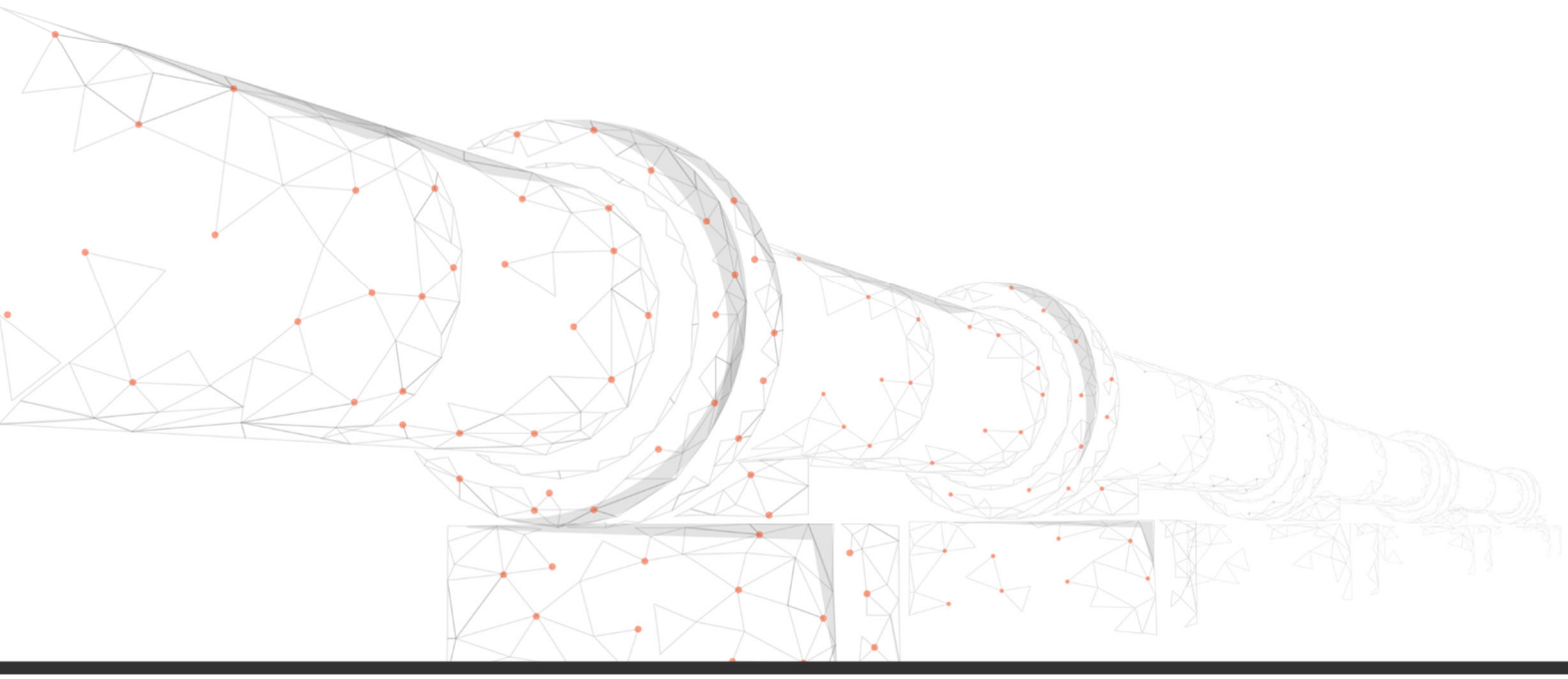
HyNet North West

Annex C

PROPOSED STORAGE CALCULATIONS Rev B



Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Ince AGI
Site location:	Ince, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.27941° N
Longitude:	2.79829° W
Reference:	3071446808
Date:	Jul 22 2022 16:41

Site characteristics

Total site area (ha):	0.18
Significant public open space (ha):	0
Area positively drained (ha):	0.18
Impermeable area (ha):	0.18
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.18
Net impermable area for storage volume design (ha):	0.18
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.302
SPR HOST:	--	0.6

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.93
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	78.54
FEH / FSR conversion factor:	1.02	1.02
SAAR (mm):	722	722
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	1	1
Q_{BAR} for net site area (l/s):	1	1

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	94	94
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2.1	2.1	Total storage 1/100 years (m^3):	94	94

This report was produced using the storage estimation tool developed by HRWallingford 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 the use of these data in the design or operational characteristics of any drainage scheme.

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Rock Bank BVS
Site location:	Rock Bank, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.23617° N
Longitude:	2.88363° W
Reference:	2567233292
Date:	Jul 22 2022 16:53

Site characteristics

Total site area (ha):	0.1050
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.105
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.492
SPR HOST:	--	0.47

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.31
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	55
Rainfall 100 yrs 12 hrs:	--	65.52
FEH / FSR conversion factor:	1.04	1.04
SAAR (mm):	698	698
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	0.34	0.34
Q_{BAR} for net site area (l/s):	0.34	0.34

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	36	36
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m^3):	36	36

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Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Mollington BVS
Site location:	Mollington, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.22534° N
Longitude:	2.92793° W
Reference:	2036154066
Date:	Jul 22 2022 17:01

Site characteristics

Total site area (ha):	0.1050
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.1050
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.682
SPR HOST:	--	0.3

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.16
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	55
Rainfall 100 yrs 12 hrs:	--	65.52
FEH / FSR conversion factor:	1.04	1.04
SAAR (mm):	699	699
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.17	0.17
Q_{BAR} for net site area (l/s):	0.17	0.17

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	36	36
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m^3):	36	36

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Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Aston Hall BVS
Site location:	Aston Hall, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.19439° N
Longitude:	3.03233° W
Reference:	75357765
Date:	Jul 22 2022 17:03

Site characteristics

Total site area (ha):	0.1050
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.1050
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.492
SPR HOST:	--	0.47

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.34
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	75.92
FEH / FSR conversion factor:	1.04	1.04
SAAR (mm):	719	719
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.36	0.36
Q_{BAR} for net site area (l/s):	0.36	0.36

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	39	39
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m^3):	39	39

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Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Kyra Wilson
Site name:	Northop Hall AGI
Site location:	Northop Hall, England

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.20370° N
Longitude:	3.11094° W
Reference:	952990071
Date:	Mar 21 2023 12:47

Site characteristics

Total site area (ha):	0.115
Significant public open space (ha):	0
Area positively drained (ha):	0.115
Impermeable area (ha):	0.115
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.12
Net impermable area for storage volume design (ha):	0.12
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics	Default	Edited
HOST class:	--	
BFI HOST:	--	0.492
SPR HOST:	--	0.47

Hydrological characteristics	Default	Edited
Q_{MED}:	--	0.46
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	77.38
FEH / FSR conversion factor:	1.06	1.06
SAAR (mm):	787	787
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.5	0.5
Q_{BAR} for net site area (l/s):	0.5	0.5

Site discharge rates	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	54	54
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	54	54

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	51.327	0.197	2.0	201.6	O K
30 min Summer	51.390	0.260	2.0	269.9	Flood Risk
60 min Summer	51.458	0.328	2.0	346.3	Flood Risk
120 min Summer	51.513	0.383	2.0	408.6	Flood Risk
180 min Summer	51.544	0.414	2.0	444.7	Flood Risk
240 min Summer	51.564	0.434	2.0	469.1	Flood Risk
360 min Summer	51.590	0.460	2.0	500.1	Flood Risk
480 min Summer	51.605	0.475	2.0	517.9	Flood Risk
600 min Summer	51.614	0.484	2.0	528.5	Flood Risk
720 min Summer	51.619	0.489	2.0	534.4	Flood Risk
960 min Summer	51.621	0.491	2.0	537.4	Flood Risk
1440 min Summer	51.611	0.481	2.0	524.6	Flood Risk
2160 min Summer	51.577	0.447	2.0	483.8	Flood Risk
2880 min Summer	51.548	0.418	2.0	449.2	Flood Risk
4320 min Summer	51.507	0.377	2.0	402.1	Flood Risk
5760 min Summer	51.479	0.349	2.0	369.8	Flood Risk
7200 min Summer	51.462	0.332	2.0	351.1	Flood Risk
8640 min Summer	51.452	0.322	2.0	339.5	Flood Risk
10080 min Summer	51.448	0.318	2.0	334.3	Flood Risk
15 min Winter	51.327	0.197	2.0	201.6	O K
30 min Winter	51.390	0.260	2.0	270.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	154.086	0.0	168.8	27
30 min Summer	103.378	0.0	163.6	42
60 min Summer	66.653	0.0	320.7	72
120 min Summer	39.817	0.0	309.9	130
180 min Summer	29.225	0.0	305.6	190
240 min Summer	23.384	0.0	303.6	250
360 min Summer	16.986	0.0	302.8	370
480 min Summer	13.480	0.0	303.7	488
600 min Summer	11.238	0.0	305.4	608
720 min Summer	9.671	0.0	307.4	728
960 min Summer	7.608	0.0	311.4	966
1440 min Summer	5.395	0.0	316.2	1444
2160 min Summer	3.796	0.0	629.7	2144
2880 min Summer	2.958	0.0	617.0	2452
4320 min Summer	2.087	0.0	576.3	3168
5760 min Summer	1.645	0.0	838.8	3984
7200 min Summer	1.395	0.0	888.9	4832
8640 min Summer	1.236	0.0	945.1	5704
10080 min Summer	1.128	0.0	1006.6	6552
15 min Winter	154.086	0.0	168.8	27
30 min Winter	103.378	0.0	163.6	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	51.458	0.328	2.0	346.4	Flood Risk
120 min Winter	51.513	0.383	2.0	408.9	Flood Risk
180 min Winter	51.544	0.414	2.0	445.2	Flood Risk
240 min Winter	51.565	0.435	2.0	469.8	Flood Risk
360 min Winter	51.591	0.461	2.0	501.2	Flood Risk
480 min Winter	51.607	0.477	2.0	519.4	Flood Risk
600 min Winter	51.616	0.486	2.0	530.4	Flood Risk
720 min Winter	51.621	0.491	2.0	536.7	Flood Risk
960 min Winter	51.624	0.494	2.0	540.5	Flood Risk
1440 min Winter	51.615	0.485	2.0	530.1	Flood Risk
2160 min Winter	51.585	0.455	2.0	493.8	Flood Risk
2880 min Winter	51.551	0.421	2.0	452.9	Flood Risk
4320 min Winter	51.502	0.372	2.0	396.4	Flood Risk
5760 min Winter	51.462	0.332	2.0	351.0	Flood Risk
7200 min Winter	51.432	0.302	2.0	316.8	Flood Risk
8640 min Winter	51.406	0.276	2.0	288.3	Flood Risk
10080 min Winter	51.388	0.258	2.0	268.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	66.653	0.0	320.7	70
120 min Winter	39.817	0.0	309.7	128
180 min Winter	29.225	0.0	305.3	188
240 min Winter	23.384	0.0	303.2	246
360 min Winter	16.986	0.0	302.2	364
480 min Winter	13.480	0.0	302.9	480
600 min Winter	11.238	0.0	304.4	598
720 min Winter	9.671	0.0	306.3	714
960 min Winter	7.608	0.0	309.9	946
1440 min Winter	5.395	0.0	313.3	1404
2160 min Winter	3.796	0.0	624.0	2064
2880 min Winter	2.958	0.0	616.3	2680
4320 min Winter	2.087	0.0	580.8	3328
5760 min Winter	1.645	0.0	838.8	4264
7200 min Winter	1.395	0.0	888.8	5192
8640 min Winter	1.236	0.0	944.7	6048
10080 min Winter	1.128	0.0	1007.0	6864

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 325134 370797 SJ 25134 70797
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.559

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.187	4	8	0.187	8	12	0.186

Model Details

Storage is Online Cover Level (m) 51.630

Tank or Pond Structure

Invert Level (m) 51.130

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	980.2	0.500	1214.8	0.501	1215.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0070-2000-0800-2000
Design Head (m)	0.800
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	50.930
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	2.0	Kick-Flo®	0.504	1.6
Flush-Flo™	0.240	2.0	Mean Flow over Head Range	-	1.7

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	1.8	1.200	2.4	3.000	3.7	7.000	5.5
0.200	2.0	1.400	2.6	3.500	3.9	7.500	5.6
0.300	2.0	1.600	2.7	4.000	4.2	8.000	5.8
0.400	1.9	1.800	2.9	4.500	4.4	8.500	6.0
0.500	1.6	2.000	3.0	5.000	4.7	9.000	6.2
0.600	1.8	2.200	3.2	5.500	4.9	9.500	6.3
0.800	2.0	2.400	3.3	6.000	5.1		
1.000	2.2	2.600	3.4	6.500	5.3		

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Kyra Wilson
Site name:	Cornist Lane BVS
Site location:	Cornist Lane, Wales

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.24265° N
Longitude:	3.17233° W
Reference:	661935429
Date:	Mar 21 2023 12:53

Site characteristics

Total site area (ha):	0.105
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.105
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST

Soil characteristics	Default	Edited
HOST class:	--	
BFI HOST:	--	0.492
SPR HOST:	--	0.47

Hydrological characteristics	Default	Edited
Q_{MED}:	--	0.48
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	77.38
FEH / FSR conversion factor:	1.06	1.06
SAAR (mm):	831	831
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.52	0.52
Q_{BAR} for net site area (l/s):	0.52	0.52

Site discharge rates	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	46	46
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	46	46

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Pentre Halkyn BVS
Site location:	Pentre Halkyn, Wales

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.25007° N
Longitude:	3.23855° W
Reference:	3469493473
Date:	Jul 22 2022 17:17

Site characteristics

Total site area (ha):	0.105
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.105
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.682
SPR HOST:	--	0.21

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.27
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	76.65
FEH / FSR conversion factor:	1.05	1.05
SAAR (mm):	875	875
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.29	0.29
Q_{BAR} for net site area (l/s):	0.29	0.29

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	40	40
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m^3):	40	40

This report was produced using the storage estimation tool developed by HRWallingford 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 the use of these data in the design or operational characteristics of any drainage scheme.

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Megan Au
Site name:	Babell BVS
Site location:	Babell, Wales

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.26070° N
Longitude:	3.27731° W
Reference:	247217570
Date:	Jul 22 2022 17:20

Site characteristics

Total site area (ha):	0.1050
Significant public open space (ha):	0
Area positively drained (ha):	0.105
Impermeable area (ha):	0.105
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.11
Net impermable area for storage volume design (ha):	0.11
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant

Soil characteristics

	Default	Edited
HOST class:	--	
BFI HOST:	--	0.682
SPR HOST:	--	0.3

Hydrological characteristics

	Default	Edited
Q_{MED}:	--	0.26
Q_{BAR} / Q_{MED} conversion factor:	--	1.075
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	75.92
FEH / FSR conversion factor:	1.04	1.04
SAAR (mm):	859	859
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Q_{BAR} for total site area (l/s):	0.28	0.28
Q_{BAR} for net site area (l/s):	0.28	0.28

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	2	2	Attenuation storage 1/100 years (m^3):	39	39
1 in 30 years (l/s):	2	2	Long term storage 1/100 years (m^3):	0	0
1 in 100 year (l/s):	2	2	Total storage 1/100 years (m^3):	39	39

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