

Client: Mr A Fraser	Project No.	1801
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Project: Fursdon House, Blunts Lane, Plymouth, PL6 8BE	Date:	May-23
	By:	GPW

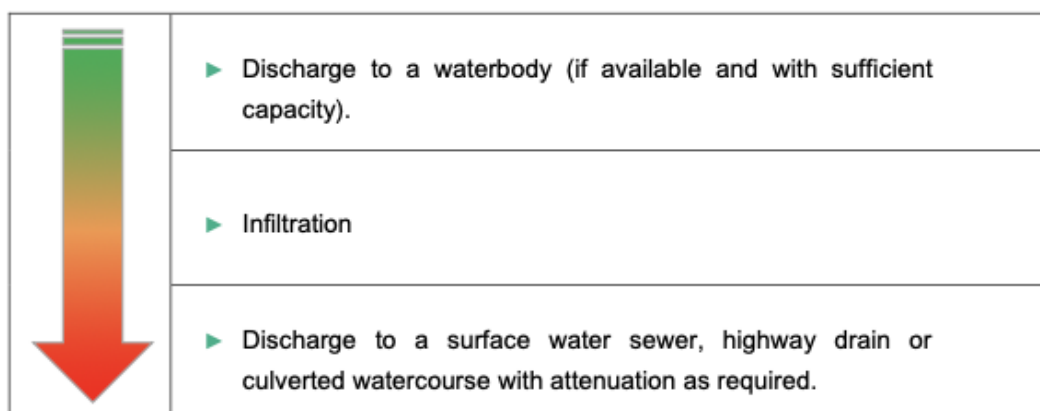
PREFACE

EXISTING

Currently the site has no formal drainage.

SURFACE WATER DRAINAGE HIERARCHY

The below is an extract from the Local Flood Risk Management Strategy Part 2 - Technical Guidance (by Plymouth City Council).



WATERCOURSES

It is not possible to discharge the surface water to a watercourse. While there is a watercourse located to the west, thus would require routeing over third-party land. It is understood this land is subject to a pre-app and it is their intention to develop the land. It is also understood that area along the watercourse will be commuted to PCC.

SOAKAWAYS

Soakaways are a viable option (using infiltration rates related with TP01 – [Soil Infiltration Report](#), by STG Engineering)

CALCULATION SHEET.REV1

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PEAK RAINFALL INTENSITY ALLOWANCES

Climate Change Allowances showing anticipated changes in peak rainfall intensity in small catchments (less than 5km²), or urbanised drainage catchments.

River District	Basin	Allowance Category	2020s	2050s	2070s
Tamar Management Catchment		Upper end (1%)	-	45%	50%
		Central (1%)	-	25%	30%
		Upper End (3.3%)	-	40%	45%
		Central (3.3%)	-	20%	30%

Extract from [Peak Rainfall Allowances](#)

For surface water design, for developments with a lifetime beyond 2100, [the upper end allowance for the 1% annual exceedance probability event, in the 2070s epoch, should be assessed.](#)

Therefore, the design rainfall intensity for this site is the 1 in 100 year (+50%) event.

EXCEEDANCE FLOWS

Due to the topography, any exceedance flows from the attenuation will run west, over private ground, towards the unnamed watercourse.

CALCULATION SHEET.REV1

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DESIGN SUMMARY

The below analysis provides design for the 1 in 100yr (+50% CC) event.

PRE DEVELOPMENT

Area of site	573m²
Area of un-developed site	356m²
Area of developed site	217m²

PROPOSED DEVELOPED AREAS

Buildings	114m²
Parking / Yards	76m²
Total Area	190m²

CALCULATION SHEET.REV1

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SOAKAWAY 1

Area Drained

Roofs & Hardstandings	190m²
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Try cellular Soakaway

Size =	<i>4m × 3m × 0.6m deep clean stone soakaway</i>
Porosity =	40%
Volume =	$4 \times 3 \times 0.6 \times 0.40 = \mathbf{2.88m^3}$
Infiltration rate	$= \mathbf{4.42 \times 10^{-4}m/s}$

Design Soakaway using MicroDrainage for 1 in 100yr + 50% climate change

Max storage required =	$2.209m^3 < 2.88m^3 \therefore \mathbf{OK}$
I.e. Depth Required =	$0.518m < 0.600m \therefore \mathbf{OK}$
Time to half drain =	$6m \leq 1440m (24hrs) \therefore \mathbf{OK}$

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Total Area

Type : Catchment Area

Area (ha)	0.019
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Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100

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Clean Stone Soakaway

Type : Infiltration Trench

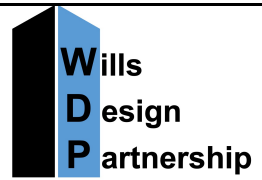
Dimensions

Exceedance Elevation (m)	67.378
Depth (m)	0.600
Base Elevation (m)	66.778
Freeboard (mm)	0
Porosity (%)	40
Length (m)	4.000
Long. Slope (1:x)	10000.00
Width (m)	3.000
Total Volume (m³)	2.880

Advanced

Base Infiltration Rate (m/hr)	1.591
Side Infiltration Rate (m/hr)	1.591
Safety Factor	2.0
Conductivity (m/hr)	500.0

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Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	<input type="checkbox"/>

Rainfall

FSR	Type: FSR
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Region	England and Wales
M5-60 (mm)	18.0
Ratio R	0.300
Summer	<input checked="" type="checkbox"/>
Winter	<input checked="" type="checkbox"/>

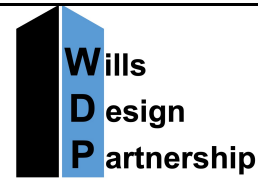
Return Period

Return Period (years)	Increase Rainfall (%)
100.0	50.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

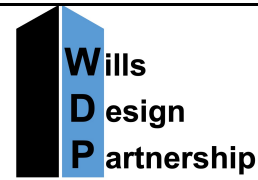
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Report Details: Type: Stormwater Controls Summary Storm Phase: 1 in 100yr + cc	Company Address: Wills Design Partnership Homeleigh, Widegates Looe, PL13 1QB		



Summary Results for Clean Stone Soakaway: Rank By: Max. Avg. Depth

Storm Event	Max. US Elevation (m)	Max. DS Elevation (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
FSR: 100 years: +50 %: 15 mins: Summer	67.230	67.097	0.451	0.319	9.4	1.849	0.000	4.254	0.0	0.000	11	35.784	OK
FSR: 100 years: +50 %: 15 mins: Winter	67.284	67.158	0.506	0.380	9.9	2.125	0.000	4.759	0.0	0.000	12	26.211	OK
FSR: 100 years: +50 %: 30 mins: Summer	67.260	67.125	0.482	0.347	6.8	1.882	0.000	5.864	0.0	0.000	5	34.653	OK
FSR: 100 years: +50 %: 30 mins: Winter	67.296	67.193	0.518	0.415	7.1	2.209	0.000	6.579	0.0	0.000	6	23.282	OK
FSR: 100 years: +50 %: 60 mins: Summer	67.237	67.110	0.459	0.332	6.2	1.857	0.000	7.755	0.0	0.000	5	35.513	OK
FSR: 100 years: +50 %: 60 mins: Winter	67.233	67.103	0.455	0.325	5.6	1.873	0.000	8.692	0.0	0.000	7	34.975	OK
FSR: 100 years: +50 %: 120 mins: Summer	67.144	66.978	0.366	0.200	4.7	1.332	0.000	9.908	0.0	0.000	5	53.742	OK
FSR: 100 years: +50 %: 120 mins: Winter	67.086	66.890	0.307	0.112	3.8	0.994	0.000	11.114	0.0	0.000	4	65.471	OK
FSR: 100 years: +50 %: 180 mins: Summer	67.078	66.858	0.300	0.080	3.8	0.871	0.000	11.265	0.0	0.000	2	69.750	OK
FSR: 100 years: +50 %: 180 mins: Winter	67.016	66.778	0.237	0.000	2.9	0.569	0.000	12.614	0.0	0.000	2	80.249	OK
FSR: 100 years: +50 %: 240 mins: Summer	67.032	66.778	0.254	0.000	3.2	0.607	0.000	12.224	0.0	0.000	2	78.923	OK
FSR: 100 years: +50 %: 240 mins: Winter	66.965	66.778	0.187	0.000	2.4	0.448	0.000	13.675	0.0	0.000	2	84.453	OK
FSR: 100 years: +50 %: 360 mins: Summer	66.962	66.778	0.184	0.000	2.4	0.440	0.000	13.663	0.0	0.000	2	84.730	OK
FSR: 100 years: +50 %: 360 mins: Winter	66.889	66.778	0.111	0.000	1.8	0.266	0.000	15.295	0.0	0.000	1	90.778	OK

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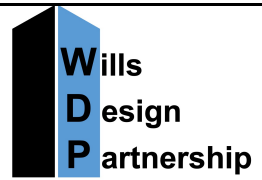
FSR: 100 years: +50 %: 480 mins: Summer	66.911	66.778	0.132	0.000	2.0	0.318	0.000	14.767	0.0	0.000	2	88.945	OK
FSR: 100 years: +50 %: 480 mins: Winter	66.816	66.778	0.038	0.000	1.5	0.090	0.000	16.567	0.0	0.000	0	96.858	OK
FSR: 100 years: +50 %: 600 mins: Summer	66.865	66.778	0.086	0.000	1.7	0.207	0.000	15.691	0.0	0.000	1	92.806	OK
FSR: 100 years: +50 %: 600 mins: Winter	66.778	66.778	0.000	0.000	1.2	0.000	0.000	17.604	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 720 mins: Summer	66.817	66.778	0.039	0.000	1.5	0.094	0.000	16.465	0.0	0.000	0	96.751	OK
FSR: 100 years: +50 %: 720 mins: Winter	66.778	66.778	0.000	0.000	1.1	0.000	0.000	18.438	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 960 mins: Summer	66.778	66.778	0.000	0.000	1.2	0.000	0.000	17.742	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 960 mins: Winter	66.778	66.778	0.000	0.000	0.9	0.000	0.000	19.830	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 1440 mins: Summer	66.778	66.778	0.000	0.000	0.9	0.000	0.000	19.692	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 1440 mins: Winter	66.778	66.778	0.000	0.000	0.7	0.000	0.000	21.978	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 2160 mins: Summer	66.778	66.778	0.000	0.000	0.7	0.000	0.000	21.786	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 2160 mins: Winter	66.778	66.778	0.000	0.000	0.5	0.000	0.000	24.318	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 2880 mins: Summer	66.778	66.778	0.000	0.000	0.5	0.000	0.000	23.352	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 2880 mins: Winter	66.778	66.778	0.000	0.000	0.4	0.000	0.000	26.142	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 4320 mins: Summer	66.778	66.778	0.000	0.000	0.4	0.000	0.000	25.698	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 4320 mins: Winter	66.778	66.778	0.000	0.000	0.3	0.000	0.000	28.764	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 5760 mins: Summer	66.778	66.778	0.000	0.000	0.3	0.000	0.000	27.714	0.0	0.000	0	100.000	OK

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FSR: 100 years: +50 %: 5760 mins: Winter	66.778	66.778	0.000	0.000	0.2	0.000	0.000	30.828	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 7200 mins: Summer	66.778	66.778	0.000	0.000	0.3	0.000	0.000	28.704	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 7200 mins: Winter	66.778	66.778	0.000	0.000	0.2	0.000	0.000	32.220	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 8640 mins: Summer	66.778	66.778	0.000	0.000	0.2	0.000	0.000	30.258	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 8640 mins: Winter	66.778	66.778	0.000	0.000	0.2	0.000	0.000	34.110	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 10080 mins: Summer	66.778	66.778	0.000	0.000	0.2	0.000	0.000	31.686	0.0	0.000	0	100.000	OK
FSR: 100 years: +50 %: 10080 mins: Winter	66.778	66.778	0.000	0.000	0.2	0.000	0.000	36.030	0.0	0.000	0	100.000	OK

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Report Details: Type: Phase Management Storm Phase: 1 in 100yr + cc	Company Address: Wills Design Partnership Homeleigh, Widegates Looe, PL13 1QB		



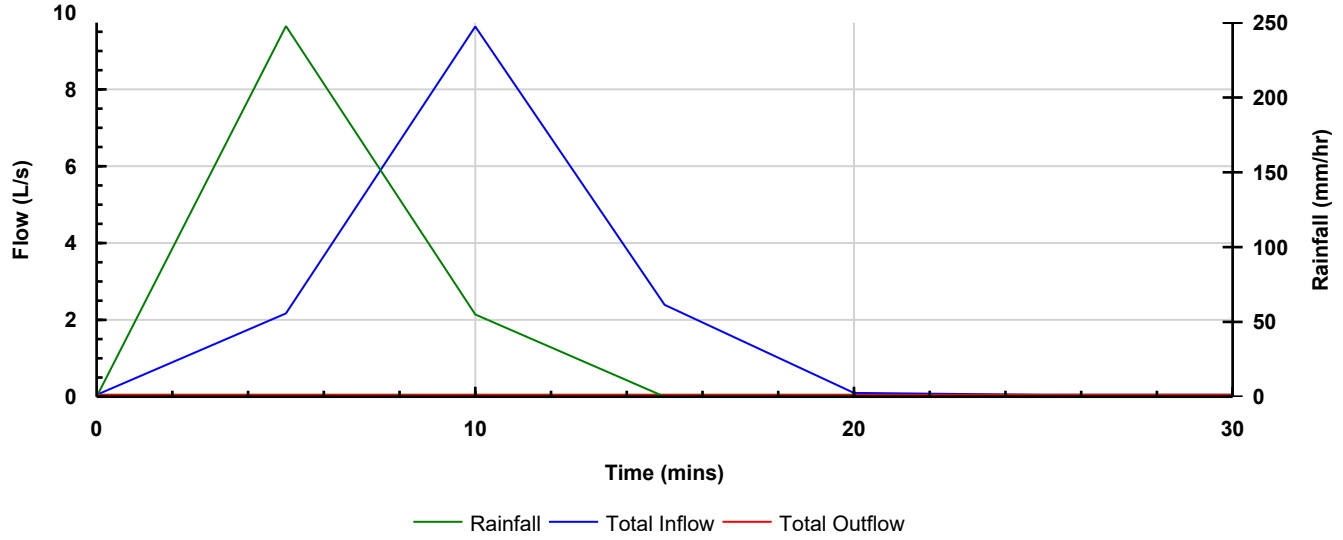
1 in 100yr + cc
FSR: 100 years: Increase Rainfall (%): +50: 15 mins: Summer

Tables

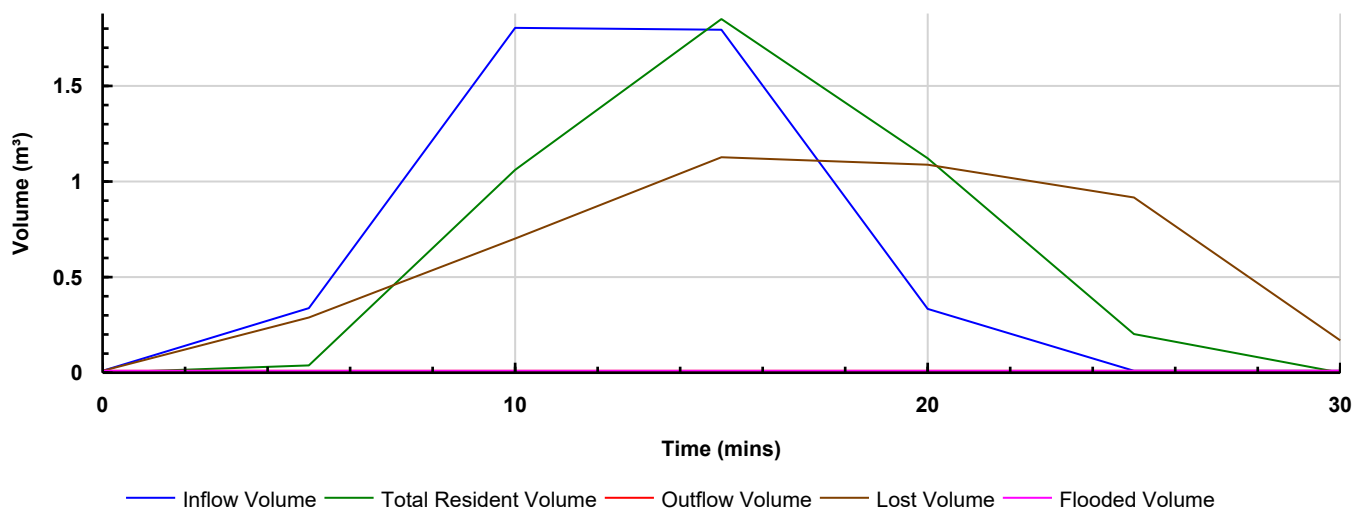
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)	Rainfall Volume (m³)	Runoff Reduction Rate (%)
TOTAL	9.6	4.252	0.0	0.000	5.663	0

Graphs

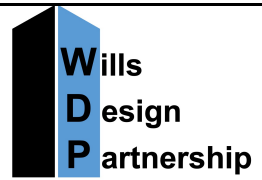
Flow Graph



Volume Graph



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Report Details: Type: Inflow Results Storm Phase: 1 in 100yr + cc	Company Address: Wills Design Partnership Homeleigh, Widegates Looe, PL13 1QB		



Total Area
Critical Storm: FSR: 100 years: Increase Rainfall (%): +50: 15 mins: Winter

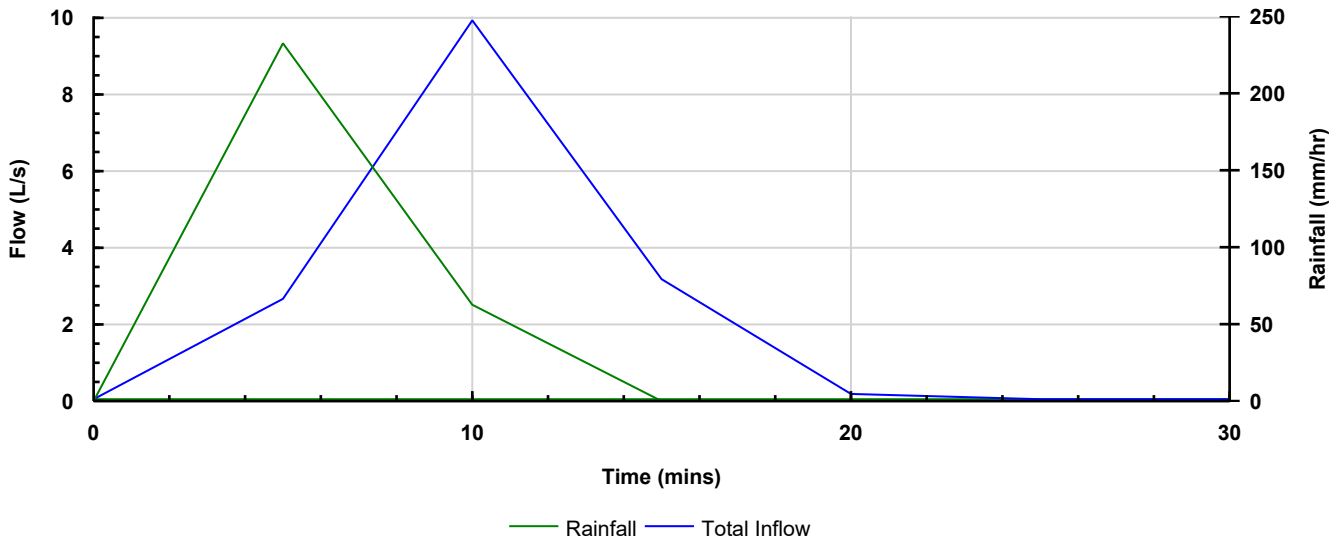
Type : Catchment Area


Inflow

Max. Inflow (L/s)	9.9
Total Inflow Volume (m ³)	4.756

Graphs

Flow Graph



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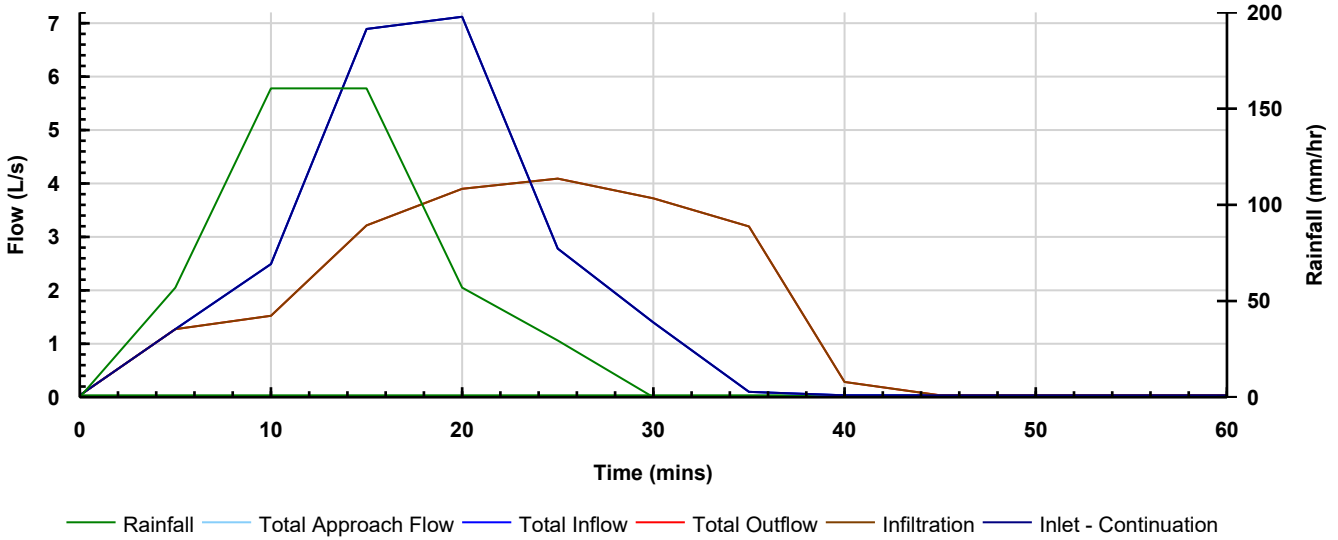


Clean Stone Soakaway
Critical Storm: FSR: 100 years: Increase Rainfall (%): +50: 30 mins: Winter

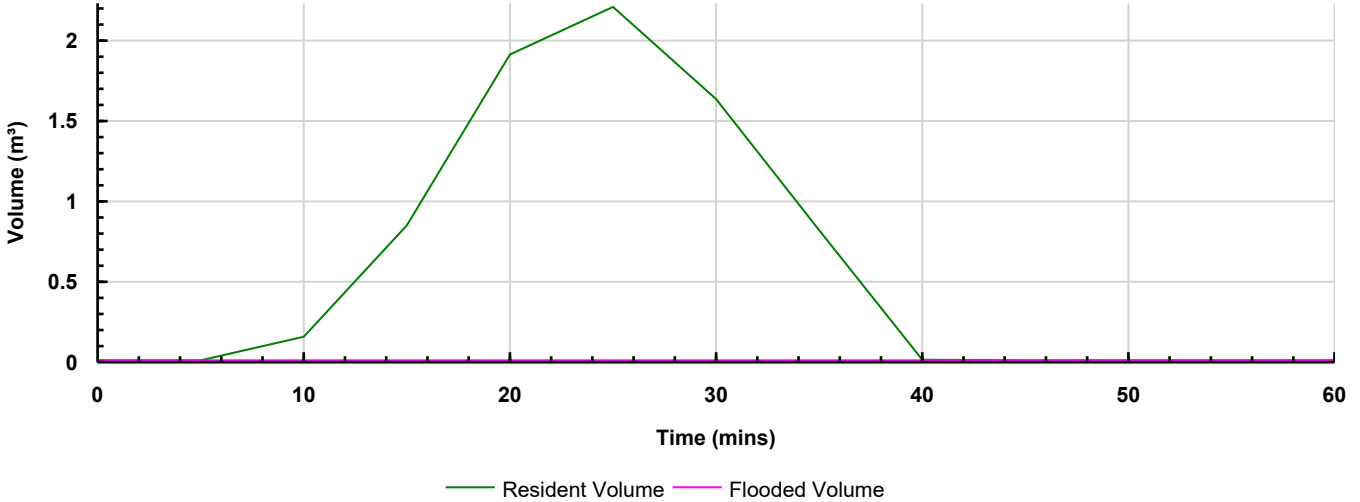
Type : Infiltration Trench

Graphs

Flow Graph



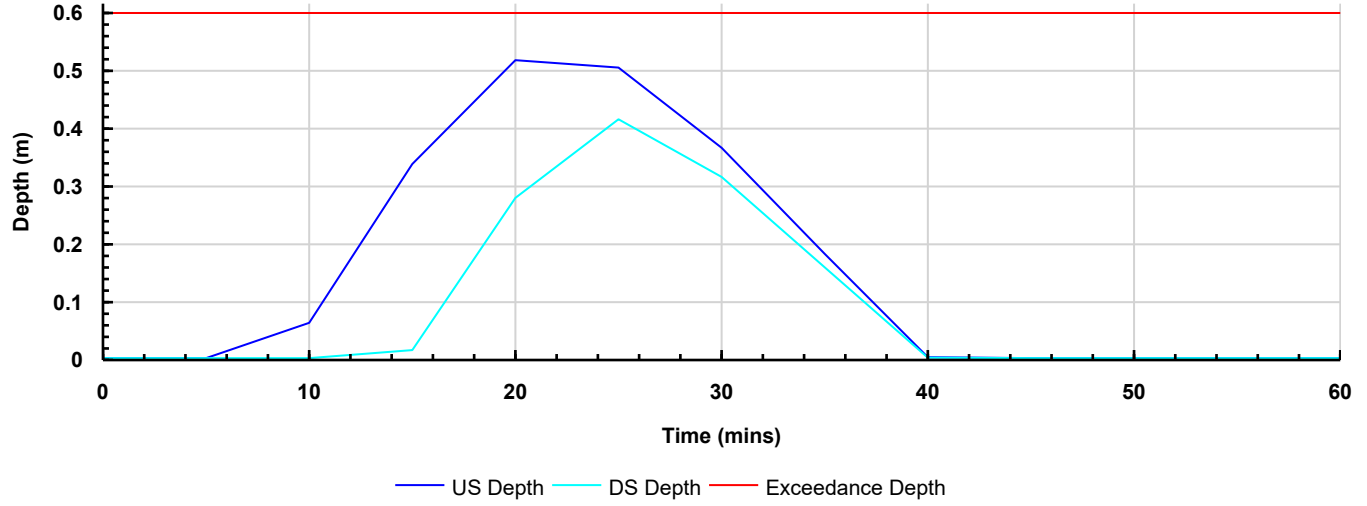
Volume Graph



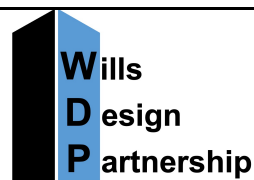
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Depth Graph



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Tables

Half Drain Down Time (mins)	6
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Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m ³)	Flooded Volume (m ³)	Total Outflow (L/s)
0	0.0	0.000	0.000	0.000	0.000	0.0
5	1.2	0.000	0.000	0.000	0.000	1.2
10	2.5	0.061	0.000	0.147	0.000	1.5
15	6.9	0.337	0.014	0.844	0.000	3.2
20	7.1	0.518	0.279	1.912	0.000	3.9
25	2.8	0.505	0.415	2.209	0.000	4.1
30	1.4	0.366	0.315	1.633	0.000	3.7
35	0.1	0.181	0.158	0.814	0.000	3.2
40	0.0	0.002	0.001	0.004	0.000	0.3
45	0.0	0.000	0.000	0.000	0.000	0.0
50	0.0	0.000	0.000	0.000	0.000	0.0
55	0.0	0.000	0.000	0.000	0.000	0.0
60	0.0	0.000	0.000	0.000	0.000	0.0