2882 – Arbour Lodge Care Home – Extension – July 2022

The site at Buxton Lane, Stockport is to be developed as a Care Home.

Intrusive site investigation was undertaken in the areas available in March 2020 which included permeability testing. The permeability test recorded rates of:

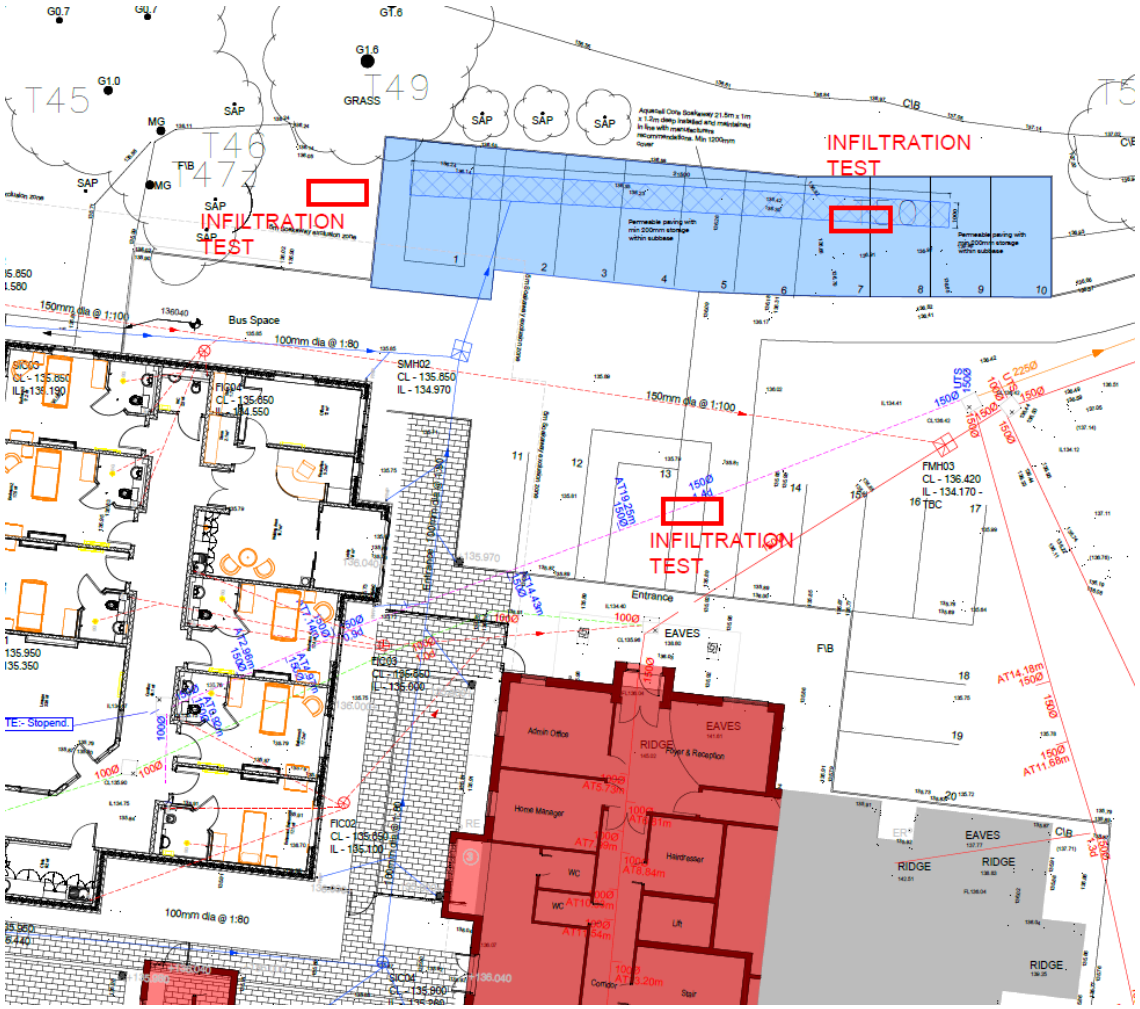
Test 1 - 1.9x10-5m/s

Test 2 - 2.3x10-5m/s

A third test was not complete to due time constraints on site during the original site investigation.

As detailed on the original drainage strategy report infiltration testing to BRE365 is required to verify ground conditions prior to commencing works on site. Access to the proposed soakaway location has been limited during construction of the extension due to the site compound and site cabins.

Further site testing was undertaken in June and July 2022 at three locations around the proposed soakaway location as indicated on the plan below and photos.



Plan 1 – Locations of infiltration testing completed 2022

Example photos of trial pits holding water with no infiltration observed over 12 hour period.

Photo 1 & 2 – Trial pits showing standing water

Photo 3 – Excavation of second trial pit within clay strata

Photo 4 – Excavation of third trial pit but still in clay formation.

Excavation of each trial pit has exposed clay strata with occasional bands of sand. Excavation depths were increased to 3m+ to find suitable strata. Each test failed with minimum infiltration observed.

From a review of the original SI it appear the original test was undertaken in an area of previously disturbed ground which is likely why the original testing proved successful. Comments from SI below:

The trial pit encountered 0.40m of soft sandy gravelly Topsoil with brick rubble, over 0.20m of Made Ground comprising soft to firm sandy gravelly Clay with roots, on a further 0.90m of possible disturbed/Made Ground comprising silty sandy Clay. At 1.40m bgl is a 0.10m band of Sand and Gravel with the hole terminating at 2.00m in sandy gravelly Clay with cobbles.

Given the space available around the site all possible locations for a soakaway have been considered and due to the clay strata observed the use of soakaways is not considered suitable.

There are no watercourses in proximity to the site. Following the hierarchy of surface water discharge it is therefore proposed to connect the surface water discharge from the extension into the existing drainage system with a restricted discharge. It is proposed to restrict the discharge to 2l/s. Flow rates of less that 2l/s are more prone to blockages.

Attenuation storage designed to accommodate up to 1 in 100 year rainfall events with 40% allowance for climate change.

Existing and Proposed Impermeable areas – See appendix A for plans

- Existing Care Home including courtyards = 2333m2
- Existing Access Road and Car Park – 1561m2
- Existing Total = 4486m2

- Remaining Care Home Building including courtyards = 2193m3
- Extension Building = 380m2
- Revised Access Road and Car Park = 1485m2 + 135m2 + 196m2 = 1816m2
- Proposed Total = 4354m2

From the impermeable areas noted above it is noted that the proposed layout provides a reduction of 132m2 of impermeable area compared to the existing site. This is a 3% reduction to the existing.

The surface water from the existing building and access road/car park areas are all drained via an existing system which combines with a foul run within the access road before discharging into Buxton Road. A separate foul system is also shown serving the building and discharging into Buxton Road.

The new car parking to the North of the site has already been installed as a Type A permeable paving with infiltration to the ground. Therefore the total impermeable area to the site is reduced to 4158m2 which is a 328m2 reduction compared to the existing site, a 7% reduction.

It is proposed to drain the extension building and the new car park adjacent via an attenuation solution with a discharge limited to 2l/s. The system has been designed to accommodate rainfall events over a range of storm durations up to a 1 in 100 year rainfall event with a 40% allowance for climate change.

Extension Building and adjacent Car Park

Proposed Impermeable area = 380 + 135 + 332 = 515m2. A 16.87m x 3.61m x 0.614m deep with 95% void ratio attenuation solution is required to accommodate the 515m2 impermeable area with a discharge of 2l/s over a range of storm durations for up to 1 in 100 year rainfall events with 40% allowance for climate change.

New Car Parking Area North

Proposed Areas = 196m2. It is proposed to use permeable paving with infiltration to the new car park area. From TEDDS calculations attached the minimum depth of permeable paving storage required is 75mm to accommodate 1:100 yr rainfall event over a range of storm durations with 40% allowance for climate change. This is based on a 30% void ratio within the subbase. It is noted that for the structural design a minimum depth of 200mm will be required.

Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Inflows Storm Phase: Phase	Company Address:		

Catchment Area

Type : Catchment Area

Area (ha)	0.085

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

Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Cellular Storage

Type : Cellular Storage

Dimensions

Exceedence Level (m)	10.010
Depth (m)	0.614
Base Level (m)	9.386
Number of Crates Long	1
Number of Crates Wide	1
Number of Crates High	1
Porosity (%)	95
Crate Length (m)	16.87
Crate Width (m)	3.61
Crate Height (m)	0.614
Total Volume (m³)	35.533

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

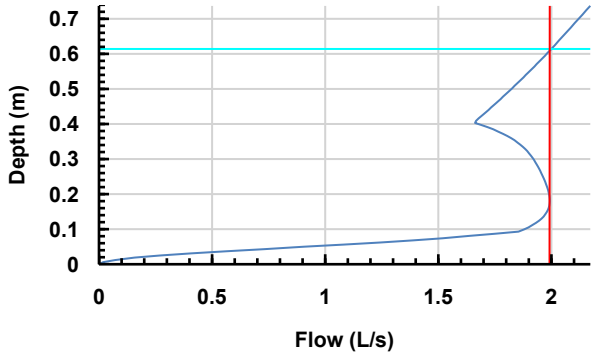
Outlets

Outlet

Outgoing Connection	(None)
Outlet Type	Hydro-Brake®

Invert Level (m)	9.386
Design Depth (m)	0.614
Design Flow (L/s)	2.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☑

Unit Reference	SHE-0073-2000-0614-2000



Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Network Design Criteria Storm Phase: Phase	Company Address:		

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:x)	500.00
Max. Slope (1:x)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Pipe Size Library

Default

Add. Increment (mm)	75

Diameter (mm)	Min. Slope (1:x)	Max. Slope (1:x)
100	0.00	0.00
150	0.00	0.00

Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Network Design Criteria Storm Phase: Phase	Company Address:		

Manhole Options

Apply Offset	☐
Synchronise Manhole Invert Levels	☑

Manhole Size Library

Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Additional Sizing

Connection (mm)	900
Diameter / Length (m)	0.900
Width (m)	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Access

Depth (m)	Ladder Protrusion (mm)
0.000	130
3.000	230

Benching Requirements

Landing Width (mm)	500
Benching Width (mm)	225

Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

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	☐

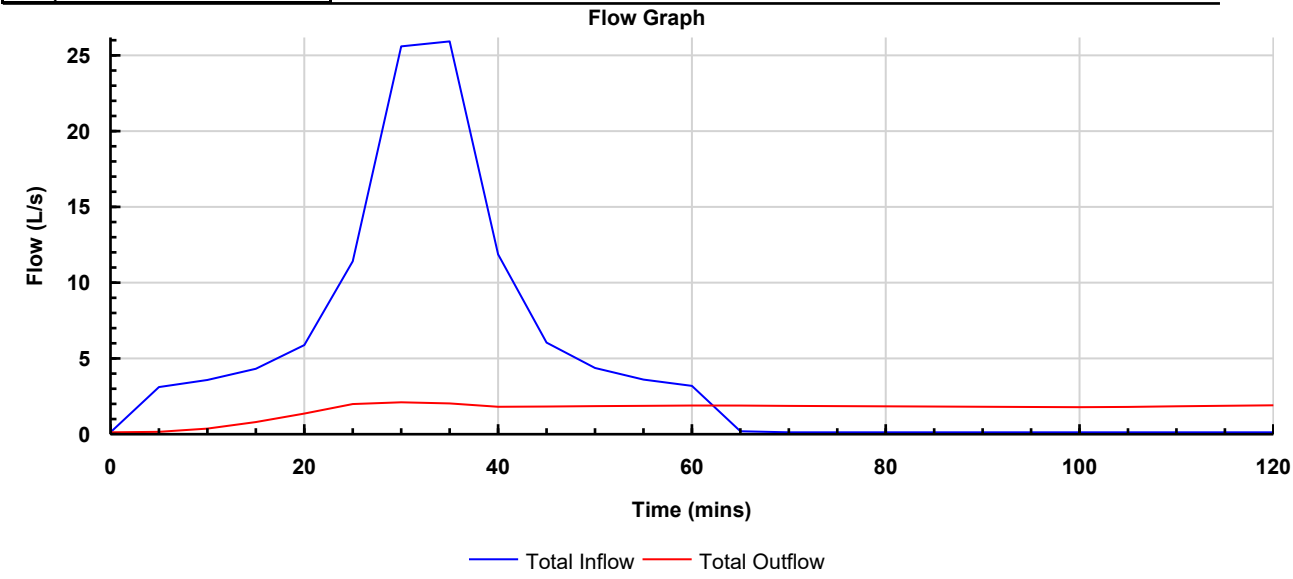
Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Phase Management Storm Phase: Phase	Company Address:		

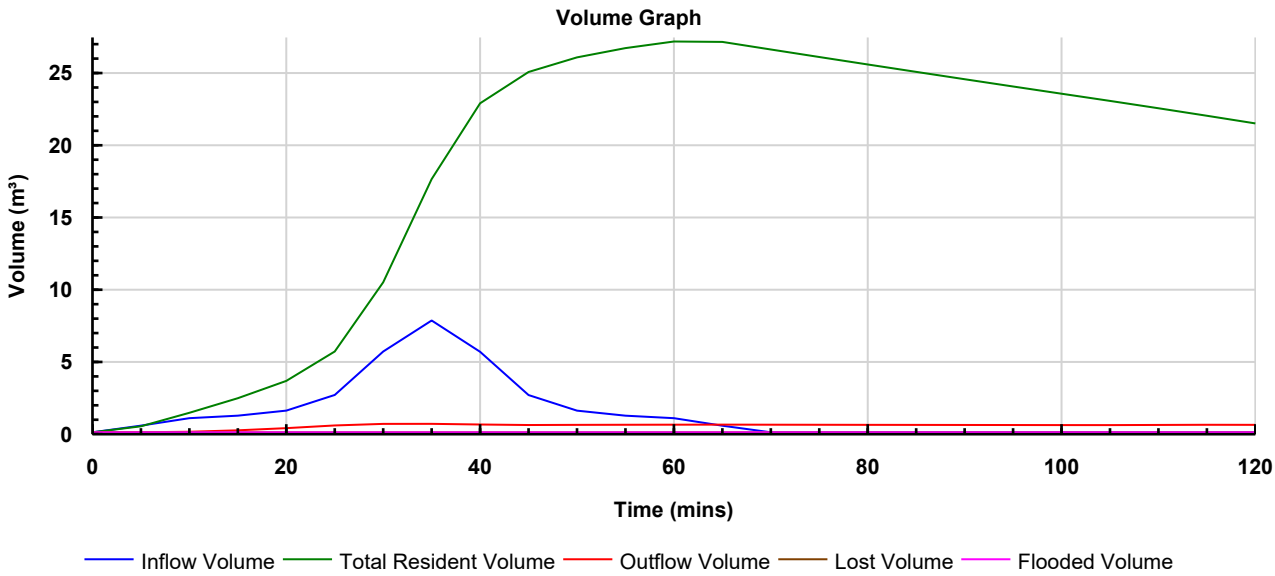
Phase
FSR: 100 years: Increase Rainfall (%): +40: 60 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Cellular Storage			2.0	10.927
TOTAL	25.9	32.396	2.0	10.927

Graphs





Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Inflow Results Storm Phase: Phase	Company Address:		

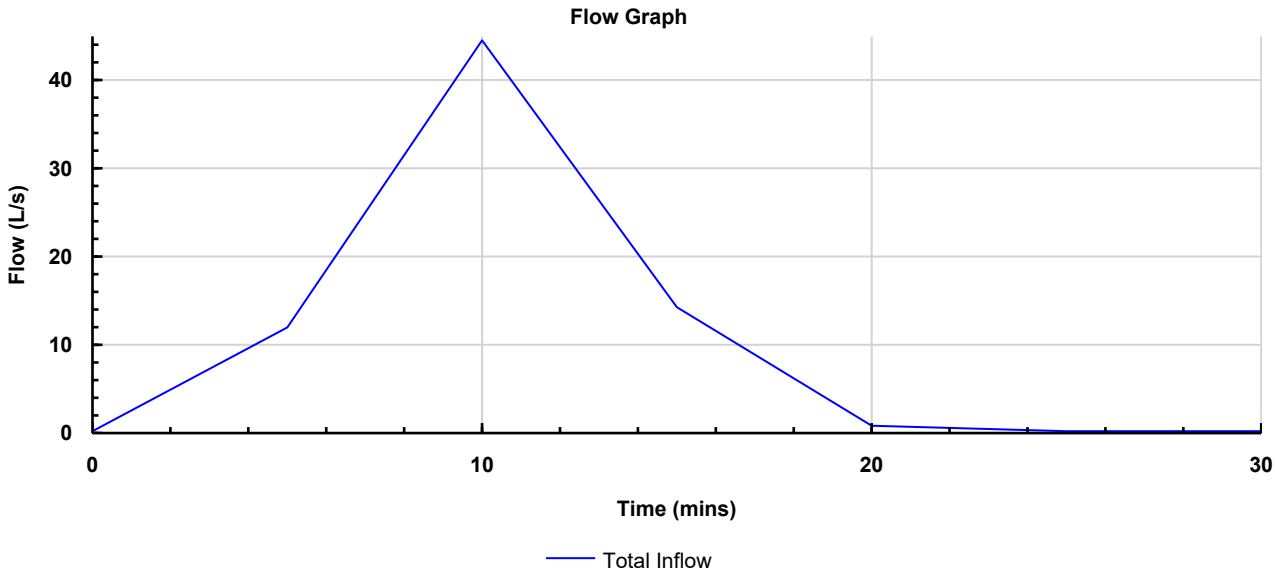
Catchment Area
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Winter

Type : Catchment Area

Inflow

Max. Inflow (L/s)	44.5
Total Inflow Volume (m³)	21.319

Graphs



Tables

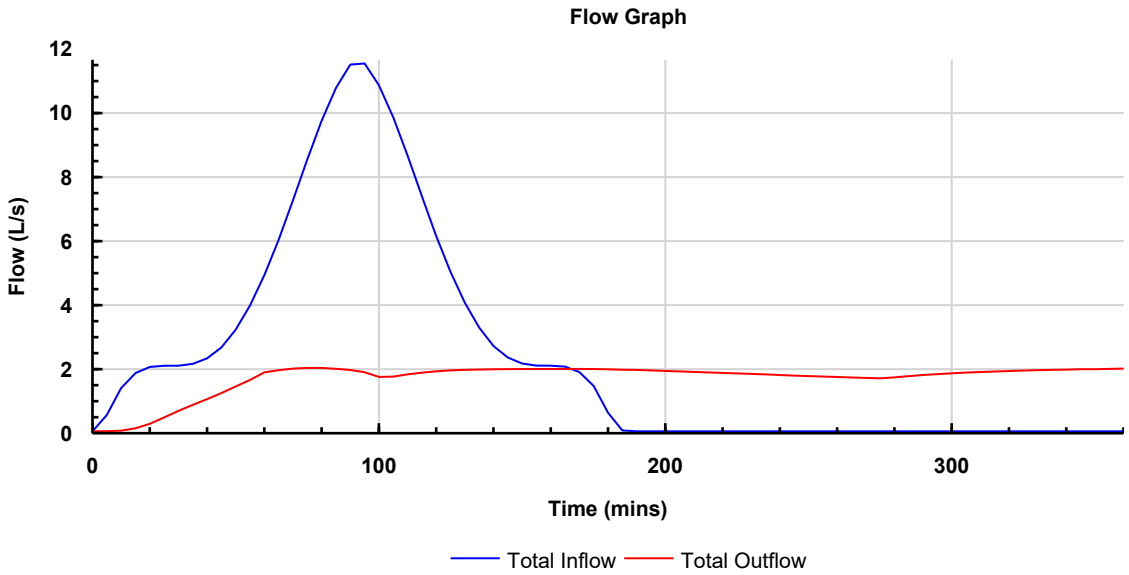
Time (mins)	Total Inflow (L/s)
0	0.0
5	11.8
10	44.5
15	14.1
20	0.6
25	0.0
30	0.0

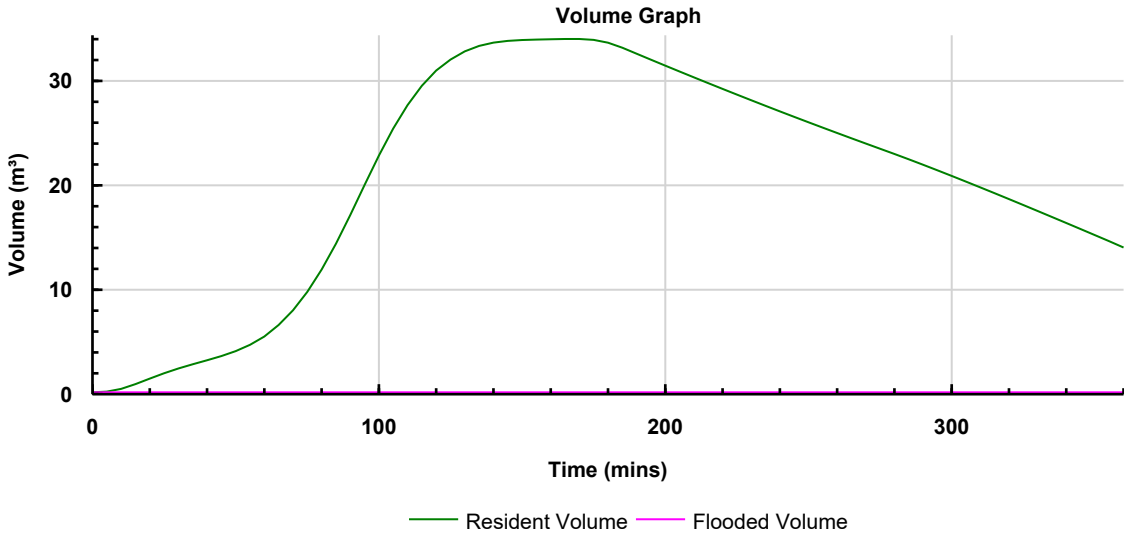
Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

Cellular Storage
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 180 mins: Winter

Type : Cellular Storage

Graphs





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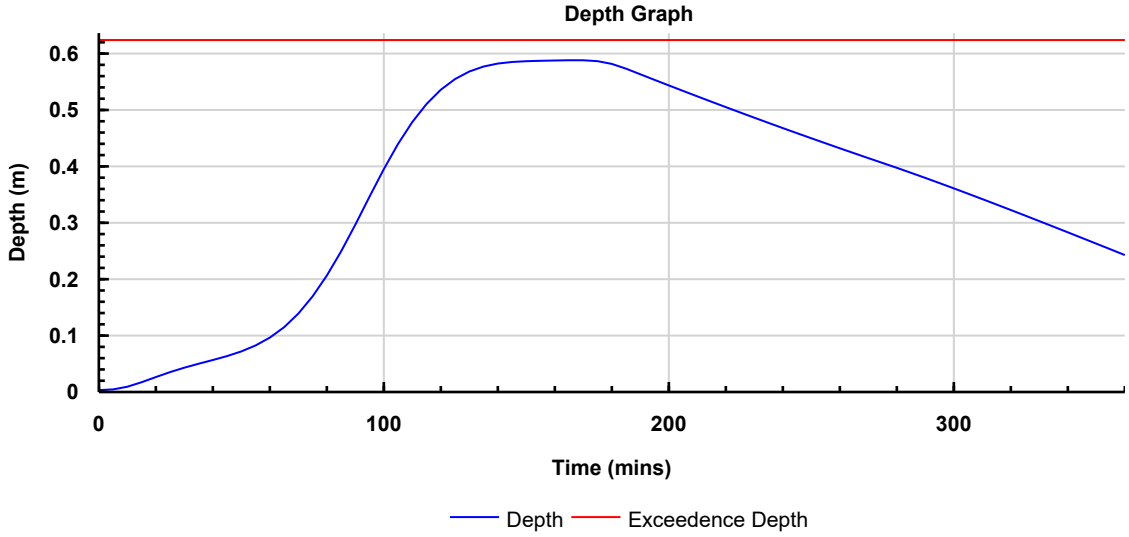
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		



Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

Tables

Time (mins)	Total Inflow (L/s)	Depth(m)	Resident Volume(m³)	Flooded Volume (m³)	Total Outflow (L/s)
0	0.0	0.000	0.000	0.000	0.0
5	0.5	0.001	0.066	0.000	0.0
10	1.4	0.006	0.329	0.000	0.0
15	1.8	0.014	0.787	0.000	0.1
20	2.0	0.023	1.318	0.000	0.2
25	2.1	0.032	1.833	0.000	0.4
30	2.1	0.040	2.293	0.000	0.6
35	2.1	0.047	2.699	0.000	0.8
40	2.3	0.054	3.084	0.000	1.0
45	2.6	0.061	3.488	0.000	1.2
50	3.2	0.069	3.963	0.000	1.4
55	4.0	0.080	4.572	0.000	1.6
60	4.9	0.094	5.368	0.000	1.9
65	6.0	0.112	6.483	0.000	1.9
70	7.3	0.136	7.891	0.000	2.0
75	8.5	0.167	9.666	0.000	2.0
80	9.7	0.204	11.812	0.000	2.0
85	10.8	0.247	14.299	0.000	2.0
90	11.5	0.295	17.061	0.000	1.9
95	11.5	0.345	19.958	0.000	1.9
100	10.9	0.394	22.788	0.000	1.7
105	9.9	0.439	25.392	0.000	1.7
110	8.7	0.478	27.646	0.000	1.8
115	7.4	0.510	29.508	0.000	1.8
120	6.1	0.535	30.977	0.000	1.9
125	5.0	0.554	32.030	0.000	1.9
130	4.0	0.568	32.823	0.000	1.9
135	3.3	0.577	33.348	0.000	1.9
140	2.7	0.582	33.663	0.000	1.9
145	2.3	0.585	33.831	0.000	2.0
150	2.1	0.586	33.914	0.000	2.0
155	2.1	0.587	33.956	0.000	2.0
160	2.1	0.587	33.987	0.000	2.0
165	2.0	0.588	34.014	0.000	2.0
170	1.9	0.588	34.013	0.000	2.0
175	1.4	0.586	33.927	0.000	2.0
180	0.6	0.581	33.657	0.000	1.9
185	0.0	0.573	33.172	0.000	1.9
190	0.0	0.563	32.594	0.000	1.9
195	0.0	0.553	32.018	0.000	1.9
200	0.0	0.543	31.447	0.000	1.9
205	0.0	0.533	30.880	0.000	1.9
210	0.0	0.524	30.318	0.000	1.9
215	0.0	0.514	29.761	0.000	1.8
220	0.0	0.504	29.209	0.000	1.8
225	0.0	0.495	28.660	0.000	1.8
230	0.0	0.486	28.117	0.000	1.8
235	0.0	0.476	27.578	0.000	1.8
240	0.0	0.467	27.044	0.000	1.8
245	0.0	0.458	26.517	0.000	1.7
250	0.0	0.449	25.995	0.000	1.7
255	0.0	0.440	25.476	0.000	1.7
260	0.0	0.431	24.962	0.000	1.7
265	0.0	0.422	24.453	0.000	1.7
270	0.0	0.413	23.948	0.000	1.7

Project:	Date: 20/07/2022		
	Designed by: g.beaven	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

Time (mins)	Total Inflow (L/s)	Depth(m)	Resident Volume(m³)	Flooded Volume (m³)	Total Outflow (L/s)
275	0.0	0.405	23.446	0.000	1.7
280	0.0	0.396	22.945	0.000	1.7
285	0.0	0.387	22.431	0.000	1.7
290	0.0	0.378	21.907	0.000	1.8
295	0.0	0.369	21.372	0.000	1.8
300	0.0	0.360	20.831	0.000	1.8
305	0.0	0.350	20.280	0.000	1.8
310	0.0	0.340	19.725	0.000	1.9
315	0.0	0.331	19.164	0.000	1.9
320	0.0	0.321	18.599	0.000	1.9
325	0.0	0.311	18.029	0.000	1.9
330	0.0	0.301	17.455	0.000	1.9
335	0.0	0.291	16.878	0.000	1.9
340	0.0	0.281	16.299	0.000	1.9
345	0.0	0.271	15.716	0.000	1.9
350	0.0	0.261	15.131	0.000	1.9
355	0.0	0.251	14.544	0.000	2.0
360	0.0	0.241	13.939	0.000	2.0

PLANE INFILTRATION SYSTEM DESIGN

In accordance with CIRIA C753 SUDS

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **196.0** m^2
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.360**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **40** %

Infiltration blanket details

Base area of blanket	A_b = **196.0** m^2
Porosity	n = **0.3**
Drainage ratio	R = A / A_b = **1.0**
Soil infiltration rate	f = **10.0×10^{-6}** m/s

Table equations

Rainfall intensity	i = M1 / D
Minimum depth required (Eq. 25.1)	H = D / n × (R × i - f)

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	1 year rainfall, M1 (mm)	Intensity, i (mm/hr)	Depth (mm)
5	0.36;	9.1;	0.61;	5.6;	66.61;	9;
10	0.51;	12.9;	0.62;	7.9;	47.48;	6;
15	0.62;	15.6;	0.62;	9.7;	38.90;	2;
30	0.79;	19.9;	0.64;	12.7;	25.47;	0;
60	1.00;	25.2;	0.66;	16.7;	16.65;	0;
120	1.22;	30.7;	0.68;	21.0;	10.48;	0;
240	1.48;	37.3;	0.69;	25.9;	6.48;	0;
360	1.67;	42.1;	0.70;	29.6;	4.94;	0;
600	1.90;	47.9;	0.72;	34.3;	3.43;	0;
1440	2.42;	61.0;	0.74;	45.0;	1.87;	0;

Min depth of blanket req'd	H_{max} = **9** mm
Time to empty blanket to half volume - Eq.25.6(1)	t_{s50} = n × H_{max} / (2 × f) = 2min 8s

PASS - Infiltration system discharge time less than or equal to 24 hours

PLANE INFILTRATION SYSTEM DESIGN

In accordance with CIRIA C753 SUDS

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **196.0** m^2
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.360**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **40** %

Infiltration blanket details

Base area of blanket	A_b = **196.0** m^2
Porosity	n = **0.3**
Drainage ratio	R = A / A_b = **1.0**
Soil infiltration rate	f = **10.0×10^{-6}** m/s

Table equations

Rainfall intensity	i = M30 / D
Minimum depth required (Eq. 25.1)	H = D / n × (R × i - f)

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall, M30 (mm)	Intensity, i (mm/hr)	Depth (mm)
5	0.36;	9.1;	1.48;	13.4;	160.93;	35;
10	0.51;	12.9;	1.51;	19.4;	116.51;	45;
15	0.62;	15.6;	1.53;	23.9;	95.54;	50;
30	0.79;	19.9;	1.54;	30.7;	61.44;	42;
60	1.00;	25.2;	1.53;	38.6;	38.62;	9;
120	1.22;	30.7;	1.51;	46.4;	23.21;	0;
240	1.48;	37.3;	1.48;	55.2;	13.79;	0;
360	1.67;	42.1;	1.46;	61.3;	10.22;	0;
600	1.90;	47.9;	1.43;	68.5;	6.85;	0;
1440	2.42;	61.0;	1.39;	84.5;	3.52;	0;

Min depth of blanket req'd	H_{max} = **50** mm
Time to empty blanket to half volume - Eq.25.6(1)	t_{s50} = n × H_{max} / (2 × f) = 12min 24s

PASS - Infiltration system discharge time less than or equal to 24 hours

PLANE INFILTRATION SYSTEM DESIGN

In accordance with CIRIA C753 SUDS

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **196.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.360**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **40** %

Infiltration blanket details

Base area of blanket	A_b = **196.0** m^2
Porosity	n = **0.3**
Drainage ratio	R = A / A_b = **1.0**
Soil infiltration rate	f = **10.0×10^{-6}** m/s

Table equations

Rainfall intensity	i = M100 / D
Minimum depth required (Eq. 25.1)	H = D / n × (R × i - f)

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Intensity, i (mm/hr)	Depth (mm)
5	0.36;	9.1;	1.89;	17.1;	205.51;	47;
10	0.51;	12.9;	1.96;	25.1;	150.80;	64;
15	0.62;	15.6;	1.99;	31.2;	124.68;	74;
30	0.79;	19.9;	2.03;	40.4;	80.80;	75;
60	1.00;	25.2;	2.01;	50.6;	50.61;	49;
120	1.22;	30.7;	1.96;	60.4;	30.19;	0;
240	1.48;	37.3;	1.91;	71.3;	17.82;	0;
360	1.67;	42.1;	1.87;	78.8;	13.14;	0;
600	1.90;	47.9;	1.83;	87.5;	8.75;	0;
1440	2.42;	61.0;	1.74;	105.8;	4.41;	0;

Min depth of blanket req'd	H_{max} = **75** mm
Time to empty blanket to half volume - Eq.25.6(1)	t_{s50} = n × H_{max} / (2 × f) = 18min 40s

PASS - Infiltration system discharge time less than or equal to 24 hours