KAVANAGH BURKE
CONSULTING ENGINEERS

Engineering Assessment and Surface Water Drainage Design Report

for

Proposed Part VIII Development

at

Fonthill Road, County Dublin

Job No:	**D1621**
Client:	**MCORM Architects**
Date:	**April 2022**
Local Authority:	**South Dublin County Council**
Revision:	**PL03 (11.04.2022)**

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Contents:

1. Basis

1.0. Introduction

This drainage report relates to a proposed residential development at FONTHILL ROAD "ST. EDMUNDS" PART 8, Palmerstown, Dublin 20.

The proposed development will consist of 7no. houses two storey height (1no. 3-bed unit semi-detached, 1no. 4bed unit semi-detached and 5no. 4-bed unit detached). The development provides for a total of 14 no. car park spaces on surface (equal to 2no. per unit). Principal vehicular and pedestrian access to the site is from Fonthill Road. The development also includes site development works above and below ground including landscaping, boundary treatments and services to facilitate the development all in 0.36 ha site.

1.1. Site

The site is located south of the N4 Lucan Road, Dublin 20. It is bounded by Ballydowd Special Care Unit to the West, St Edmunds development under Ref. Reg ABP-305857-19 to the South, Fonthill Road to the East, and the Eastern Health Board to the North adjacent to the Lucan Road. The subject site is under the same ownership as the St. Edmunds Phase 3, currently under construction, under Ref. Reg ABP-305857-19.

Picture 1 – Development extent of St Edmund State, St Edmunds Phase III, and subject site FONTHILL ROAD, "ST EDMUNDS" PART 8.

Map is an extract from Google Maps for clarity of sites location.

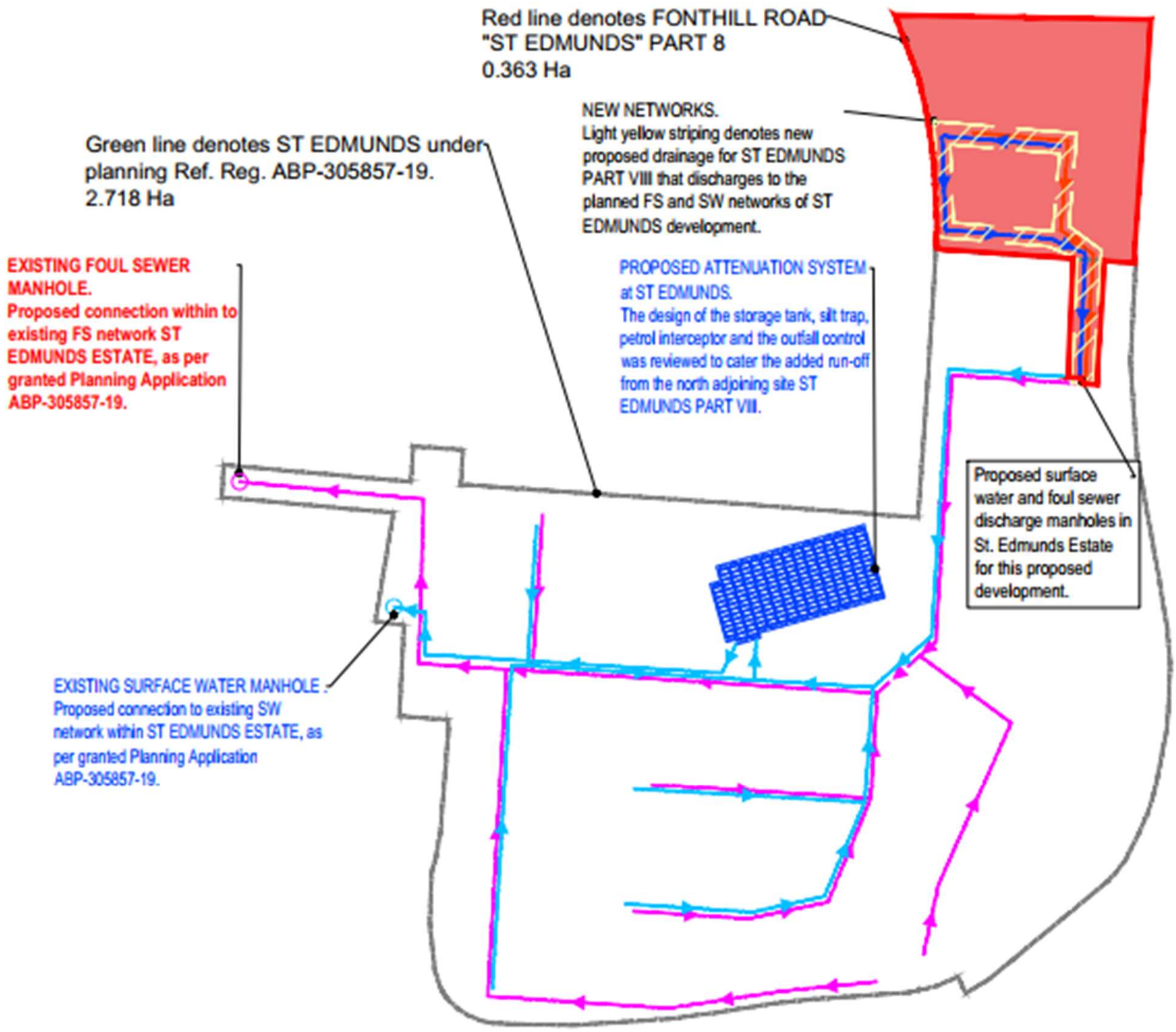
For further details of the proposed site layout please refer to Kavanagh Burke (KB) drawing Ref. D1621 D11 Drainage & Watermain Layout Part VIII Rev PL02.

2. Existing Services

The surface water (SW) and foul sewer (FS) networks within the existing St. Edmund's Estate were built to service the existing development and the Phase 3 St Edmunds development under Ref. Reg ABP-305857-19.

The outfall location for all the above-mentioned networks is via the exiting local authority SW and FS manholes located within Mount Andrew Avenue Estate.

It is proposed to route the discharge from the subject site proposed FS and SW manholes the Phase St Edmunds development under Ref. Reg ABP-305857-19, and then via the existing networks within the St Edmunds Estate to the outfall manholes located in Mount Andrew Avenue Estate.



Picture 2 – General scheme of SW and FS drainage networks.

3. Surface Water Drainage

3.1. SuDS Management Train

The treatment train approach was applied to both the storm water network and the attenuation design to ensure that both run-off quality and quantity are appropriately addressed. An array of techniques was used to fulfil requirements of each element of the treatment train:

- ✓ *Pollution prevention.*
  To prevent chemicals and other pollutants from contaminating the rainfall runoff, a maintenance regime for the proposed development will be established and it will include regular sweeping of the estate roads and collection of rubbish. Waste bins provided will be watertight and will incorporate lids to prevent the rainfall flushing the contaminants out of them. A proprietary silt trap and petrol interceptor will be provided on the surface water drainage network to intercept debris, silts and hydrocarbons and prevent them from entering the attenuation tank and from being discharged to the soil or receiving watercourse.

- ✓ *Source control*
  To detain and infiltrate the runoff as close as possible to the point of origin, we have included for the following:

  + The permeable paving will provide infiltration of the surface water into the angular stone filled infiltration pit below promoting water disposal at source and limiting the discharge to the SW network. Like above, where the rainfall event exceeding the capacity of the infiltration pit, runoff water will be allowed to discharge through a high-level drainage outfall connection to the storm water drain in the road.

- ✓ *Site control*
  The inclusion of SUDs devices around the site will provide a means for run-off to infiltrate into the ground across the site. That only once rainfall event exceeds the capacity of the infiltration devices will it flow into the storm water drain in the road and then into the proposed attenuation tank. This approach will inevitability reduce the quantity of water that discharges from the site.

- ✓ *Regional control*
  To mimic the behaviour of the green field site and protect the receiving watercourse, the attenuation tank is designed to cater for all durations of rainfall up to 30-year return period with 20% climate change factor applied. The attenuation system has also been designed to cater for 1 in 100-year storms of all durations exceeding the requirements of Greater Dublin Strategic Drainage Study (GDSDS). This 1 in 100-year temporary flood storage is accommodated in the sunken play space above the proposed attenuation tank.

3.2. Proposed Surface Water Strategy

The surface water runoff generated from the proposed houses and driveways will be routed through permeable paving which will facilitate the detention and infiltration at source. Only once the rainfall has passed through the permeable paving will the excess runoff enter the drainage network and then reach the underground attenuation system ("StormTech" or equivalent type) in the Phase III St Edmunds.

The flow control device will be installed on the outfall to limit the runoff from this proposed development (to greenfield runoff rate) into the existing surface water network / attenuation tank serving the existing St Edmunds Estate. The attenuation tank will be increased in size to cater this proposed new development.

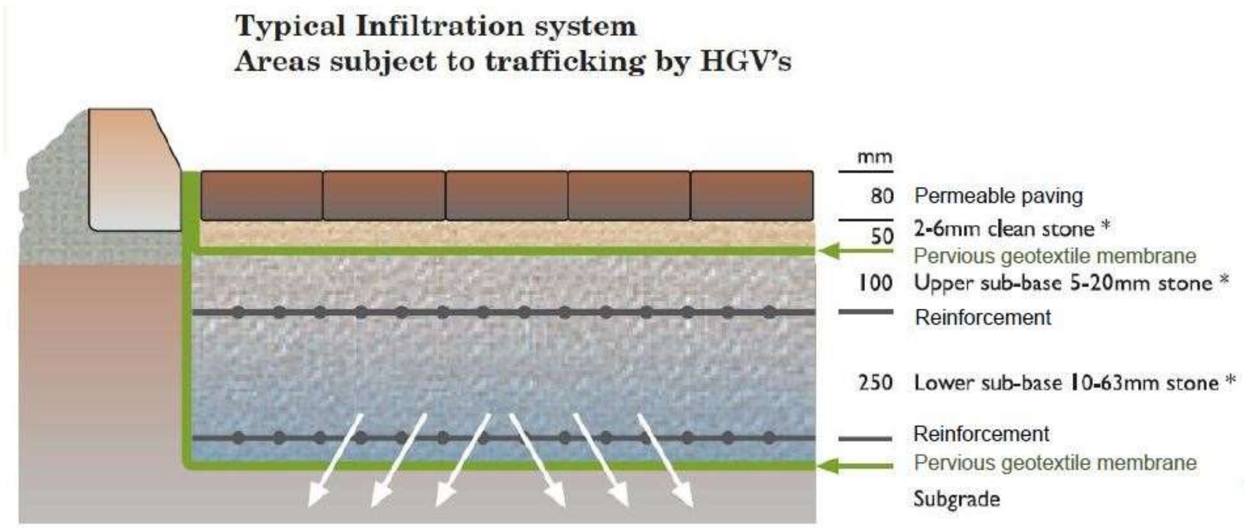
3.3. Proposed SuDS elements to improve the quality and reduce run-off

3.3.1. Pervious Paving

Pervious paving is proposed to all car parking spaces on site, thus allowing for infiltration of the storm water runoff from the permeable paving and from the roof of the property into underlying stone and soil. This device not only reduces the quantity of runoff, but it also has a positive impact on water quality.

Due to the shallow nature of the underlying build-up, permeable paving can be utilised even on sites with high ground water levels where other deeper infiltration devices would not work. According to CIRIA 697 SUDS Manual:" Pervious surfaces, together with their associated substructures, intercept surface water runoff and provide a pollutant treatment medium prior to discharge to receiving waters".

Permeable surfacing is not proposed to the carriageway due to Irish Water and Local Authority taking in charge requirements.



Picture 3 – Pervious paving schematic cross section

3.3.2. Silt Trap, Petrol Interceptor, Attenuation Tank & Flow Control Device

An underground surface water attenuation tank in the Phase III St Edmunds development is proposed as the main runoff quantity reducing SuDS device. The attenuation facility proposed is a "StormTech" or equivalent. This proprietary system consists of thermoplastic arches backfilled in specified stone and wrapped in a pervious geotextile. Prior to entering the system, the surface water runoff will pass through a proprietary silt trap and petrol interceptor to ensure debris, silt particles and hydrocarbons are removed. Subsequently the surface runoff enters the attenuation facility through an “isolator row” whereby a row of void forming thermoplastic arches are wrapped in a pervious geotextile which provides a second level of suspended solid removal prior to the water entering the greater attenuation area. See Appendix C for details of the proposed silt trap and petrol interceptor.

These water quality control devices can be cleaned out by suction hose/tanker if required from standard maintenance inspection chambers. In the case of the isolator rows, debris can be jetted out and removed by suction hose/tanker.

All these components of the attenuation system, that are located at St Edmunds development under Ref. Reg ABP-305857-19, will be increased in size to cater for this proposed development. For technical specifications refer to Appendix C.

4. Surface Water Attenuation Calculation

All calculations were done to include both the subject site Fonthill Road “St Edmunds” Part VIII and St Edmunds development under Ref. Reg ABP-305857-19.

4.1 Site Characteristics

Site Area (St Edmunds Part VIII)	3,625 m^2 (0.36 ha)	
Area within site boundary not contributing	695 m^2	
Applicable Catchment Area	2,930 m^2 (0.29 ha)	
Landscaping	852 m^2	
Roof area	628 m^2	
Permeable paving (car parking)	154 m^2	
Roads	381 m^2	
Footpaths	915 m^2	
Impermeable areas:		2,078 m^2

It should also be noted that the hardstanding areas include all permeable paving areas. No reduction was applied to runoff from permeable paving. This approach is conservative, as the real runoff from these surfaces will be significantly reduced.

4.2 Interception, Temporary Flood and Attenuation Storage

In summary:

- *Interception Storage*: increased 54 m^3 from to **63 m^3**.
  To be provided by green roofs at St Edmunds Ref. Reg ABP-305857-19, which maximum capacity is 84 m^3.
- *Required Attenuation Volume*: increased from 963 m^3 to **1230 m^3**.
  To be provided within the attenuation system on St Edmunds Ref. Reg ABP-305857-19.
- Temporary Flood Storage: consider within Flow storm volume storage calculations.

5. Storm Water Network Calculation

The storm water drainage network and attenuation were designed in Flow drainage design software.

The M5-60 rainfall intensity figure for the Irish Grid coordinates (306230, 234970) of the subject site, according to MET Eireann, equals 16.5mm. Climate change factor of 20% was applied to all rainfall intensities for Flow storm water network calculations. For detailed calculations of the storm water network flow capacities and sizes refer to the Appendix A.

The proposed system is designed to attenuate a 1 in 30-year storm event of any duration (plus 20% CCF); therefore, no flooding will occur on site for any duration events up to a 30-year return period as per the GDSDS requirements. All flows for the storm water network design and the attenuation volume were calculated with the 20% climate change factor applied for all rainfall intensities, greater than as per chapter 6.3.2.4 of GDSDS table 6.2 “Climate Change Factors”.

6. Foul Sewer

The foul sewer has been designed to collect discharge from the proposed 7 no. dwellings of the development, connected to the proposed foul network of Phase III St Edmunds development under Ref. Reg ABP-305857-19, as shown on the KB drawing ref. D1621 D11 Drainage & Watermain Layout St Edmunds Part VIII Rev PL02.

The entire foul network, including both for the proposed development and St Edmunds development under Ref. Reg ABP-305857-19, is modelled in Flow design software based on the fixture unit method that considers the probability of simultaneous discharge from different fixtures and translates it to the design flow as set out in EN752 “Drain and Sewer Systems Outside Buildings - Sewer System Management”.

For detailed calculations of the foul network flow capacities and sizes and discharge units for proposed development, refer to the Appendix B.

As per requirements of the Irish Water Code of Practice min velocities of 0.75 m/s are met for the proposed gradients and contributing dwelling numbers (refer to calculation sheet in Appendix B for details). The proposed foul sewer including manholes and service connections will be constructed in compliance with design standards set out by Irish Water in the IW Code of Practice for Wastewater Infrastructure and Wastewater Infrastructure Standard Details.

7. Watermain

The water supply to the new development is proposed by connecting to an existing 300mm diameter watermain at the footpath of N4 Slip Road. The 100mm diameter watermain serving the proposed development will be provided with adequate water meters, sluice valves and fire hydrants to provide water supply and for firefighting purposes (Hydrant locations to be within min. 6m & max. 46m from the proposed buildings) as shown on the accompanying KB Drainage and Watermain Layout drawing Ref. D1621 D11 Drainage and Watermain Layout Part VIII Rev PL02. All watermain details will be accordance with IW Water Infrastructure Standard Details.

Guidelines set out in the Irish Water Publications IW-CDS_5020-1 & IW-CDS-5030-1 have been consulted and adopted within the design of the proposed drainage & watermain networks.

8. Flood Risk Assessment

The subject site is located within Flood Zone C where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river & coasted flooding). In CFRAM mapping Flood Zone C covers all areas of the Flood Risk Management Plan which are not in zones A&B (the higher risk areas). Therefore, the site is at minimal risk of flooding and is remote from mapped flood areas.

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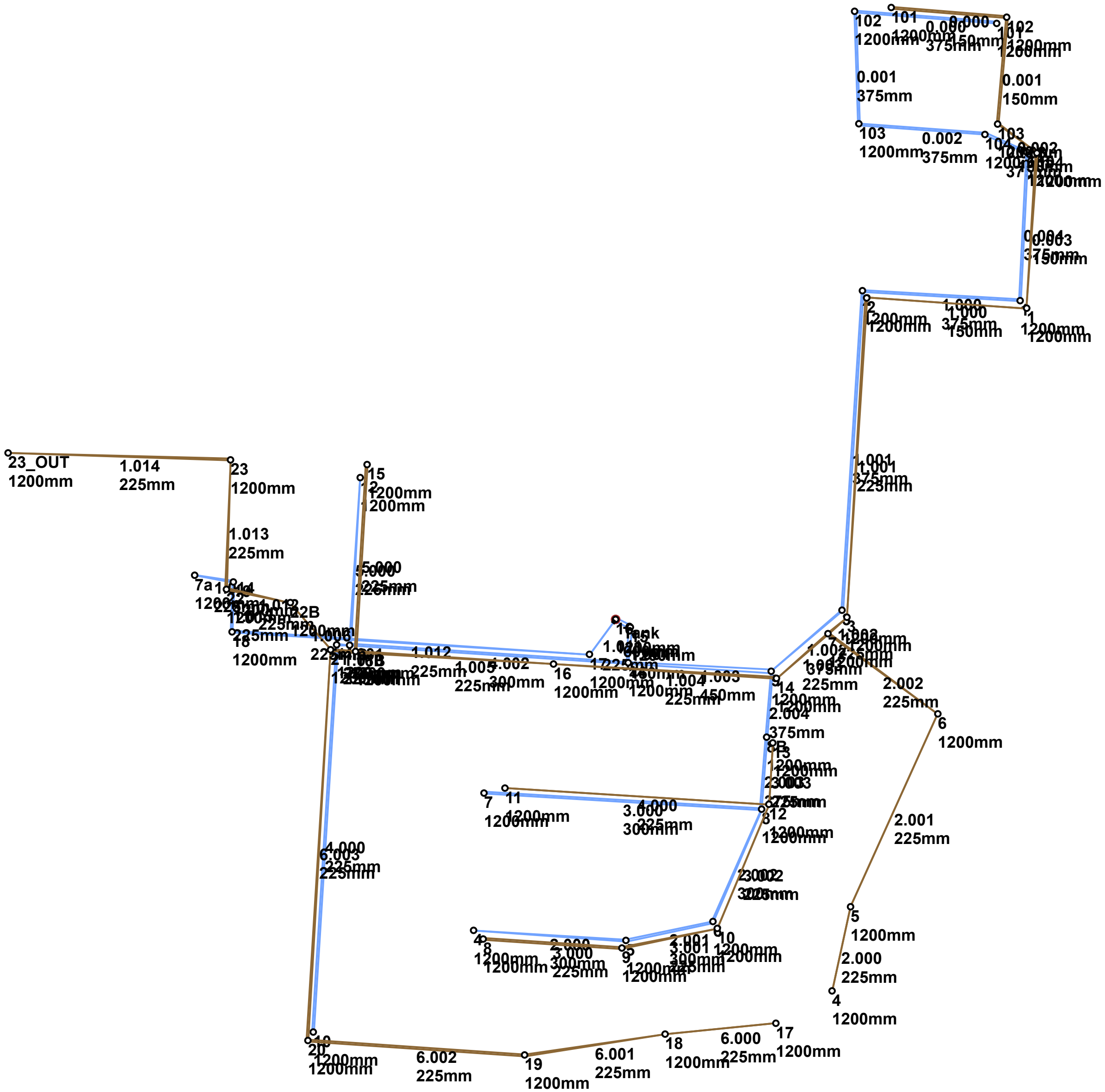
APPENDIX A

SW & FS Networks
Surface Water Network Design



102
101
1200mm
0.001
375mm
150mm
103
0.002
1.000
1.001
225mm
23_OUT
1.014
23
1.013
15
5.000
16
2.004
2.002
6
2.001
5
2.000
4
3.000
4.000
7
11
300mm
6.003
12
10
9
8
20
6.002
19
6.001
18
6.000
17

Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	20
FSR Region	England and Wales
M5-60 (mm)	16.500
Ratio-R	0.276
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	200.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	3.000
Preferred Cover Depth (m)	0.750
Include Intermediate Ground	x
Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
101	0.173	5.00	62.460	1200	306308.403	235116.425	1.306
102	0.000		62.850	1200	306278.243	235119.009	1.777
103	0.000	5.00	62.900	1200	306279.144	235094.991	1.892
104	0.024	5.00	62.500	1200	306305.908	235092.704	1.564
105	0.000		62.200	1200	306314.792	235088.928	1.290
1	0.077	5.00	62.000	1200	306313.380	235057.214	1.175
2	0.223	5.00	62.190	1200	306279.906	235059.339	1.455
3	0.034	5.00	62.170	1200	306275.571	234991.100	2.026
4	0.191	5.00	62.000	1200	306197.374	234922.719	1.300
5	0.081	5.00	62.000	1200	306229.704	234920.574	1.440
6	0.060	5.00	62.000	1200	306248.177	234924.609	1.510
7	0.262	5.00	62.000	1200	306199.582	234952.040	1.300
8	0.088	5.00	62.000	1200	306258.508	234948.597	1.675
8B			62.000	1200	306259.572	234963.980	1.780
9	0.056	5.00	62.080	1200	306260.545	234978.057	2.690
10	0.060	5.00	62.000	1200	306163.342	234900.998	1.425
11	0.016	5.00	61.320	1200	306168.303	234983.714	1.495
12	0.150	5.00	61.720	1200	306173.313	235019.419	1.425
13	0.115	5.00	61.470	1200	306171.062	234983.617	1.740
14			61.930	1200	306230.192	234979.881	2.610
15	0.196	5.00	61.320	1200	306230.645	234987.468	2.620
16			61.320	1200	306227.520	234989.127	2.670
17			61.200	1200	306221.963	234981.673	2.590
18			60.880	1200	306146.114	234986.470	2.610
19			60.550	1200	306146.380	234997.130	2.330
7a			60.810	1200	306138.174	234998.567	2.630

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
0.000	101	102	30.270	1.500	61.154	61.073	0.081	373.7	375	5.61	45.8
0.001	102	103	24.035	1.500	61.073	61.008	0.065	369.8	375	6.09	44.4
0.002	103	104	26.862	1.500	61.008	60.936	0.072	373.1	375	6.63	42.9
0.003	104	105	9.653	1.500	60.936	60.910	0.026	371.3	375	6.83	42.4
0.004	105	1	31.745	1.500	60.910	60.825	0.085	373.5	375	7.47	40.8
1.000	1	2	33.541	0.600	60.825	60.735	0.090	372.7	375	8.07	39.4
1.001	2	3	68.377	0.600	60.735	60.144	0.591	115.7	375	8.74	38.0
1.002	3	9	19.897	0.600	60.144	59.995	0.149	133.5	375	8.95	37.6
2.000	4	5	32.401	1.500	60.700	60.560	0.140	231.4	300	5.59	45.9
2.001	5	6	18.909	0.600	60.560	60.490	0.070	270.1	300	5.92	44.9
2.002	6	8	26.118	0.600	60.490	60.400	0.090	290.2	300	6.40	43.5
3.000	7	8	59.027	0.600	60.700	60.400	0.300	196.8	300	5.88	45.0
2.003	8	8B	15.420	0.600	60.325	60.220	0.105	146.9	375	6.57	43.0
2.004	8B	9	14.111	0.600	60.220	59.465	0.755	18.7	375	6.63	42.9
1.003	9	14	30.408	0.600	59.390	59.320	0.070	434.4	450	9.48	36.6
4.000	10	11	82.865	0.600	60.575	59.825	0.750	110.5	225	6.11	44.3
4.001	11	13	2.761	0.600	59.825	59.730	0.095	29.1	225	6.13	44.3
5.000	12	13	35.873	0.600	60.295	59.730	0.565	63.5	225	5.36	46.6
4.002	13	14	59.248	0.600	59.730	59.470	0.260	227.9	300	7.08	41.7
1.004	14	15	7.601	0.600	59.320	59.170	0.150	50.7	450	9.52	36.5
Tank	15	16	3.538	0.600	58.700	58.650	0.050	70.8	600	9.54	36.5
1.011	16	17	9.000	0.600	58.650	58.610	0.040	225.0	225	9.72	36.2
1.012	17	18	76.001	0.600	58.610	58.270	0.340	223.5	225	11.17	33.9
1.013	18	19	10.663	0.600	58.270	58.220	0.050	213.3	225	11.37	33.6

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
0.000	101	102	91.3	25.8	0.931	1.402	1.402	0.173	0.0	0.712
0.001	102	103	91.8	25.0	1.402	1.517	1.517	0.173	0.0	0.710
0.002	103	104	91.4	24.1	1.517	1.189	1.517	0.173	0.0	0.701
0.003	104	105	91.6	27.1	1.189	0.915	1.189	0.197	0.0	0.724
0.004	105	1	91.4	26.1	0.915	0.800	0.915	0.197	0.0	0.716
1.000	1	2	103.0	35.1	0.800	1.080	1.080	0.274	0.0	0.846
1.001	2	3	185.9	61.5	1.080	1.651	1.651	0.497	0.0	1.518
1.002	3	9	173.0	65.0	1.651	1.710	1.710	0.531	0.0	1.460
2.000	4	5	64.3	28.5	1.000	1.140	1.140	0.191	0.0	0.882
2.001	5	6	67.3	39.8	1.140	1.210	1.210	0.272	0.0	0.990
2.002	6	8	64.9	47.0	1.210	1.300	1.300	0.332	0.0	0.998
3.000	7	8	79.0	38.3	1.000	1.300	1.300	0.262	0.0	1.109
2.003	8	8B	164.9	95.5	1.300	1.405	1.405	0.682	0.0	1.544
2.004	8B	9	464.7	95.2	1.405	2.240	2.240	0.682	0.0	3.338
1.003	9	14	154.1	151.3	2.240	2.160	2.240	1.270	0.0	1.097
4.000	10	11	49.4	8.6	1.200	1.270	1.270	0.060	0.0	0.941
4.001	11	13	96.8	10.9	1.270	1.515	1.515	0.076	0.0	1.622
5.000	12	13	65.4	22.8	1.200	1.515	1.515	0.150	0.0	1.502
4.002	13	14	73.3	46.2	1.440	2.160	2.160	0.341	0.0	1.095
1.004	14	15	455.0	191.4	2.160	1.700	2.160	1.610	0.0	2.743
Tank	15	16	819.1	214.5	2.020	2.070	2.070	1.806	0.0	2.457
1.011	16	17	34.5	212.7	2.445	2.365	2.445	1.806	0.0	0.883
1.012	17	18	34.6	198.9	2.365	2.385	2.385	1.806	0.0	0.886
1.013	18	19	35.4	197.2	2.385	2.105	2.385	1.806	0.0	0.908

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.014	19	7a	8.331	0.600	58.220	58.180	0.040	208.3	225	11.52	33.4

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
1.014	19	7a	35.9	195.9	2.105	2.405	2.405	1.806	0.0	0.919

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
101	306308.403	235116.425	62.460	1.306	1200	0	0.000	61.154	375
102	306278.243	235119.009	62.850	1.777	1200	1	0.000	61.073	375
						0	0.001	61.073	375
103	306279.144	235094.991	62.900	1.892	1200	1	0.001	61.008	375
						0	0.002	61.008	375
104	306305.908	235092.704	62.500	1.564	1200	1	0.002	60.936	375
						0	0.003	60.936	375
105	306314.792	235088.928	62.200	1.290	1200	1	0.003	60.910	375
						0	0.004	60.910	375
1	306313.380	235057.214	62.000	1.175	1200	1	0.004	60.825	375
						0	1.000	60.825	375
2	306279.906	235059.339	62.190	1.455	1200	1	1.000	60.735	375
						0	1.001	60.735	375
3	306275.571	234991.100	62.170	2.026	1200	1	1.001	60.144	375
						0	1.002	60.144	375
4	306197.374	234922.719	62.000	1.300	1200	0	2.000	60.700	300
5	306229.704	234920.574	62.000	1.440	1200	1	2.000	60.560	300
						0	2.001	60.560	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	306248.177	234924.609	62.000	1.510	1200	1	2.001	60.490	300
						0	2.002	60.490	300
7	306199.582	234952.040	62.000	1.300	1200	0	3.000	60.700	300
8	306258.508	234948.597	62.000	1.675	1200	1	3.000	60.400	300
						2	2.002	60.400	300
						0	2.003	60.325	375
8B	306259.572	234963.980	62.000	1.780	1200	1	2.003	60.220	375
						0	2.004	60.220	375
9	306260.545	234978.057	62.080	2.690	1200	1	2.004	59.465	375
						2	1.002	59.995	375
						0	1.003	59.390	450
10	306163.342	234900.998	62.000	1.425	1200	0	4.000	60.575	225
11	306168.303	234983.714	61.320	1.495	1200	1	4.000	59.825	225
						0	4.001	59.825	225
12	306173.313	235019.419	61.720	1.425	1200	0	5.000	60.295	225
13	306171.062	234983.617	61.470	1.740	1200	1	5.000	59.730	225
						2	4.001	59.730	225
						0	4.002	59.730	300
14	306230.192	234979.881	61.930	2.610	1200	1	4.002	59.470	300
						2	1.003	59.320	450
						0	1.004	59.320	450
15	306230.645	234987.468	61.320	2.620	1200	1	1.004	59.170	450
						0	Tank	58.700	600
16	306227.520	234989.127	61.320	2.670	1200	1	Tank	58.650	600
						0	1.011	58.650	225
17	306221.963	234981.673	61.200	2.590	1200	1	1.011	58.610	225
						0	1.012	58.610	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
18	306146.114	234986.470	60.880	2.610	1200	1	1.012	58.270	225
						0	1.013	58.270	225
19	306146.380	234997.130	60.550	2.330	1200	1	1.013	58.220	225
						0	1.014	58.220	225
7a	306138.174	234998.567	60.810	2.630	1200	1	1.014	58.180	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	✓
M5-60 (mm)	16.500	Drain Down Time (mins)	240
Ratio-R	0.276	Additional Storage (m³/ha)	25.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200
30	120	240	480	720	1440	2880	5760	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	20	0	0
100	20	0	0

Node 16 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	58.650	Product Number	CTL-SHE-0089-4800-2050-4800
Design Depth (m)	2.050	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.8	Min Node Diameter (mm)	1200

Node 16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	58.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	583.0	0.0	2.061	0.1	0.0	2.570	667.0	0.0
2.060	583.0	0.0	2.560	0.1	0.0			

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	235.969	66.771	100 year +20% CC 15 minute summer	305.953	86.574
30 year +20% CC 15 minute winter	165.592	66.771	100 year +20% CC 15 minute winter	214.704	86.574
30 year +20% CC 30 minute summer	162.138	45.879	100 year +20% CC 30 minute summer	211.652	59.890
30 year +20% CC 30 minute winter	113.781	45.879	100 year +20% CC 30 minute winter	148.528	59.890
30 year +20% CC 60 minute summer	113.289	29.939	100 year +20% CC 60 minute summer	147.199	38.900
30 year +20% CC 60 minute winter	75.266	29.939	100 year +20% CC 60 minute winter	97.795	38.900
30 year +20% CC 120 minute summer	72.122	19.060	100 year +20% CC 120 minute summer	92.945	24.563
30 year +20% CC 120 minute winter	47.916	19.060	100 year +20% CC 120 minute winter	61.750	24.563
30 year +20% CC 180 minute summer	56.455	14.528	100 year +20% CC 180 minute summer	72.306	18.607
30 year +20% CC 180 minute winter	36.697	14.528	100 year +20% CC 180 minute winter	47.001	18.607
30 year +20% CC 240 minute summer	45.270	11.964	100 year +20% CC 240 minute summer	57.724	15.255
30 year +20% CC 240 minute winter	30.076	11.964	100 year +20% CC 240 minute winter	38.351	15.255
30 year +20% CC 360 minute summer	35.272	9.077	100 year +20% CC 360 minute summer	44.666	11.494
30 year +20% CC 360 minute winter	22.928	9.077	100 year +20% CC 360 minute winter	29.034	11.494
30 year +20% CC 480 minute summer	28.203	7.453	100 year +20% CC 480 minute summer	35.532	9.390
30 year +20% CC 480 minute winter	18.737	7.453	100 year +20% CC 480 minute winter	23.607	9.390
30 year +20% CC 600 minute summer	23.375	6.394	100 year +20% CC 600 minute summer	29.330	8.023
30 year +20% CC 600 minute winter	15.971	6.394	100 year +20% CC 600 minute winter	20.040	8.023
30 year +20% CC 720 minute summer	21.042	5.639	100 year +20% CC 720 minute summer	26.313	7.052
30 year +20% CC 720 minute winter	14.141	5.639	100 year +20% CC 720 minute winter	17.684	7.052
30 year +20% CC 960 minute summer	17.563	4.625	100 year +20% CC 960 minute summer	21.844	5.752
30 year +20% CC 960 minute winter	11.634	4.625	100 year +20% CC 960 minute winter	14.470	5.752
30 year +20% CC 1440 minute summer	13.042	3.496	100 year +20% CC 1440 minute summer	16.100	4.315
30 year +20% CC 1440 minute winter	8.765	3.496	100 year +20% CC 1440 minute winter	10.820	4.315
30 year +20% CC 2160 minute summer	9.556	2.641	100 year +20% CC 2160 minute summer	11.706	3.235
30 year +20% CC 2160 minute winter	6.584	2.641	100 year +20% CC 2160 minute winter	8.066	3.235
30 year +20% CC 2880 minute summer	8.070	2.163	100 year +20% CC 2880 minute summer	9.830	2.634
30 year +20% CC 2880 minute winter	5.424	2.163	100 year +20% CC 2880 minute winter	6.606	2.634
30 year +20% CC 4320 minute summer	6.239	1.631	100 year +20% CC 4320 minute summer	7.533	1.970
30 year +20% CC 4320 minute winter	4.108	1.631	100 year +20% CC 4320 minute winter	4.961	1.970
30 year +20% CC 5760 minute summer	5.213	1.334	100 year +20% CC 5760 minute summer	6.255	1.601
30 year +20% CC 5760 minute winter	3.374	1.334	100 year +20% CC 5760 minute winter	4.048	1.601
30 year +20% CC 7200 minute summer	4.476	1.142	100 year +20% CC 7200 minute summer	5.343	1.363
30 year +20% CC 7200 minute winter	2.889	1.142	100 year +20% CC 7200 minute winter	3.449	1.363

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	101	10	61.368	0.214	52.6	0.9487	0.0000	OK
15 minute winter	102	11	61.288	0.215	51.0	0.2433	0.0000	OK
15 minute winter	103	12	61.225	0.217	50.6	0.2449	0.0000	OK
15 minute winter	104	12	61.175	0.239	56.2	0.3626	0.0000	OK
15 minute winter	105	12	61.141	0.231	54.9	0.2612	0.0000	OK
15 minute winter	1	12	61.076	0.251	73.7	0.6946	0.0000	OK
15 minute winter	2	11	60.974	0.239	133.6	1.1851	0.0000	OK
15 minute winter	3	12	60.441	0.297	140.3	0.4612	0.0000	OK
15 minute winter	4	11	61.111	0.411	58.0	1.9752	0.0000	SURCHARGED
15 minute winter	5	11	61.001	0.441	73.9	1.1240	0.0000	SURCHARGED
15 minute winter	6	11	60.890	0.400	89.2	0.8499	0.0000	SURCHARGED
15 minute winter	7	11	60.949	0.249	79.5	1.5315	0.0000	OK
15 minute winter	8	11	60.683	0.358	190.2	0.8758	0.0000	OK
15 minute winter	8B	12	60.477	0.257	186.8	0.2910	0.0000	OK
2880 minute winter	9	2340	60.328	0.938	16.0	1.5501	0.0000	SURCHARGED
15 minute winter	10	11	60.667	0.092	18.2	0.2006	0.0000	OK
2880 minute winter	11	2340	60.328	0.503	1.7	0.7033	0.0000	SURCHARGED
15 minute winter	12	11	60.435	0.140	45.6	0.5278	0.0000	OK
2880 minute winter	13	2340	60.328	0.598	4.4	1.6605	0.0000	SURCHARGED
2880 minute winter	14	2340	60.328	1.008	23.2	1.1397	0.0000	SURCHARGED
2880 minute winter	15	2340	60.328	1.628	22.5	4.8781	0.0000	SURCHARGED
2880 minute winter	16	2340	60.328	1.678	22.0	979.9641	0.0000	SURCHARGED
2880 minute winter	17	2340	58.664	0.054	4.4	0.0606	0.0000	OK
2880 minute winter	18	2340	58.325	0.055	4.4	0.0627	0.0000	OK
2880 minute winter	19	2340	58.275	0.055	4.4	0.0626	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	0.000	102	51.0	0.800	0.558	1.9609	
15 minute winter	102	0.001	103	50.6	0.787	0.552	1.5764	
15 minute winter	103	0.002	104	49.3	0.716	0.539	1.8823	
15 minute winter	104	0.003	105	54.9	0.778	0.599	0.7019	
15 minute winter	105	0.004	1	55.0	0.744	0.602	2.3732	
15 minute winter	1	1.000	2	74.1	1.023	0.719	2.5368	
15 minute winter	2	1.001	3	131.2	1.614	0.706	5.6923	
15 minute winter	3	1.002	9	138.2	1.672	0.799	1.8430	
15 minute winter	4	2.000	5	50.6	0.790	0.787	2.2817	
15 minute winter	5	2.001	6	72.2	1.026	1.074	1.3316	
15 minute winter	6	2.002	8	88.1	1.251	1.358	1.8188	
15 minute winter	7	3.000	8	76.9	1.199	0.974	3.8741	
15 minute winter	8	2.003	8B	186.8	2.205	1.133	1.4551	
15 minute winter	8B	2.004	9	184.6	1.978	0.397	1.3470	
2880 minute winter	9	1.003	14	18.8	0.825	0.122	4.8179	
15 minute winter	10	4.000	11	17.5	1.041	0.355	2.2785	
2880 minute winter	11	4.001	13	1.4	0.280	0.015	0.1098	
15 minute winter	12	5.000	13	44.9	1.245	0.688	1.1799	
2880 minute winter	13	4.002	14	4.4	0.568	0.060	4.1722	
2880 minute winter	14	1.004	15	20.1	1.316	0.044	1.2043	
2880 minute winter	15	Tank	16	22.0	0.975	0.027	0.9966	
2880 minute winter	16	Hydro-Brake®	17	4.4				
2880 minute winter	17	1.012	18	4.4	0.590	0.126	0.5627	
2880 minute winter	18	1.013	19	4.4	0.576	0.123	0.0808	
2880 minute winter	19	1.014	7a	4.4	0.598	0.122	0.0608	645.4

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	7a	2340	58.233	0.053	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	101	10	61.408	0.254	68.1	1.1280	0.0000	OK
15 minute winter	102	11	61.331	0.258	65.9	0.2917	0.0000	OK
15 minute winter	103	12	61.275	0.267	64.7	0.3017	0.0000	OK
15 minute winter	104	13	61.245	0.309	71.4	0.4682	0.0000	OK
15 minute winter	105	13	61.226	0.316	69.0	0.3571	0.0000	OK
15 minute winter	1	12	61.177	0.352	94.6	0.9739	0.0000	OK
15 minute winter	2	12	61.135	0.400	173.2	1.9843	0.0000	SURCHARGED
2160 minute winter	3	2040	61.080	0.936	10.0	1.4544	0.0000	SURCHARGED
15 minute winter	4	12	61.645	0.945	75.2	4.5393	0.0000	SURCHARGED
15 minute winter	5	12	61.505	0.945	88.8	2.4054	0.0000	SURCHARGED
15 minute winter	6	12	61.362	0.872	103.9	1.8515	0.0000	SURCHARGED
15 minute winter	7	12	61.454	0.754	103.0	4.6491	0.0000	SURCHARGED
15 minute winter	8	12	61.088	0.763	214.5	1.8677	0.0000	SURCHARGED
2160 minute winter	8B	2040	61.080	0.860	12.8	0.9726	0.0000	SURCHARGED
2160 minute winter	9	2040	61.080	1.690	23.9	2.7934	0.0000	SURCHARGED
2160 minute winter	10	2040	61.080	0.505	1.1	1.1027	0.0000	SURCHARGED
2160 minute winter	11	2040	61.080	1.255	1.6	1.7556	0.0000	FLOOD RISK
2160 minute winter	12	2040	61.080	0.785	2.8	2.9537	0.0000	SURCHARGED
2160 minute winter	13	2040	61.080	1.350	6.4	3.7500	0.0000	SURCHARGED
2160 minute winter	14	2040	61.080	1.760	67.8	1.9904	0.0000	SURCHARGED
2160 minute winter	15	2040	61.080	2.380	33.7	7.1323	0.0000	FLOOD RISK
2160 minute winter	16	2040	61.080	2.430	32.6	1204.0570	0.0000	FLOOD RISK
2160 minute winter	17	2040	58.668	0.058	5.2	0.0661	0.0000	OK
2160 minute winter	18	2040	58.331	0.061	5.2	0.0687	0.0000	OK
2160 minute winter	19	2040	58.281	0.061	5.2	0.0686	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	0.000	102	65.9	0.842	0.721	2.4227	
15 minute winter	102	0.001	103	64.7	0.822	0.705	1.9652	
15 minute winter	103	0.002	104	62.5	0.744	0.684	2.4188	
15 minute winter	104	0.003	105	69.0	0.802	0.753	0.9471	
15 minute winter	105	0.004	1	66.0	0.740	0.722	3.2725	
15 minute winter	1	1.000	2	90.5	1.084	0.879	3.6511	
15 minute winter	2	1.001	3	154.6	1.622	0.831	7.5418	
2160 minute winter	3	1.002	9	10.0	0.851	0.058	2.1946	
15 minute winter	4	2.000	5	57.3	0.814	0.891	2.2817	
15 minute winter	5	2.001	6	81.9	1.163	1.218	1.3316	
15 minute winter	6	2.002	8	100.0	1.421	1.542	1.8392	
15 minute winter	7	3.000	8	82.6	1.203	1.046	4.1566	
15 minute winter	8	2.003	8B	208.7	2.197	1.266	1.7008	
2160 minute winter	8B	2.004	9	12.8	1.742	0.028	1.5564	
2160 minute winter	9	1.003	14	32.2	0.898	0.209	4.8179	
2160 minute winter	10	4.000	11	1.1	0.572	0.022	3.2956	
2160 minute winter	11	4.001	13	1.4	0.313	0.014	0.1098	
2160 minute winter	12	5.000	13	2.8	0.490	0.043	1.4267	
2160 minute winter	13	4.002	14	6.4	0.616	0.087	4.1722	
2160 minute winter	14	1.004	15	-29.6	1.362	-0.065	1.2043	
2160 minute winter	15	Tank	16	32.6	1.057	0.040	0.9966	
2160 minute winter	16	Hydro-Brake®	17	5.2				
2160 minute winter	17	1.012	18	5.2	0.618	0.150	0.6384	
2160 minute winter	18	1.013	19	5.2	0.602	0.146	0.0919	
2160 minute winter	19	1.014	7a	5.2	0.627	0.145	0.0690	551.5

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	7a	2040	58.237	0.057	5.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)

KAVANAGH BURKE
CONSULTING ENGINEERS

APPENDIX B

Foul Sewer Network Design

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	2680	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	3.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.750
Additional Flow (%)	0	Include Intermediate Ground	x

Nodes

Name	Units	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
101	42.0	62.800	Storm MH	306286.019	235119.821	0.900
102		62.460	Storm MH	306310.525	235117.750	0.887
103		62.500	Storm MH	306308.596	235094.927	1.213
104		62.200	Storm MH	306316.934	235088.733	1.043
1	20.0	62.000	Storm MH	306314.769	235055.603	1.258
2	140.0	62.170	Storm MH	306280.805	235057.783	1.730
3	170.0	62.150	Storm MH	306276.612	234989.594	2.050
4	150.0	62.100	Storm MH	306273.458	234909.787	1.564
5	100.0	62.100	Storm MH	306277.387	234927.757	1.656
6		62.100	Storm MH	306295.915	234968.962	1.882
7		62.150	Storm MH	306272.591	234986.087	2.077
8	150.0	62.000	Storm MH	306199.410	234920.867	1.275
9	100.0	62.000	Storm MH	306228.853	234918.947	1.575
10	100.0	62.000	Storm MH	306249.095	234923.136	1.785
11	275.0	62.000	Storm MH	306204.031	234953.104	1.515
12		62.000	Storm MH	306260.050	234949.647	2.085
13		62.000	Storm MH	306260.879	234962.760	2.255
14	625.0	62.110	Storm MH	306261.655	234976.549	2.110
15	80.0	61.730	Storm MH	306174.772	235022.204	0.975
16		61.850	Storm MH	306214.337	234979.601	2.088
16B		61.470	Storm MH	306172.320	234982.285	1.917
17	150.0	62.100	Storm MH	306261.535	234902.877	1.620
18		62.100	Storm MH	306238.024	234900.560	1.740
19		62.100	Storm MH	306208.204	234896.109	1.891
20	150.0	62.000	Storm MH	306162.214	234899.196	2.022
21		61.250	Storm MH	306167.019	234982.652	1.724
22B		61.250	Storm MH	306158.482	234992.725	1.790
22		60.790	Storm MH	306144.914	234995.552	1.400
23		60.620	Storm MH	306145.782	235023.204	1.400
23_OUT		60.950	Storm MH	306098.573	235024.687	2.010

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
0.000	101	102	24.593	1.500	61.900	61.573	0.327	75.2	150
0.001	102	103	22.904	1.500	61.573	61.287	0.286	80.1	150
0.002	103	104	10.387	1.500	61.287	61.157	0.130	79.9	150
0.003	104	1	33.201	1.500	61.157	60.742	0.415	80.0	150
1.000	1	2	34.034	1.500	60.742	60.515	0.227	149.9	150
1.001	2	3	68.318	1.500	60.440	60.100	0.340	200.9	225
1.002	3	7	5.335	1.500	60.100	60.073	0.027	197.6	225
2.000	4	5	18.395	1.500	60.536	60.444	0.092	199.9	225
2.001	5	6	45.179	1.500	60.444	60.218	0.226	199.9	225
2.002	6	7	28.936	1.500	60.218	60.073	0.145	199.6	225
1.003	7	14	14.511	1.500	60.073	60.000	0.073	198.8	225
3.000	8	9	29.506	1.500	60.725	60.425	0.300	98.4	225
3.001	9	10	20.671	1.500	60.425	60.215	0.210	98.4	225
3.002	10	12	28.685	1.500	60.215	59.915	0.300	95.6	225
4.000	11	12	56.126	1.500	60.485	59.915	0.570	98.5	225
3.003	12	13	13.139	1.500	59.915	59.745	0.170	77.3	225
1.004	14	16	47.416	1.500	60.000	59.762	0.238	199.2	225
5.000	15	16B	39.994	1.500	60.755	60.350	0.405	98.8	225
1.005	16	16B	42.103	1.500	59.762	59.553	0.209	201.4	225
6.000	17	18	23.625	1.500	60.480	60.360	0.120	196.9	225
6.001	18	19	30.150	1.500	60.360	60.209	0.151	199.7	225
6.002	19	20	46.093	1.500	60.209	59.978	0.231	199.5	225
6.003	20	21	83.594	1.500	59.978	59.526	0.452	184.9	225
1.010	16B	21	5.314	1.500	59.553	59.526	0.027	196.8	225

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Velocity (m/s)
0.000	101	102	17.9	3.2	0.750	0.737	0.750	0.000	42.0	0.0	0.767
0.001	102	103	17.3	3.2	0.737	1.063	1.063	0.000	42.0	0.0	0.749
0.002	103	104	17.3	3.2	1.063	0.893	1.063	0.000	42.0	0.0	0.750
0.003	104	1	17.3	3.2	0.893	1.108	1.108	0.000	42.0	0.0	0.750
1.000	1	2	12.6	3.9	1.108	1.505	1.505	0.000	62.0	0.0	0.631
1.001	2	3	32.1	7.1	1.505	1.825	1.825	0.000	202.0	0.0	0.648
1.002	3	7	32.4	9.6	1.825	1.852	1.852	0.000	372.0	0.0	0.710
2.000	4	5	32.2	6.1	1.339	1.431	1.431	0.000	150.0	0.0	0.622
2.001	5	6	32.2	7.9	1.431	1.657	1.657	0.000	250.0	0.0	0.670
2.002	6	7	32.2	7.9	1.657	1.852	1.852	0.000	250.0	0.0	0.671
1.003	7	14	32.3	12.5	1.852	1.885	1.885	0.000	622.0	0.0	0.761
3.000	8	9	46.0	6.1	1.050	1.350	1.350	0.000	150.0	0.0	0.806
3.001	9	10	46.0	7.9	1.350	1.560	1.560	0.000	250.0	0.0	0.863
3.002	10	12	46.7	9.4	1.560	1.860	1.860	0.000	350.0	0.0	0.916
4.000	11	12	46.0	8.3	1.290	1.860	1.860	0.000	275.0	0.0	0.876
3.003	12	13	51.9	12.5	1.860	2.030	2.030	0.000	625.0	0.0	1.075
1.004	14	16	32.3	17.7	1.885	1.863	1.885	0.000	1247.0	0.0	0.831
5.000	15	16B	45.9	4.5	0.750	0.895	0.895	0.000	80.0	0.0	0.735
1.005	16	16B	32.1	17.7	1.863	1.692	1.863	0.000	1247.0	0.0	0.826
6.000	17	18	32.5	6.1	1.395	1.515	1.515	0.000	150.0	0.0	0.627
6.001	18	19	32.2	6.1	1.515	1.666	1.666	0.000	150.0	0.0	0.623
6.002	19	20	32.2	6.1	1.666	1.797	1.797	0.000	150.0	0.0	0.623
6.003	20	21	33.5	8.7	1.797	1.499	1.797	0.000	300.0	0.0	0.706
1.010	16B	21	32.5	18.2	1.692	1.499	1.692	0.000	1327.0	0.0	0.841

Links

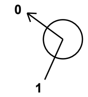
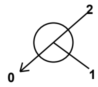
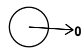
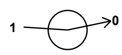
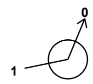
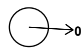
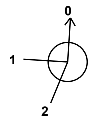
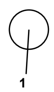
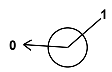
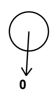
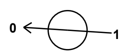
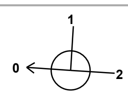
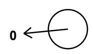
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.006	21	22B	13.204	1.500	59.526	59.460	0.066	200.1	225
1.012	22B	22	13.859	1.500	59.460	59.390	0.070	198.0	225
1.013	22	23	27.666	1.500	59.390	59.220	0.170	162.7	225
1.014	23	23_OUT	47.232	1.500	59.220	58.940	0.280	168.7	225

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Velocity (m/s)
1.006	21	22B	32.2	20.2	1.499	1.565	1.565	0.000	1627.0	0.0	0.854
1.012	22B	22	32.4	20.2	1.565	1.175	1.565	0.000	1627.0	0.0	0.858
1.013	22	23	35.7	20.2	1.175	1.175	1.175	0.000	1627.0	0.0	0.925
1.014	23	23_OUT	35.1	20.2	1.175	1.785	1.785	0.000	1627.0	0.0	0.914

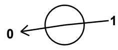
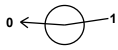
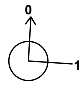
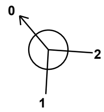
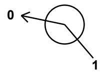
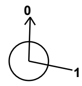
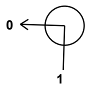
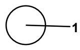
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
101	306286.019	235119.821	62.800	0.900	1200	0	0.000	61.900	150
102	306310.525	235117.750	62.460	0.887	1200	1	0.000	61.573	150
						0	0.001	61.573	150
103	306308.596	235094.927	62.500	1.213	1200	1	0.001	61.287	150
						0	0.002	61.287	150
104	306316.934	235088.733	62.200	1.043	1200	1	0.002	61.157	150
						0	0.003	61.157	150
1	306314.769	235055.603	62.000	1.258	1200	1	0.003	60.742	150
						0	1.000	60.742	150
2	306280.805	235057.783	62.170	1.730	1200	1	1.000	60.515	150
						0	1.001	60.440	225
3	306276.612	234989.594	62.150	2.050	1200	1	1.001	60.100	225
						0	1.002	60.100	225
4	306273.458	234909.787	62.100	1.564	1200	0	2.000	60.536	225
5	306277.387	234927.757	62.100	1.656	1200	1	2.000	60.444	225
						0	2.001	60.444	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
6	306295.915	234968.962	62.100	1.882	1200		1	2.001	60.218	225
							0	2.002	60.218	225
7	306272.591	234986.087	62.150	2.077	1200		1	2.002	60.073	225
							2	1.002	60.073	225
							0	1.003	60.073	225
8	306199.410	234920.867	62.000	1.275	1200		0	3.000	60.725	225
9	306228.853	234918.947	62.000	1.575	1200		1	3.000	60.425	225
							0	3.001	60.425	225
10	306249.095	234923.136	62.000	1.785	1200		1	3.001	60.215	225
							0	3.002	60.215	225
11	306204.031	234953.104	62.000	1.515	1200		0	4.000	60.485	225
12	306260.050	234949.647	62.000	2.085	1200		1	4.000	59.915	225
							2	3.002	59.915	225
							0	3.003	59.915	225
13	306260.879	234962.760	62.000	2.255	1200		1	3.003	59.745	225
14	306261.655	234976.549	62.110	2.110	1200		1	1.003	60.000	225
							0	1.004	60.000	225
15	306174.772	235022.204	61.730	0.975	1200		0	5.000	60.755	225
16	306214.337	234979.601	61.850	2.088	1200		1	1.004	59.762	225
							0	1.005	59.762	225
16B	306172.320	234982.285	61.470	1.917	1200		1	5.000	60.350	225
							2	1.005	59.553	225
							0	1.010	59.553	225
17	306261.535	234902.877	62.100	1.620	1200		0	6.000	60.480	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
18	306238.024	234900.560	62.100	1.740	1200		1	6.000	60.360	225
							0	6.001	60.360	225
19	306208.204	234896.109	62.100	1.891	1200		1	6.001	60.209	225
							0	6.002	60.209	225
20	306162.214	234899.196	62.000	2.022	1200		1	6.002	59.978	225
							0	6.003	59.978	225
21	306167.019	234982.652	61.250	1.724	1200		1	6.003	59.526	225
							2	1.010	59.526	225
							0	1.006	59.526	225
22B	306158.482	234992.725	61.250	1.790	1200		1	1.006	59.460	225
							0	1.012	59.460	225
22	306144.914	234995.552	60.790	1.400	1200		1	1.012	59.390	225
							0	1.013	59.390	225
23	306145.782	235023.204	60.620	1.400	1200		1	1.013	59.220	225
							0	1.014	59.220	225
23_OUT	306098.573	235024.687	60.950	2.010	1200		1	1.014	58.940	225

APPENDIX C

Rainfall Return Period
SOIL Type Value (www.uksuds.com)
StormTech Storage Cumulative Volume Spreadsheet
StormTech MC4500 Chamber Information Sheet
Specification / Product Information for Separators, Silt Trap & Flow Control Device

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 306230, Northing: 234970,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.7,	6.2,	7.9,	9.9,	11.2,	13.1,	14.9,	16.2,	18.4,	20.0,	21.4,	N/A ,
10 mins	3.3,	4.8,	5.7,	7.0,	7.9,	8.6,	11.0,	13.8,	15.6,	18.3,	20.7,	22.6,	25.6,	27.9,	29.9,	N/A ,
15 mins	3.8,	5.6,	6.7,	8.2,	9.3,	10.1,	12.9,	16.2,	18.4,	21.5,	24.4,	26.6,	30.1,	32.8,	35.1,	N/A ,
30 mins	5.1,	7.4,	8.6,	10.6,	11.9,	12.9,	16.4,	20.3,	23.0,	26.8,	30.2,	32.9,	37.1,	40.3,	43.0,	N/A ,
1 hours	6.7,	9.6,	11.2,	13.6,	15.2,	16.5,	20.7,	25.6,	28.8,	33.4,	37.5,	40.7,	45.6,	49.5,	52.7,	N/A ,
2 hours	8.8,	12.5,	14.5,	17.5,	19.5,	21.1,	26.3,	32.2,	36.1,	41.6,	46.5,	50.3,	56.2,	60.7,	64.5,	N/A ,
3 hours	10.4,	14.6,	16.9,	20.3,	22.6,	24.4,	30.2,	36.8,	41.2,	47.3,	52.7,	56.9,	63.4,	68.5,	72.6,	N/A ,
4 hours	11.7,	16.3,	18.8,	22.5,	25.1,	27.0,	33.3,	40.5,	45.2,	51.8,	57.6,	62.2,	69.1,	74.5,	79.0,	N/A ,
6 hours	13.8,	19.1,	21.9,	26.1,	29.0,	31.2,	38.3,	46.3,	51.5,	58.9,	65.4,	70.4,	78.1,	84.0,	89.0,	N/A ,
9 hours	16.2,	22.3,	25.5,	30.3,	33.5,	36.0,	44.0,	52.9,	58.8,	66.9,	74.1,	79.7,	88.2,	94.7,	100.2,	N/A ,
12 hours	18.2,	24.9,	28.4,	33.7,	37.2,	39.8,	48.5,	58.2,	64.5,	73.3,	81.1,	87.0,	96.1,	103.1,	108.9,	N/A ,
18 hours	21.4,	29.1,	33.1,	39.0,	43.0,	46.0,	55.8,	66.6,	73.6,	83.4,	91.9,	98.5,	108.6,	116.3,	122.6,	N/A ,
24 hours	24.1,	32.5,	36.9,	43.3,	47.6,	50.9,	61.5,	73.2,	80.8,	91.3,	100.5,	107.6,	118.3,	126.6,	133.4,	156.9,
2 days	30.0,	39.5,	44.4,	51.5,	56.2,	59.7,	71.1,	83.4,	91.3,	102.2,	111.6,	118.8,	129.7,	138.0,	144.8,	168.0,
3 days	34.8,	45.2,	50.5,	58.1,	63.1,	66.9,	78.9,	91.8,	100.0,	111.3,	121.0,	128.4,	139.5,	148.0,	154.9,	178.4,
4 days	39.0,	50.1,	55.7,	63.8,	69.1,	73.1,	85.7,	99.1,	107.7,	119.3,	129.3,	136.9,	148.2,	156.9,	163.9,	187.8,
6 days	46.3,	58.7,	65.0,	73.8,	79.5,	83.9,	97.4,	111.8,	120.9,	133.2,	143.7,	151.6,	163.5,	172.5,	179.7,	204.3,
8 days	52.8,	66.3,	73.0,	82.5,	88.7,	93.3,	107.7,	122.9,	132.4,	145.3,	156.2,	164.5,	176.8,	186.1,	193.6,	218.9,
10 days	58.8,	73.3,	80.4,	90.5,	97.0,	101.8,	117.0,	132.9,	142.8,	156.2,	167.5,	176.1,	188.8,	198.3,	206.1,	232.0,
12 days	64.4,	79.7,	87.2,	97.8,	104.6,	109.7,	125.5,	142.1,	152.4,	166.2,	178.0,	186.8,	199.8,	209.7,	217.6,	244.1,
16 days	74.7,	91.6,	99.8,	111.4,	118.7,	124.2,	141.2,	158.9,	169.8,	184.5,	196.9,	206.2,	219.9,	230.2,	238.5,	266.2,
20 days	84.3,	102.5,	111.4,	123.7,	131.6,	137.5,	155.5,	174.1,	185.7,	201.1,	214.1,	223.7,	238.1,	248.8,	257.4,	286.0,
25 days	95.6,	115.3,	124.8,	138.1,	146.5,	152.8,	171.9,	191.7,	203.9,	220.1,	233.7,	243.9,	258.8,	270.0,	279.0,	308.7,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

RETURN PERIOD RAINFALL DEPTHS FROM MET EIREANN.
VALUES OUTLINED IN RED WERE USED FOR CALCULATION OF REQUIRED ATTENUATION VOLUME FOR 30 YEARS STORM EVENT.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Bartosz Kedzierski
Site name:	St. Edmunds
Site location:	

Site Details

Latitude:	53.35442° N
Longitude:	6.405° W
Reference:	2231352229
Date:	Nov 30 2021 14:21

This is an estimation of the greenfield runoff rates that are used 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). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.0645

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	959	781
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is 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 would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.44	4.28
1 in 1 year (l/s):	4.62	3.64
1 in 30 years (l/s):	11.58	9.11
1 in 100 year (l/s):	14.19	11.16
1 in 200 years (l/s):	15.55	12.23

Project: D1621 -St Edmunds development

Chamber Model -	MC-4500		
Units -	**Metric**	Click Here for Imperial	
Number of Chambers -	236		
Number of chambers -	36		
Voids in the stone (porosity) -	43	%	
Base of Stone Elevation -	58.65	m	☑ Include Perimeter Stone in Calculations
Amount of Stone Above Chambers -	305	mm	
Amount of Stone Below Chambers -	230	mm	
Area of system -	910	sq.meters	Min. Area - 909.949 sq.meters

StormTech — Detention • Retention • Water Quality — A division of ADS

StormTech MC-4500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2057	0.00	0.00	0.00	0.00	9.934	9.93	1231.11	60.71
2032	0.00	0.00	0.00	0.00	9.934	9.93	1221.18	60.68
2007	0.00	0.00	0.00	0.00	9.934	9.93	1211.24	60.66
1981	0.00	0.00	0.00	0.00	9.934	9.93	1201.31	60.63
1956	0.00	0.00	0.00	0.00	9.934	9.93	1191.38	60.61
1930	0.00	0.00	0.00	0.00	9.934	9.93	1181.44	60.58
1905	0.00	0.00	0.00	0.00	9.934	9.93	1171.51	60.56
1880	0.00	0.00	0.00	0.00	9.934	9.93	1161.57	60.53
1854	0.00	0.00	0.00	0.00	9.934	9.93	1151.64	60.50
1829	0.00	0.00	0.00	0.00	9.934	9.93	1141.71	60.48
1803	0.00	0.00	0.00	0.00	9.934	9.93	1131.77	60.45
1778	0.00	0.00	0.00	0.00	9.934	9.93	1121.84	60.43
1753	0.00	0.00	0.27	0.00	9.816	10.09	1111.90	60.40
1727	0.00	0.00	0.78	0.01	9.596	10.38	1101.81	60.38
1702	0.00	0.00	1.10	0.03	9.449	10.58	1091.43	60.35
1676	0.01	0.00	1.39	0.05	9.313	10.76	1080.85	60.33
1651	0.01	0.00	1.79	0.07	9.133	11.00	1070.10	60.30
1626	0.01	0.00	3.03	0.09	8.594	11.71	1059.10	60.28
1600	0.02	0.00	4.45	0.12	7.973	12.53	1047.39	60.25
1575	0.02	0.00	5.34	0.14	7.576	13.06	1034.86	60.22
1549	0.03	0.00	6.07	0.17	7.251	13.49	1021.80	60.20
1524	0.03	0.01	6.70	0.20	6.968	13.87	1008.31	60.17
1499	0.03	0.01	7.27	0.22	6.715	14.20	994.44	60.15
1473	0.03	0.01	7.78	0.25	6.485	14.51	980.24	60.12
1448	0.03	0.01	8.25	0.28	6.269	14.79	965.74	60.10
1422	0.04	0.01	8.69	0.30	6.069	15.06	950.94	60.07
1397	0.04	0.01	9.10	0.33	5.881	15.31	935.89	60.05
1372	0.04	0.01	9.48	0.35	5.705	15.54	920.58	60.02
1346	0.04	0.01	9.85	0.38	5.538	15.76	905.04	60.00
1321	0.04	0.01	10.19	0.40	5.379	15.97	889.28	59.97
1295	0.04	0.01	10.52	0.43	5.227	16.17	873.30	59.95
1270	0.05	0.01	10.84	0.45	5.082	16.37	857.13	59.92
1245	0.05	0.01	11.14	0.47	4.943	16.55	840.76	59.89
1219	0.05	0.01	11.42	0.49	4.811	16.73	824.21	59.87
1194	0.05	0.01	11.70	0.51	4.684	16.89	807.49	59.84
1168	0.05	0.01	11.96	0.54	4.562	17.06	790.60	59.82
1143	0.05	0.02	12.21	0.56	4.444	17.21	773.54	59.79
1118	0.05	0.02	12.45	0.58	4.332	17.36	756.33	59.77
1092	0.05	0.02	12.69	0.59	4.223	17.50	738.97	59.74
1067	0.05	0.02	12.91	0.61	4.119	17.64	721.46	59.72
1041	0.06	0.02	13.13	0.63	4.018	17.78	703.82	59.69
1016	0.06	0.02	13.33	0.65	3.921	17.90	686.05	59.67
991	0.06	0.02	13.53	0.67	3.827	18.03	668.14	59.64
965	0.06	0.02	13.73	0.69	3.737	18.15	650.11	59.62
940	0.06	0.02	13.91	0.70	3.650	18.26	631.96	59.59
914	0.06	0.02	14.09	0.72	3.566	18.38	613.70	59.56
889	0.06	0.02	14.26	0.74	3.485	18.48	595.33	59.54
864	0.06	0.02	14.43	0.75	3.406	18.59	576.84	59.51
838	0.06	0.02	14.59	0.77	3.331	18.69	558.26	59.49
813	0.06	0.02	14.74	0.79	3.258	18.78	539.57	59.46
787	0.06	0.02	14.89	0.80	3.188	18.88	520.78	59.44
762	0.06	0.02	15.03	0.82	3.120	18.97	501.91	59.41
737	0.06	0.02	15.17	0.84	3.053	19.06	482.94	59.39
711	0.06	0.02	15.30	0.86	2.988	19.14	463.89	59.36
686	0.07	0.02	15.42	0.86	2.931	19.22	444.74	59.34
660	0.07	0.02	15.54	0.88	2.874	19.29	425.53	59.31
635	0.07	0.02	15.66	0.89	2.818	19.37	406.23	59.29
610	0.07	0.03	15.77	0.90	2.765	19.44	386.87	59.26
584	0.07	0.03	15.88	0.92	2.713	19.51	367.43	59.23
559	0.07	0.03	15.98	0.93	2.664	19.57	347.92	59.21

Project: D1621 -St Edmunds development

Chamber Model -	MC-4500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	236	
Number of chambers -	36	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	58.65	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	230	mm
Area of system -	910	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 909.949 sq.meters

StormTech Detention • Retention • Water Quality

A division of ADS

StormTech MC-4500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
533	0.07	0.03	16.08	0.94	2.617	19.63	328.35	59.18
508	0.07	0.03	16.17	0.95	2.572	19.69	308.72	59.16
483	0.07	0.03	16.26	0.96	2.530	19.75	289.03	59.13
457	0.07	0.03	16.34	0.98	2.489	19.80	269.28	59.11
432	0.07	0.03	16.42	0.99	2.450	19.85	249.48	59.08
406	0.07	0.03	16.49	1.00	2.414	19.90	229.62	59.06
381	0.07	0.03	16.56	1.01	2.379	19.95	209.72	59.03
356	0.07	0.03	16.63	1.02	2.346	19.99	189.77	59.01
330	0.07	0.03	16.69	1.03	2.315	20.03	169.78	58.98
305	0.07	0.03	16.75	1.04	2.286	20.07	149.75	58.95
279	0.07	0.03	16.81	1.04	2.259	20.11	129.67	58.93
254	0.07	0.03	16.89	1.05	2.220	20.16	109.57	58.90
229	0.00	0.00	0.00	0.00	9.934	9.93	89.41	58.88
203	0.00	0.00	0.00	0.00	9.934	9.93	79.47	58.85
178	0.00	0.00	0.00	0.00	9.934	9.93	69.54	58.83
152	0.00	0.00	0.00	0.00	9.934	9.93	59.60	58.80
127	0.00	0.00	0.00	0.00	9.934	9.93	49.67	58.78
102	0.00	0.00	0.00	0.00	9.934	9.93	39.74	58.75
76	0.00	0.00	0.00	0.00	9.934	9.93	29.80	58.73

MC-4500 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH MC-4500 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
52" x 100" x 60"
1,321 mm x 2,540 mm x 1,524 mm

Chamber Storage
106.5 ft³ (3.01 m³)

Min. Installed Storage*
162.6 ft³ (4.60 m³)

Weight
120 lbs (54.4 kg)

Shipping
7 chambers/pallet
11 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-4500 END CAP
(not to scale)

Nominal End Cap Specifications

Size (L x W x H)
35.1" x 90.2" x 59.4"
891 mm x 2,291 mm x 1,509 mm

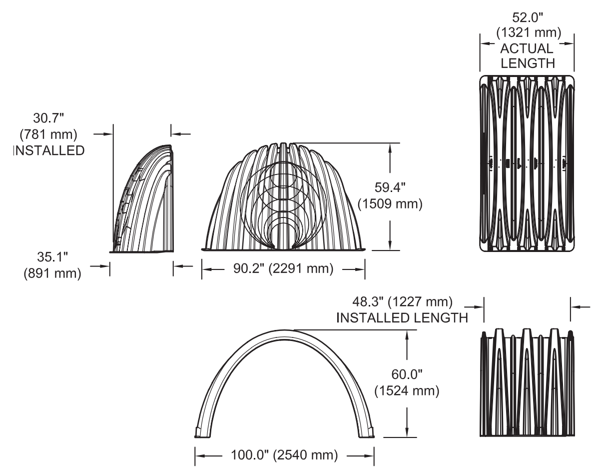
End Cap Storage
35.7 ft³ (1.01 m³)

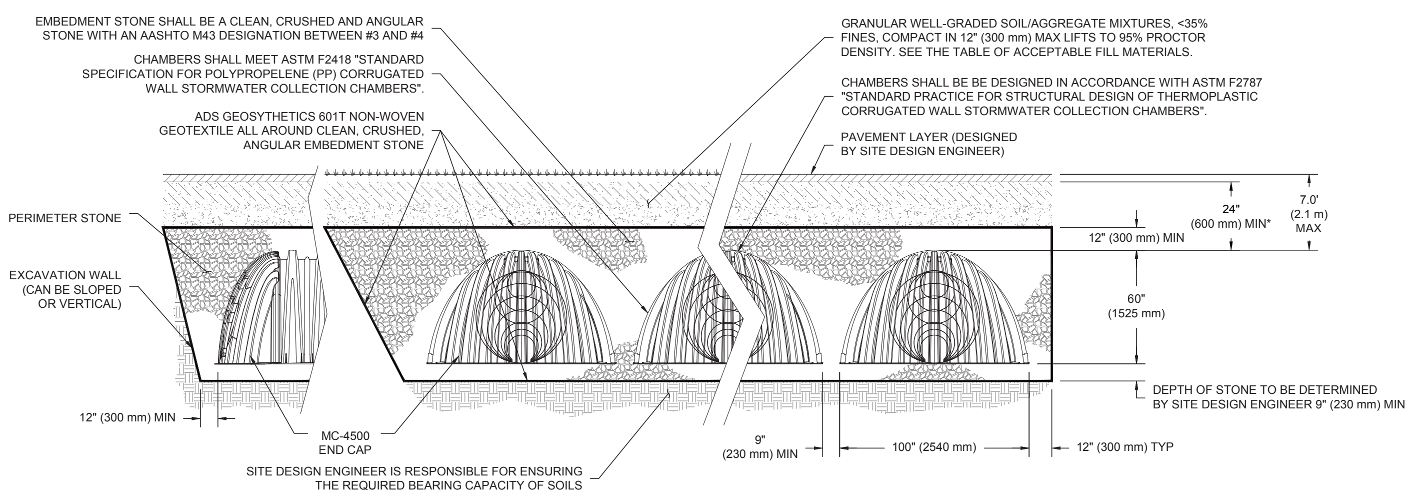
Min. Installed Storage*
108.7 ft³ (3.08 m³)

Weight
120 lbs (54.4 kg)

Shipping
7 end caps/pallet
11 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

StormTech®

ADS®

MC-4500 CHAMBER SPECIFICATIONS

STORAGE VOLUME PER CHAMBER FT^3 (M^3)

	Bare Chamber Storage ft^3 (m^3)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.6 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.0)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds^3)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500 Chamber	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
MC-4500 End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC KILOGRAMS (m^3)	230 mm	300 mm	375 mm	450 mm
MC-4500 Chamber	6,681 (4.0)	7,117 (4.2)	7,552 (4.5)	7,987 (4.7)
MC-4500 End Cap	8,691 (5.2)	9,075 (5.4)	9,460 (5.6)	9,845 (5.9)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 12" (300 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD^3 (M^3)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-4500 Chamber	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
MC-4500 End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

Note: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of the end caps, and 24" (600 mm) of cover. The volume of excavation will varyas depth of cover increases.

Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech MC-4500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Kingspan Klargester

SEPARATORS

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Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.
helpingyou@klargester.com to make the right decision or call **028 302 66799**

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention or bypass separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

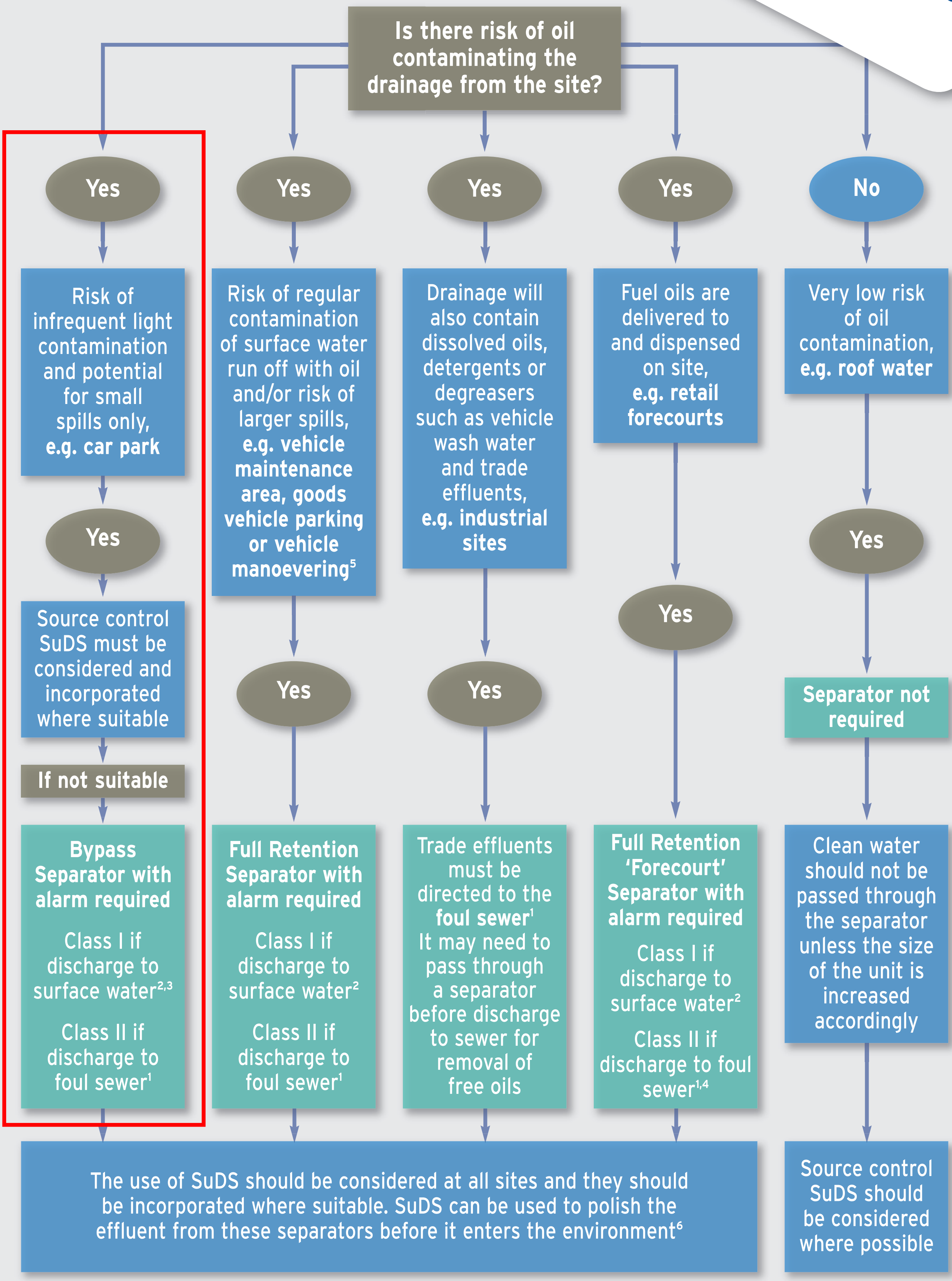
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

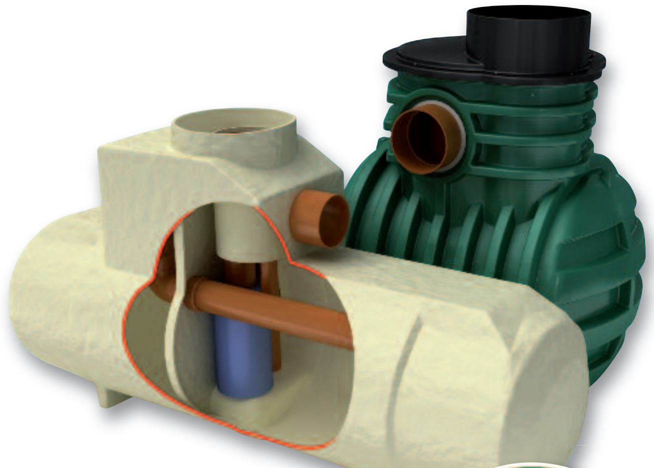
For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 *You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.*
2 *You must seek prior permission from the relevant environmental body before you decide which separator to install.*
3 *In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.*
4 *In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.*
5 *Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.*
6 *In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.*

Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Klargester full retention separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

Class II separators are designed to achieve a concentration of 100mg/litre of oil under standard test conditions.

Advanced rotomoulded construction on selected models
• Compact and robust
• Require less backfill
• Tough, lightweight and easy to handle

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped .
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

CLASS II P.I. ON FOUL NETWORK

CLASS I P.I. ON SW NETWORK

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction   *GRP chamber construction*   ** Some units have more than one access shaft – diameter of largest shown.*

PROFESSIONAL INSTALLERS

Klargester Accredited Installers

Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.

Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
- Tank and drainage system installation
- Connection to discharge point and electrical networks
- Waste emptying and disposal

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- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

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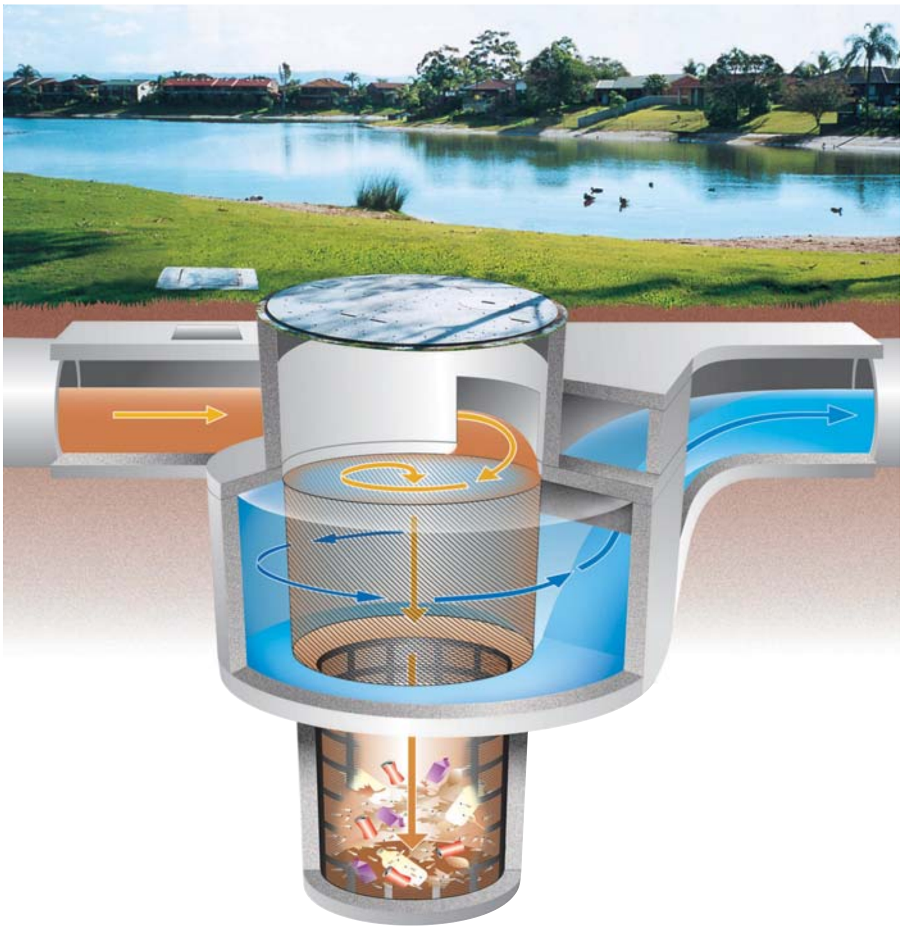
Issue No. 20: August 2014

Specialists in Wastewater Treatment & Stormwater Management

Surface Water Treatment SUDs Protector






The CDS Non Blocking screening technology is an innovative method of liquid / solid separation for Surface Water, Combined Sewer Overflows (CSO) and Foul Sewage Systems.

- ***SurfSep*** for Surface Water applications
- ***OverSep*** for Combined Sewer Overflow applications.

The technology accomplishes high efficiency separation of settleable particulate matter and capture of floatable material.

A unique feature of the CDS Technology is it's compact design. Both the *SurfSep* and *OverSep* are available as packaged systems, which can either be installed inside pre-cast concrete chamber rings, or complete BBA Approved Polyethylene Chambers unit.

Applications

- Storm-water Treatment
- Combined Sewer Overflow Treatment
- Parking Area Run-Off Treatment
- Vehicle Service Yard Areas
- Pre-treatment for Wetlands, Ponds and Swales
- Rainwater Harvesting
- Pre-treatment for Oil Separators
- Pre-treatment for media and Ground In-filtration Systems

Rapid installation

Primary features

- **Effective**: Capturing more than 95% of solid pollutants.
- **Non-Blocking**: Unique design takes advantage of indirect filtration and properly proportioned hydraulic forces that virtually makes the unit unblockable.
- **Non-Mechanical**: The unit has no moving parts and requires no mechanical devices to support the solid separation function.
- **Low Maintenance Costs**: The system has no moving parts and is fabricated of durable materials.
- **Compact & Flexible**: Design and size flexibility enables the use of various configurations.
- **High Flow Effectiveness**: The technology remains highly effective across a broad spectrum of flow ranges.
- **Assured Pollutant Capture**: All materials captured are retained during high flow conditions.
- **Safe & Easy Pollutant Removal**: Extraction methods allow safe and easy removal of pollutants without manual handling.

Surface Water System

Hydraulic Analysis

In storm water applications, an analysis of the catchment in terms of its size, topography and land use will provide information for determining flow to be expected for various return periods.

The *SurfSep* is designed for the flow that mobilizes the gross pollutants within the catchment. Since there are variations in catchment response due to region, land use and topography, it is recommended that the selection of flow to be treated will be for return periods of between 3 months and 1 year.

Balancing the cost to the operator against the benefits to the environment

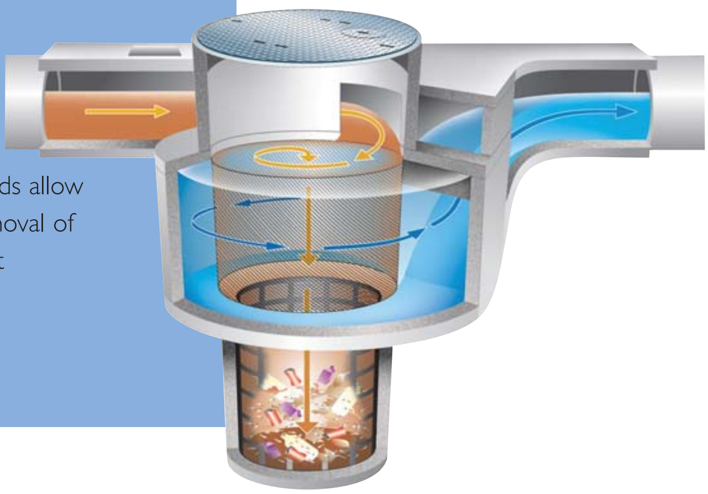
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

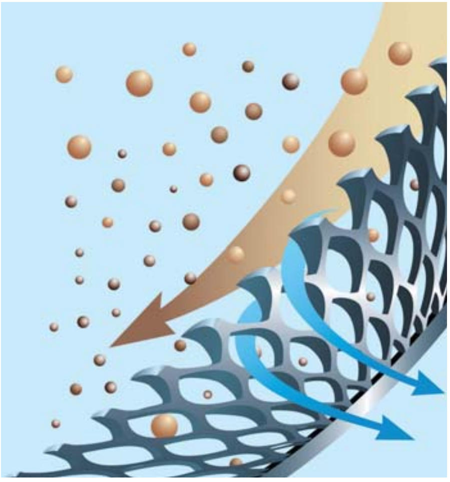
Therefore it is typical not to design the *SurfSep* models to process the conveyance system's maximum flow in order to achieve a very high level of pollutant removal.

The added value benefit to the operator is reduced civil costs without compromising the benefits to the environment.

How it works

Water and pollutants enter the system and are introduced tangentially inside the separation chamber forming a circular flow motion. Floatables and suspended solids are diverted to the slow moving centre of the flow. Negatively buoyant solids settle out to an undisturbed sump chamber below, while the water passes countercurrently through the separation screen. Floatables remain at the water surface and retained within the screen.





Surface Water Treatment Systems

Hydraulic Design

Every application requires a detailed hydraulic analysis to ensure the final installation will perform to effect optimum solids separation without blocking the screen.

After the design flow has been determined, the appropriate standard model can be selected. A selection table is provided on page 7.

The Ultimate SUDs Protector

There a four principal areas of proprietary SUDs technology;

• Infiltration • Flow Control • Storage/attenuation • Treatment

SurfSeps, although a common form of treatment are unique. When installed upstream of any proprietary SUDs technology, the *SurfSep* protects the receiving SUDs from fine solids and debris that would otherwise accumulate over time rendering the SUDs non-operational, as the worst case.

SurfSeps have been successfully installed in front of;

- Soakaways
- Infiltration Trenches
- Filters
- Wetlands
- Ponds and Water Features
- Detention and Retention Systems
- Oil Separators
- Create storage storage systems

to remove fine solids and debris that would otherwise accumulate over time reducing the down stream effectiveness of downstream SUDs assets.

Various independent field trials have shown that the *SurfSep* can remove high levels of Phosphates, Heavy Metals and PolyAramatic Hydrocarbons (PAH's) from the flow.

Infiltration

SurfSeps have been successfully installed in front of ground Infiltration systems to remove grit, fine solids and debris which accumulates in and around the SUDs causing visual degradation in the short term and accumulation of silt and grits leading to reduced volume in the long term.

Studies have also shown that Heavy metals & PAH's accumulate within the SUDs over time before being released back to the environment resulting in elevated concentrations.

Detention & Retention Systems

SurfSeps have been successfully installed in front of collection and attenuation SUDs to remove grit, fine solids and debris which accumulates in the SUDs leading to potential blockage of flow regulators resulting in increased Occupational Health & Safety risk during the treatment of blockages and during the periodic cleaning operations.

Applications

- Rainwater Harvesting
- Road run off
- New Developments
- Motorways
- A / B Roads
- Local Roads
- Residential
- Industrial
- Commercial

Purpose

Removal of plastics, oil, grit, fine solids, organic and inorganic debris, from point source pollution.

Flow Control Systems

Flow Control

Flow control is often required to reduce flooding of downstream sewer networks or receiving water courses. There are a number of ways to achieve this. The Hydroslide - Float controlled, constant flow regulator, as detailed below is ideally suited to the providing an efficient and reliable means of flow control.

There are four types of standard Hydroslide flow regulators as pictured.

1) Mini
2) HydroLimiter
3) VS - Vertical Standard
4) Combi - self flushing, can be mounted on the dry or wet side of the flow chamber.

Most applications can be dealt with using any of the four models to suit the flow. An accuracy of +/-5% is achievable.

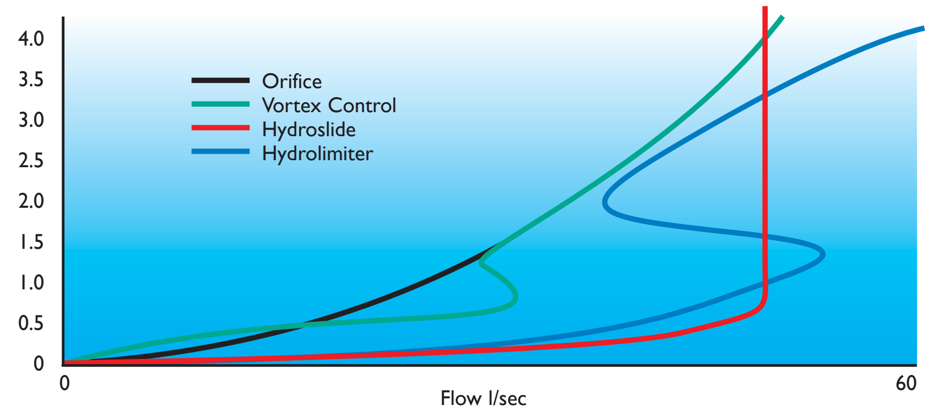
Typical SurfSep installation

Flow Control Technical Design

The Hydroslide regulator does not affect the flow until the flow is approaching the set discharge limit, this allows all flow (the first flush) to be discharged to the sewer. Because the flow to the sewer can be optimised at it's maximum permitted capacity the attentuation/storage capacity can be reduced over other methods of flow control, thus giving cost savings in storage provision. This is best explained by looking at a single storm event and comparing the 3 flow regulation processes as was done independantly by WRc in the report titled 'REDUCING THE COST OF STORMWATER STORAGE', Report No. PT1052, March 1995. The chart below represents 50 l/s control and up to 4m of head. The area difference between the curves being the detention volume saving.

Typically the volume saving when using a Hydroslide regulator is between 7% to 40%

Representation of flow through an orifice



Operation & Performance

Performance Criteria

Note: Screen apertures of 4.8 mm , 2.4 mm and 1.2 mm are available.

The 4.8 and 2.4 mm screens are generally used for Surface Water applications, with foul applications using either 2.4 or 1.2 mm aperture units.

Typical 1.2 mm aperture Performance

- shall remove all solids with a single dimension greater than 1.2 mm and positively contain those solids until the unit is cleaned.
- shall remove and positively contain 100 percent of all neutrally buoyant particles with a single dimension greater than 1.2 mm for all flow conditions to design capacity.
- shall remove and positively contain 100 percent of all floating trash and debris with a single dimension greater than 1.2 mm for all flow conditions to the design capacity.
- shall remove a minimum of 50 percent of oil and grease (as defined as the floating portion of total hexane extractable materials) for all flow conditions to the design capacity, without the addition of absorbents.
- shall provide the following minimum particle removal efficiencies (based on a specific gravity of 2.65):

a) 100 percent of all particles greater than 1100 microns.

b) 95 percent of all particles greater than 550 microns.

c) 90 percent of all particles greater than 367 microns.

d) 20 percent of all particles greater than 200 microns.

Maintenance

SurfSep maintenance can be site and drainage area specific. The installation should be inspected periodically to assure its condition to handle anticipated runoff. If pollutant loadings are known, then a preventive maintenance schedule can be developed based on runoff volumes processed.

Since this is seldom the case we recommend;

New Installations

Check the condition of the installation after the first few events. This includes a visual inspection to ascertain that the unit is operating correctly and measuring the amount of deposition that has occurred in the unit. This may be achieved using a 'Dip Stick'.

Ongoing Operation

For the first 12 months the installations sump full volume should be inspected monthly and recorded. When the inspection indicates that the sump full volume is approaching the top of the sump (base of screen) a cleanout should be undertaken.

Cleaning Methods

- Eduction (Suction)
- Basket Removal
- Mechanical Grab

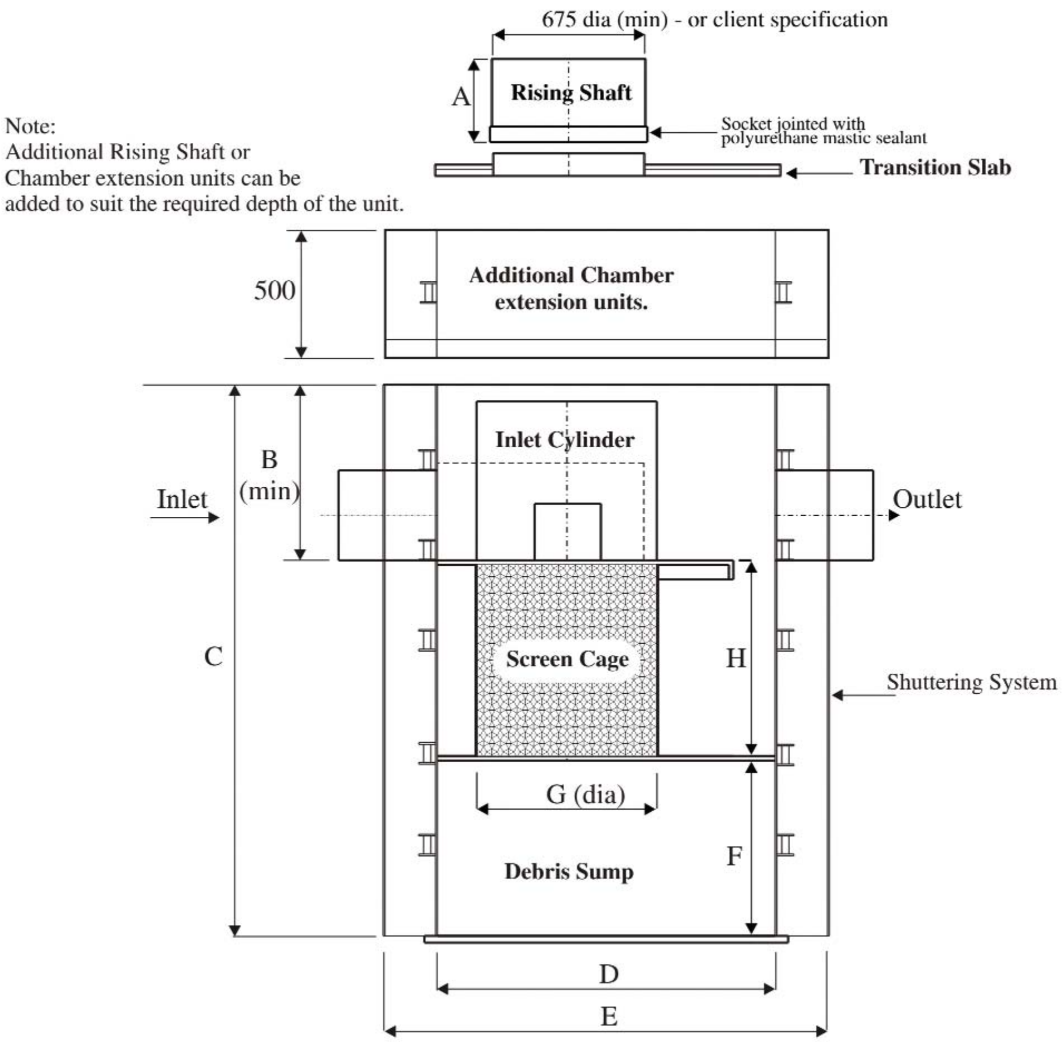
Maintenance Cycle

Minimum once per year. Depending on the pollutant load it may be necessary to maintain the installation more frequently.

The operator shall be able to devise the most efficient maintenance schedule for any particular installation over a 12 month operating cycle.

CDS TECHNOLOGIES

SurfSep Dimensions



SurfSep Dimensions (mm)

	SW0404	SW0604	SW0606	SW0804	SW0806	SW0808	SW1010	SW1012	SW1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	1200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table - *SurfSep*

Model Reference	Hydraulic Peak Flow Rate l/s	Drainage Area - Impermeable m^2	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
SWI 0404	30	2,000	900	150 / 225
SWI 0604	70	5,000	1200	225
SWI 0606 / 01	140	10,000	1200	225 - 375
SWI 0606 / 02	200	15,000	1200	225 - 375
SWI 0804	275	20,000	1500	300
SWI 0806	350	25,000	1500	450
SWI 0808	400	30,000	1500	450
SWI 1010	480	35,000	2000	450
SWI 1012	550	40,000	2000	450 / 750
SWI 1015	700	50,000	2000	450 / 750

* Proposed Peak Flow Rate for each model calculated using Rational Lloyd Davies with a rainfall intensity of 50mm/hr. For greater flows - special design / construction required.

In-Line *SurfSep* Units (SWI)

These units are used with in the drainage system in-line and are supplied as BBA Approved complete Polyethylene Chamber units from the selection table above.

Off-Line *SurfSep* Units (SWO)

These can be designed either using pre-cast concrete or specially designed Polyethylene chambers.

Model Designation

SurfSep models are firstly identified by the letters SW for Surface Water followed by a letter (**I** or **O**) representing the configuration (**I**nline or **O**ffline).

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a *SurfSep* screen for installation into standard commercially available pre-fabricated manhole chambers i.e SWI 0806. Example: SWI 0806 designates Surface Water Inline with a separation screen dia 0.8 m and screen height of 0.6m.

Surface Water Treatment

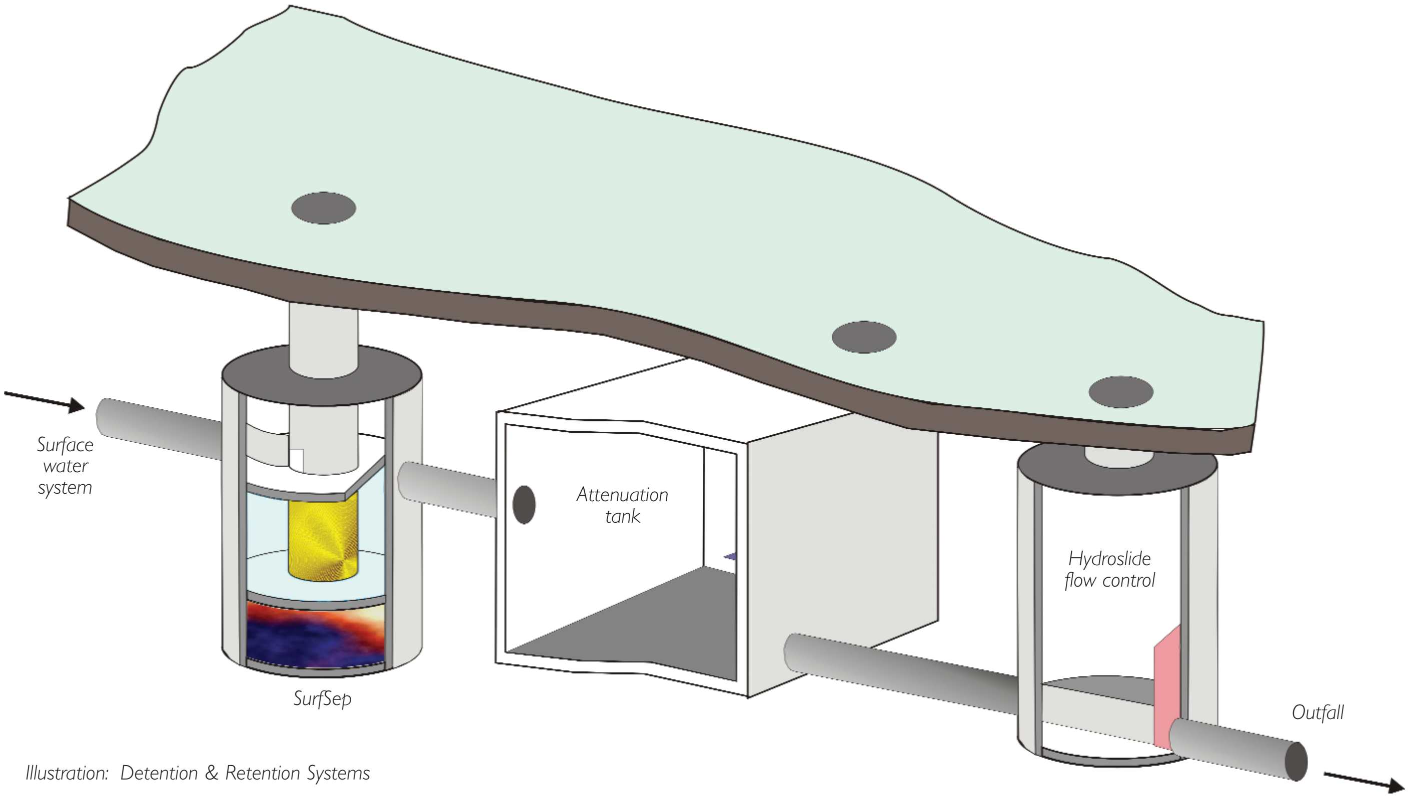


Illustration: Detention & Retention Systems

SurfSeps unit installed in front of attenuation tank / cellular storage system, to remove grit, fine sediments and floating debris which can accumulate within surface water systems. Hydroslide flow control regulating the discharge to the outfall. The Hydroslide can be supplied for installation in an insitu constructed chamber, or as a complete unit housed within a pre-fabricated polyethylene manhole chamber.

BBA BRITISH BOARD OF AGRÉMENT TECHNICAL APPROVALS FOR CONSTRUCTION

* BBA - THIS CERTIFICATE RELATES TO PIPEX UNIVERSAL MANHOLES AND ACCESS CHAMBERS, WHICH ARE MANUFACTURED FROM WELDED POLYPROPYLENE. This Certificate covers the use of the manholes and chambers for drain and sewer applications where they are used for maintenance to depths of 6 mtrs.

Approved Suppliers

If you would like more information please contact:

CDS Technologies is a multi disciplined, international, company offering a comprehensive product range of; wastewater treatment technologies and processes, and stormwater management solutions for attenuation, infiltration, flow control and overflow treatment. CDS have an established network of Distributors and Representatives. Further information can be found on our website www.cdstech.com.au
Alternatively please contact our approved supplier detailed left.

Hydro-Brake® Flow Control

Modelling Guide

Unit Selection Design Guide

Overview

Hydro-Brake® Flow Controls restrict the flow in surface/storm water or foul/combined sewer systems by inducing a vortex flow pattern in the water passing through the device, having the effect of increasing back-pressure.

Their 'hydrodynamic' rather than 'physical restriction' based operation provides flow regulation whilst maintaining larger clearances than most other types of flow control, making them less susceptible to blockage. Their unique "S"-shaped head-flow characteristic also enables them to pass greater flows at lower heads, which can enable more efficient use of upstream storage facilities.

This document provides guidance relating to the selection and use of Hydro-Brake® Flow Controls for use in surface/storm water and foul/combined sewer systems.

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. If in doubt, or to enquire about new product additions, please contact HRD Technologies Ltd.

STH Range of Hydro-Brake® Flow Controls

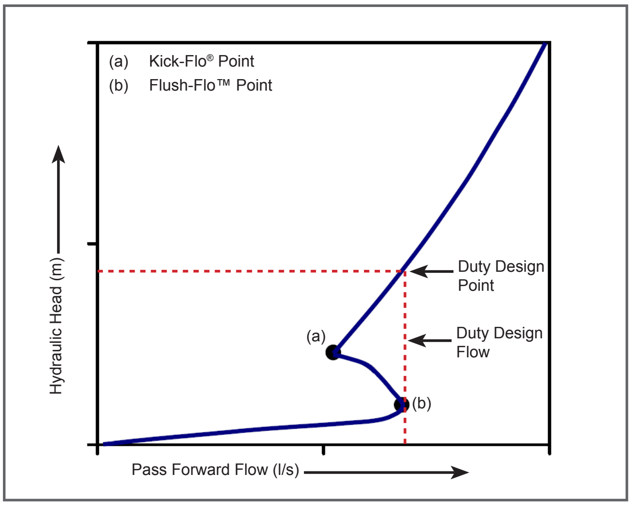
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

Hydro-Brake® Flow Controls should be selected such that the duty/design flow is not exceeded at any point on the head-flow curve, see illustration right. If this is not achievable using the initially selected unit, it may be appropriate to select an alternative option (see selection guidance overleaf).

While the primary aim of a flow control is to provide a particular flow rate at a given upstream head (giving a design/duty point), it is important to note that secondary opportunities, such as potential for optimised storage use, derive from consideration of the full hydraulic characteristic. It is therefore important to ensure that the same flow control, or one confirmed to provide equivalent hydraulic performance, is implemented in any final installation.



Typical Hydro-Brake® Head Versus Flow Characteristics

To ensure correct implementation a multiple design-point specification, defining the main hydraulic features of the selected flow control, can be provided by HRD Technologies Ltd. This should include at least the following information:

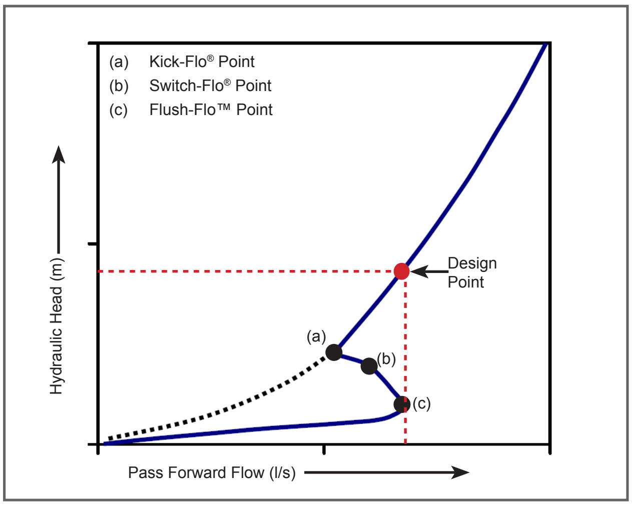
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

To ensure that a drainage system performs as designed, it is strongly recommended that this information is reproduced on any technical specifications.

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in WinDes® W.12.6!

The new STH type Hydro-Brake® Flow Control range has a unique head / discharge performance curve which introduces a very important feature - the Switch-Flo® Point. This point illustrates the unique performance feature of the STH range which can lead to further savings in upstream storage, whilst also enabling increased inlet / outlet size to further reduce the risk of blockage.



Typical STH Head Versus Flow Characteristics

Kick-Flo® (a) - the point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve and reach the same design point or desired head / flow condition.

NEW Switch-Flo® (b) - marks the transition between the Kick-Flo® and Flush-Flo™, from vortex initiation to stabilisation. This point adds a new layer of resolution to the Hydro-Brake® curve that has implications to upstream storage savings.

Flush-Flo™ (c) - the point at which the vortex begins to initiate and have a throttling effect. This point on the Hydro-Brake® curve is usually much nearer to the maximum design flow (Design Point), than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

STH Range of
Hydro-Brake® Flow Controls

The STH Hydro-Brake® Flow Control is the only vortex flow control available today that has been given the prestigious BBA Approval Certificate. The BBA assessment procedure entails rigorous assessment of production and manufacturing standards, and confirms that the hydraulic performance of the Hydro-Brake® Flow Control matches the data given to designers by HRD Technologies with their head / discharge curves.

A worked example showing the steps to model a Hydro-Brake® Flow Control and associated Stormcell® Storage System within Micro Drainage WinDes® is available on our website:

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

Engineering Nature's Way is a brand new resource for people working with Sustainable Drainage and flood management in the UK.

The site provides an opportunity to share news, opinion, information and best practice for people working in local and central Government; developers, consulting engineers and contractors. Do you have something to share? We would be delighted to receive your contributions.

turning water around ...®

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