KAVANAGH BURKE
CONSULTING ENGINEERS

Drainage Design Report

for

Industrial Development

at

Tay Lane, Greenogue, Rathcoole, Co. Dublin

Job No:	D1541
Client:	Electrical Waste Management Limited
Date:	5th November 2021
Local Authority:	South Dublin County Council
Revision:	PL2 (Planning Alterations)

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Contents:

Introduction

This report details the site development works design for a development at Tay Lane, Greenogue, Rathcoole, Co. Dublin – revised to suit subject alterations as listed at enclosed site notice and newspaper advert for which planning permission is sought for.

The subject site is located south of the R120 - Newcastle to Rathcoole Road, which also serves the mature Greenogue Business Park located to the immediate north. Proposed access to site is trough recently constructed fourth arm of Greenogue roundabout in the southward direction (as per granted planning permission reg.ref. SD18A/0265) as shown at enclosed drawing ref D1541 D2 Site Plan rev.PL2.

The site will be serviced primarily through connection to the existing services in the area.

The provision of the new on-site foul sewer, surface water & watermain are described as follows with calculations appended.

Surface Water:

Due to the industrial nature of the proposed development, the yard surfacing for HGV access and marshalling is concrete. An area of porous asphalt is provided to the car park area where traffic loads are light.

The surface water runoff generated from the proposed development is divided into 2 No. catchments within the overall site. one incorporating majority of the site while another incorporate low portion of the site (site's access road and yard area in front of the workshop and around weighbridges). This approach has been adopted by reviewing the network on proposed site layout and site's topography in order to provide reasonable drainage pipe depths and the depth of attenuation facilities.

Both catchments will be provided with their own SuDS compliant underground attenuation system and both will discharge from site through flow control devices to an existing surface water manhole located at the site's access to the north east as shown on the accompanying Drainage and Watermain layout drg.ref D1541 D3 rev. PL2.

Runoff from the hardstanding areas will be collected by trapped road gullies and rainwater goods throughout the development and directed to an on-site surface water attenuation facility. This facility is designed to attenuate 1 in 30-year storm event of any duration, therefore no flooding will occur on site for any duration events up to 30 year return period as per "Greater Dublin Strategic Drainage Study" (GDSDS) requirements. In addition to providing attenuation volume, temporary flood storage is check and provided where needed (as an integrated part of the attenuation system) for 100-year return events as per GDSDS requirements. The restricted discharge from site will be limited by a proprietary flow control device. The maximum allowable discharge is limited to calculated flow (see calculations in the succeeding chapters) not exceeding Greenfield runoff rate, QBAR (as per criterion 4.3 "River Flood Protection" chapter 6.3.4 of GDSDS). All flows and runoffs for storm water network design and attenuation sizing are calculated incorporating 10% climate change factor for all rainfall intensities as per chapter 6.3.2.4 of GDSDS table 6.2 "Climate Change Factors". In addition, a computer analysis in the storm network modelling software was performed to confirm the sizing of the pipe network and underground attenuation storage for 1 in 100 year storms of all durations. This analysis include a specific model of vortex flow control device with discharge of the calculated QBAR and 20% Climate Change Factor. The analysis indicated no on-site flooding (meaning that both the network and all proposed attenuation storage have sufficient capacities).

The attenuation facilities proposed are "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.

These water quality control measures can be cleaned out by suction hose/tanker if required from standard maintenance inspections. In the case of the isolator row, the chamber is backwashed with a proprietary power jet wash and its water removed by suction hose/tanker.

Water quantity control is provided downstream of the attenuation facilities by providing the above-mentioned flow control device. The proposed vortex style flow control device of discharge rate will be installed on the outfall of the last surface water manhole, shown at accompanying Drainage and Watermain Layout drg. ref D1541 D3. The discharge from site, i.e. the restricted flow from the flow control device will discharge to an existing surface manhole at the site's access (as constructed as per granted permission reg.ref. SD18A/0265) and ultimately to the existing Griffeen River open channel adjacent to the Greenogue Roundabout.

In considering the above surface water management solution we considered all SuDS devices and given the industrial nature of the proposed operations on this site, the above solution of underground surface water attenuation was decided on.

Facilities provided for the handling of WEEE products and waste metal require robust industrial structures coupled with hard wearing durable large yard areas. Consideration was given to SuDS devices which incorporate infiltration at source however we have opted for a solution that ensures managed filtration prior to any infiltration to ground or discharge from site. In such an industrial environment, items such as swales, detention or attenuation ponds, infiltration trenches and other open devices were deemed unsuitable due to possible pollution risks to the groundwater – addressed below in greater detail.

The management of runoff from the open storage of metals has been discussed earlier in this document (where this small area of runoff is directed to the foul sewer), however the management of runoff from the general concrete yard where HGV's traverse and park, is dealt with by providing trapped gullies, silt traps, petrol interceptors, and the aforementioned surface water attenuation facility incorporating the "isolator row". Runoff from these areas can contain silts and hydrocarbons therefore direct discharge to infiltration devices have been avoided.

Suds devices included and others not included are as follows with reasoning:

- Water butts – provided on site at source/rain water pipes.
- Greywater re-use – not provided as water usage is minimal. There is no trade water usage within the industrial process of WEEE & waste metal handling.
- Infiltration trenches, infiltration basins, swales, bioretention areas – not provided as risk of pollution to direct infiltration devices would exist. The subject proposal incorporates infiltration through the base of the underground surface water attenuation system which is downstream of trapped gullies, proprietary silt trap and petrol interceptor and integrated "isolator row" within the attenuation system. The infiltration proposed within the attenuation facility caters for the first 5mm of rainfall on site as per SuDS guidance.

- Permeable Paving – provided to the pollution low risk car park area to the front of the main building. This permeable surfacing will be provided by placing open textured macadam or asphalt as opposed to paving setts. Possible flash runoff from this area is allowed for in the on-site surface water attenuation system.
- Retention ponds, detention basins, stormwater wetlands – not provided due to the relatively small size of the site and the required building footprint and associated yard area. Such open water holding devices lend themselves to larger developments where a number of sites share such a facility. For the subject site, sterilising a percentage of the site to such a surface device would require additional lands to be attained which impacts on the viability of the project. Such land is not available to the Applicant.

The proposed surface water management solution for the subject site provides both runoff quality and quantity control. Quality control is provided by ensuring all surface water runoff is dealt with on site as described earlier in this document with reference to the specified attenuation system with in-built "isolator row", proprietary silt traps & petrol interceptors. Quantity control is also provided through the surface water attenuation system coupled with the downstream flow control device. This system of surface water management has been put in place throughout the more recent phases of Greenogue Business Park where many individual sites have been developed in a similar nature.

In summary, the following figures synopsise the surface water attenuation calculations:

SITE AREA	21,785 m^2
CATCHMENT #1 AREA	15,170 m^2
CATCHMENT #2 AREA	5,000 m^2
SAAR	810
SOIL VALUE	0.3

STRUCTURE TYPE	RUNOFF COEFFICIENTS	C#1 AREA (ha)	C#1 AREA (ha)
Impermeable Areas *(Roofs; Concrete Yard/Road; Pathways; Permeable paving)*	0.8	1.13	0.32
Green Roof (if any)	0.8	0	0
Contributing Landscaping	0.3	0.15	0.13
TOTAL	-	1.28	0.45

The details of the surface water attenuation system including interceptors, flow restrictions, volume and pipe designs are attached in this Drainage Design Report and on the accompanying drainage layout (drawing reference D1541 D3 Drainage & Watermain Layout PL2) for review by the Local Authority.

All other details and reports remain unaltered as per granted permission reg.reg SD19A/0065.

Foul Sewer:

A new foul sewer has been designed to collect discharge from the proposed development and discharge to the existing foul sewer manhole and network at site's access to the north east. This network recently constructed as per granted permission SD18A/0265 has become a part of the existing Greenogue Business Park network.

The peak foul sewer discharge rate is based on the discharge unit method of drainage design for calculating maximum sewage and wastewater flows. The proposed ancillary offices and warehouse toilet facilities are the source of wastewater for overall development. Additional flow is directed to this wastewater pipe from:

a) an internal sump within the industrial unit which is provided to collect small quantities of water that are drained from end of life fridges, dishwashers and washing machines. The flow from this source is expected to be minimal with a design peak defined in the calculations at 2.0 l/sec.

b) possible runoff from the 2 No. HGV washes. The automatic brush wash will have a built-in water recycling mechanism so there won't be any discharge from this unit. A water topping up supply is only required due to loss of small quantities of water on the vehicles and possible evaporation. The second HGV was is a hand-held lance wash. This wash will incorporate a silt pit directly below and possible runoff from both washes will pass through a proprietary silt trap and washdown separator.

c) surface runoff from the waste metal external storage area. This runoff will be collected at source through a number of gullies where it is subsequently discharged to the foul sewer through a proprietary petrol interceptor. Discharge to the foul sewer for such surface water runoff is confined to this defined area (as detailed on the enclosed Drainage Layout, Drg. No. D1541 D3 PL2). All other surface water runoff from the building roofs or the general yard will be directed to the on site surface water attenuation system incorporating proprietary filters as described above in this document.

As per the requirements of the Irish Water Code of Practice, minimum velocities of 0.75 m/s are met for the proposed gradients and contributing discharge unit numbers (refer to discharge unit calculation sheet 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.

The method of calculating the total discharge units from the development is carried out in accordance with BS EN 752-4:1998 "Drain and sewer systems outside buildings", refer to insert below for the relative tabulated extract;

Table C.1 — Typical frequency factors (k_{DU})

Type of building	k_{DU}
Dwelling, guesthouse, office (intermittent use)	0.5
Hospital, school, restaurant, hotel (frequent use)	0.7
Toilets and/or shower open to the public (congested use)	1.0
Laboratory buildings (special use)	1.2

Table C.2 — Typical values of discharge units (*DU*)

Type of appliance	*DU*
Washbasin, shower	0.3 to 0.6
Urinal	0.3 to 0.8
Bath, kitchen sink	0.8 to 1.3
Dishwasher	0.2 to 0.8
Household washing machine	0.5 to 0.8
Commercial washing machine	1.0 to 1.5
WCs (4.0 l to 9.0 l cistern)	1.2 to 2.5
Floor drains (DN 50 to DN 100)	0.6 to 2.0
The discharge unit will depend on the type of drainage system inside the building and the size of the appliance. Where no specific information is available, the higher value should be used.	

All proposed calculations of discharge units, flows and pipe designs are included further in this Drainage Design Report for the review of the Local Authority.

Watermain:

The watermain proposed to serve the development will form a metered connection from the existing 150mm private main at recently constructed access road. exact location show on accompanying drg ref. D1541 D3.

A new looped 150mm dia. HDPE watermain within the site will be provided with adequate sluice valves, water meter & fire hydrants to provide water supply and for firefighting purposes. Hydrants will not be placed within 6m of a building or structure and at a maximum 46m from proposed buildings. All associated details including watermain pipe material will be in accordance with the current Irish Water guidelines. 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. Refer to enclosed Drainage & Watermain drawing Ref. D1693-D4 for layout details.

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Surface Water Attenuation Design

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Surface Water Attenuation Calculation

1) Areas for Attenuation Calculation

Site Area of development:	22,465 m^2 (2.25 ha)
Catchment #1 area:	15,170 m^2 (4.752 ha)
Contributing Landscaping:	1,500 m^2
Impermeable Areas (roof, concrete yard):	11,265 m^2
Catchment #2 area:	5,000 m^2 (0.5 ha)
Contributing Landscaping:	1,300 m^2
Impermeable Areas (roof, concrete yard):	3,250 m^2
Directed to Foul Sewer:	*2,070 m^2*
External storage contributing area:	*1,580 m^2*
Wash contributing area:	*490 m^2*

2) Interception Storage

Calculate runoff from 5mm of rainfall on developed area.
For this calculation only hardstanding areas are assumed to provide 80% runoff, and non-hardstanding areas are assumed to provide 0% runoff.
The equivalent volume of Interception Storage should be provided on site as no discharge from site should occur for this initial 5mm depth of rainfall. The Interception Storage on this subject site will be provided through the base of attenuation tank.

Catchment 1:

Design Impermeable Areas:	11,265 m^2 x 0.80 = 9,012 m^2
Total volume for 5mm rainfall:	5mm x 9,012 m^2 = **45 m^3**

Catchment 2:

Design Impermeable Areas:	3,250 m^2 x 0.80 = 2,600 m^2
Total volume for 5mm rainfall:	5mm x 2,600 m^2 = **13 m^3**

Therefore, a minimum Interception Storage volume of 45m^3 (C#1) and 13m^3 (C#2) should be provided. This will prevent discharge from site during rainfall events of up to 5mm rainfall.

3) Greenfield Runoff Rate – QBAR, (mean annual flood flow):

$Q_{BARrural}$ (m^3/sec) = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$

SAAR (E 302600, N 227750): <u>810 mm</u> (*as per Met Eireann data*)

Soil Index: S1 (very low runoff)
S2
S3 (moderate runoff)
S4
S5 (very high runoff)

Soil = 0.1($Soil_1$) + 0.3($Soil_2$) + 0.37($Soil_3$) + 0.47($Soil_4$) + 0.53($Soil_5$)
As the site is relatively small in catchment terms the soil class will be 100% Soil2 as per online Wallingford Procedure Greenfield runoff estimation tool on www.uksuds.com (see Appendix to Surface Water Design for the HR Wallingford Greenfield runoff rate estimation report).

Soil Class:	$Soil_2$
Runoff Potential:	Low
Soil Value:	0.3

Q_{BAR}:
As the site area is less than 50 hectares, QBAR for 50 hectares is firstly calculated:

Q_{BAR} (m^3/sec) = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$ =
0.00108 x $(0.5)^{0.89}$ x $(810)^{1.17}$ x $(0.3)^{2.17}$ =
108.1 l/sec =
2.16 l/sec/ha

CATHCMENT 1 - Q_{BAR} for the subject site area:

2.16 l/sec/ha x 1.517 ha =
Q_{BAR} = 3.3 l/sec

CATHCMENT 2 - Q_{BAR} for the subject site area:

2.16 l/sec/ha x 0.5 ha =
Q_{BAR} = 1.1 l/sec

According to GDSDS chapter 6.3.1.4 if the separate long term storage cannot be provided and temporary flood storage forms part of the single attenuation system, all the runoff from the site should be discharged at either a rate of 2.0 l/s/ha or the average annual peak flow rate Q_{BAR}, whichever is greater:

<u>Therefore, allowable discharge (Q_{BAR}) will be set at</u>
<u>**3.3 l/sec (Catchment #1)**</u> and <u>**2.0 l/sec (Catchment #2).**</u>

4) Attenuation Storage Volume – Catchment 1

100% of hardstand areas are assumed to contribute.
Permeable paving taken as impervious surfacing for attenuation storage calculations to allow for long term paving infiltration rate reduction.

Equivalent Runoff Area: (roof, concrete yard, roads): 11,265 m^2

Met Eireann's Rainfall depths for the 30 year storm event have been used. The table below identified the 24 hour event as the critical event. The rainfall depth used includes a 10% allowance for climate change giving a volume of 899 m^3 - (Column G).

A	B	C	D	E	F	G
Duration	**Runoff Area**	**Total Rainfall Depth**	**Revised Depth for 10% Climate Change**	**Total Surface Water**	**Total Permitted Discharge**	**Storage Volume Required**
	(m^2)	**(mm)**	**(mm) C x 1.1**	**(m^3) B x D**	**(m^3) Q2 x A *(Q_{BAR}=3.3 l/sec)***	**(m^3) E - F**
15 min	11265	19.80	21.78	245.35	2.95	242.40
30 min	11265	25.20	27.72	312.27	5.90	306.36
1 hour	11265	31.90	35.09	395.29	11.81	383.48
2 hour	11265	40.50	44.55	501.86	23.61	478.24
4 hour	11265	51.50	56.65	638.16	47.22	590.94
6 hour	11265	59.20	65.12	733.58	70.84	662.74
12 hour	11265	75.20	82.72	931.84	141.67	790.17
1 day	11265	95.40	104.94	1182.15	283.35	898.80
2 day	11265	106.80	117.48	1323.41	566.69	756.72

Critical Attenuation Volume = 899 m^3

Subtract Interception Storage: 899 m^3 – 45 m^3 **= 854 m^3 Required Attenuation Volume**

The calculated attenuation storage volume was analysed in the storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 30-year return period therefore calculated volume of attenuation tank is sufficient.

5) Temporary Flood Storage – Catchment 1

In addition to the previous calculations for interception & attenuation storage, the temporary flood storage must be calculated.

For long term storage the GDSDS runoff model assumptions:

80% of hardstand areas are assumed to contribute.
Soil SPR Value – 0.3, therefore 30% of non-hardstand areas assumed to contribute.

Equivalent Runoff Area:	80% x 11,265 m^2 + 30% x 1,500 m^2 =
	= 9,012 m^2 + 450 m^2 =
	= **9,462 m^2**

The 6 hour duration, 100 year return period must be checked to assess the **temporary flood storage** required for the site.

100 year 6 hour event, rainfall depth: 82.9 mm
Factor up by 10% for climate change: 91.19 mm

Total Volume of Runoff:	91.19mm x 9,462 m^2	=	863 m^3
Deduct discharge at Q_{BAR} for 6hrs:	3.3 l/sec x 6 hrs	=	71 m^3
Storage volume required:	863 – 71	=	792 m^3
Deduct Interception Storage:	45 m^3		
Deduct Attenuation Storage:	854 m^3		
Temporary Flood Storage required:	792 –45 – 854	<	0 m^3

The calculated attenuation volume was analysed in a storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 30 with 20% climate change. The storage was also analysed for 1 in 100 year storms with 20% CCF and there is no flooding or ponding during the analysis.
The detailed results of this analysis are enclosed in this report at Surface Water Network Design.

CATCHMENT 1 in summary:

INTERCEPTION STORAGE: 45m^3 to be provided by a lowered base to the attenuation system.
Attenuation System Area: 825m^2. Therefore, the Interception Storage Depth will equal 150mm. A lowered base level to the attenuation facility allowing base infiltration will facilitate on site discharge of this interception volume. This storage volume being lower than the system outlet cannot discharge from site.

ATTENUATION VOLUME: 854m^3 to be provided within the attenuation system on site

TEMPORARY FLOOD STORAGE:
Due to the high percentage of hardstanding areas on site the long term flood storage will be fully provided within the calculated attenuation volume of 899 m^3.

ATTENUATION VOLUME REQUIRED: 899m^3

ATTENUATION VOLUME PROVIDED: 902.5 m^3
(Refer to StormTech Cumulative Storages spreadsheet below)

Storm Water Network analysis and Attenuation Tank Size checks were performed using a computer hydraulic analysis software. The analysis did not highlight any ponding for any storm durations up to 1:100y return therefore the network and attenuation capacity calculated above are satisfactory.
The results of the analysis are included in this report.

6) Attenuation Storage Volume – Catchment 2

100% of hardstand areas are assumed to contribute.
Permeable paving taken as impervious surfacing for attenuation storage calculations to allow for long term paving infiltration rate reduction.

Equivalent Runoff Area: (roof, concrete yard, roads): 3,250 m^2

Met Eireann's Rainfall depths for the 30 year storm event have been used. The table below identified the 12 hour event as the critical event. The rainfall depth used includes a 10% allowance for climate change giving a volume of 182 m^3 - (Column G).

A	B	C	D	E	F	G
Duration	**Runoff Area**	**Total Rainfall Depth**	**Revised Depth for 10% Climate Change**	**Total Surface Water**	**Total Permitted Discharge**	**Storage Volume Required**
	(m^2)	**(mm)**	**(mm) C x 1.1**	**(m^3) B x D**	**(m^3) Q2 x A *(Q_{BAR}=2.0 l/sec)***	**(m^3) E - F**
15 min	3250	19.80	21.78	70.79	1.80	68.99
30 min	3250	25.20	27.72	90.09	3.60	86.49
1 hour	3250	31.90	35.09	114.04	7.20	106.84
2 hour	3250	40.50	44.55	144.79	14.40	130.39
4 hour	3250	51.50	56.65	184.11	28.80	155.31
6 hour	3250	59.20	65.12	211.64	43.20	168.44
12 hour	3250	75.20	82.72	268.84	86.40	182.44
1 day	3250	95.40	104.94	341.06	172.80	168.26
2 day	3250	106.80	117.48	381.81	345.60	36.21

Critical Attenuation Volume = 182 m^3

Subtract Interception Storage: 182 m^3 – 13 m^3 = **169 m^3 Required Attenuation Volume**

The calculated attenuation storage volume was analysed in the storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 30-year return period therefore calculated volume of attenuation tank is sufficient.

7) Temporary Flood Storage – Catchment 2

In addition to the previous calculations for interception & attenuation storage, the temporary flood storage must be calculated.

For long term storage the GDSDS runoff model assumptions:

80% of hardstand areas are assumed to contribute.
Soil SPR Value – 0.3, therefore 30% of non-hardstand areas assumed to contribute.

Equivalent Runoff Area:	80% x 3,250 m^2 + 30% x 1,300 m^2 =
	= 2,600 m^2 + 390 m^2 =
	= **2,990 m^2**

The 6 hour duration, 100 year return period must be checked to assess the **temporary flood storage** required for the site.

100 year 6 hour event, rainfall depth: 82.9 mm
Factor up by 10% for climate change: 91.19 mm

Total Volume of Runoff:	91.19mm x 2,990 m^2	=	273 m^3
Deduct discharge at Q_{BAR} for 6hrs:	2.0 l/sec x 6 hrs	=	43 m^3
Storage volume required:	273 –43	=	230 m^3
Deduct Interception Storage:	13 m^3		
Deduct Attenuation Storage:	169 m^3		
Temporary Flood Storage required:	230 –13 – 169	=	48 m^3

The calculated attenuation volume was analysed in a storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 30 with 20% climate change. The storage was also analysed for 1 in 100 year storms with 20% CCF and there is no flooding or ponding during the analysis.
The detailed results of this analysis are enclosed in this report at Surface Water Network Design.

CATCHMENT 2 in summary:

INTERCEPTION STORAGE: 13m³ to be provided by a lowered base to the attenuation system.
Attenuation System Area: 250m². Therefore, the Interception Storage Depth will equal 150mm. A lowered base level to the attenuation facility allowing base infiltration will facilitate on site discharge of this interception volume. This storage volume being lower than the system outlet cannot discharge from site.

ATTENUATION VOLUME: 169m³ to be provided within the attenuation system on site

TEMPORARY FLOOD STORAGE: 48m³
(Refer to StormTech Cumulative Storages spreadsheet below)

Storm Water Network analysis and Attenuation Tank Size checks were performed using a computer hydraulic analysis software. The analysis did not highlight any ponding for any storm durations up to 1:100y return therefore the network and attenuation capacity calculated above are satisfactory.
The results of the analysis are included in this report.

Project: **D1541 - Catchment #1**

Chamber Model -	MC-3500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	155	
Number of End Caps -	24	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	98.25	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	305	mm
Area of system -	825	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 777.66 sq.meters

StormTech MC-3500 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 *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1753	0.00	0.00	0.00	0.00	9.006	9.01	902.55	100.00
1727	0.00	0.00	0.00	0.00	9.006	9.01	893.54	99.98
1702	0.00	0.00	0.00	0.00	9.006	9.01	884.54	99.95
1676	0.00	0.00	0.00	0.00	9.006	9.01	875.53	99.93
1651	0.00	0.00	0.00	0.00	9.006	9.01	866.52	99.90
1626	0.00	0.00	0.00	0.00	9.006	9.01	857.52	99.88
1600	0.00	0.00	0.00	0.00	9.006	9.01	848.51	99.85
1575	0.00	0.00	0.00	0.00	9.006	9.01	839.51	99.82
1549	0.00	0.00	0.00	0.00	9.006	9.01	830.50	99.80
1524	0.00	0.00	0.00	0.00	9.006	9.01	821.49	99.77
1499	0.00	0.00	0.00	0.00	9.006	9.01	812.49	99.75
1473	0.00	0.00	0.00	0.00	9.006	9.01	803.48	99.72
1448	0.00	0.00	0.25	0.00	8.896	9.15	794.47	99.70
1422	0.01	0.00	0.85	0.01	8.637	9.50	785.32	99.67
1397	0.01	0.00	1.29	0.01	8.448	9.75	775.83	99.65
1372	0.01	0.00	1.77	0.01	8.238	10.02	766.08	99.62
1346	0.02	0.00	3.02	0.03	7.697	10.74	756.06	99.60
1321	0.03	0.00	4.51	0.03	7.051	11.60	745.32	99.57
1295	0.04	0.00	5.48	0.05	6.627	12.16	733.72	99.55
1270	0.04	0.00	6.24	0.06	6.296	12.60	721.56	99.52
1245	0.04	0.00	6.90	0.07	6.008	12.98	708.96	99.49
1219	0.05	0.00	7.49	0.08	5.749	13.32	695.98	99.47
1194	0.05	0.00	8.03	0.10	5.514	13.63	682.66	99.44
1168	0.05	0.00	8.51	0.11	5.302	13.92	669.02	99.42
1143	0.06	0.01	8.96	0.12	5.102	14.18	655.11	99.39
1118	0.06	0.01	9.37	0.14	4.919	14.42	640.92	99.37
1092	0.06	0.01	9.76	0.14	4.747	14.65	626.50	99.34
1067	0.07	0.01	10.12	0.16	4.582	14.87	611.85	99.32
1041	0.07	0.01	10.47	0.18	4.429	15.07	596.98	99.29
1016	0.07	0.01	10.79	0.18	4.286	15.26	581.91	99.27
991	0.07	0.01	11.10	0.20	4.150	15.44	566.64	99.24
965	0.07	0.01	11.38	0.22	4.017	15.62	551.20	99.22
940	0.08	0.01	11.66	0.22	3.897	15.78	535.58	99.19
914	0.08	0.01	11.92	0.24	3.780	15.93	519.80	99.16
889	0.08	0.01	12.16	0.25	3.668	16.08	503.87	99.14
864	0.08	0.01	12.40	0.27	3.561	16.22	487.78	99.11
838	0.08	0.01	12.62	0.28	3.459	16.36	471.56	99.09
813	0.08	0.01	12.83	0.29	3.362	16.49	455.20	99.06
787	0.08	0.01	13.04	0.31	3.269	16.61	438.71	99.04
762	0.09	0.01	13.22	0.31	3.186	16.72	422.10	99.01
737	0.09	0.01	13.40	0.33	3.103	16.83	405.38	98.99
711	0.09	0.01	13.58	0.33	3.023	16.94	388.55	98.96
686	0.09	0.01	13.74	0.35	2.949	17.04	371.61	98.94
660	0.09	0.01	13.89	0.35	2.879	17.13	354.58	98.91
635	0.09	0.02	14.04	0.37	2.810	17.22	337.45	98.89
610	0.09	0.02	14.18	0.37	2.750	17.30	320.23	98.86
584	0.09	0.02	14.31	0.38	2.687	17.38	302.93	98.83
559	0.09	0.02	14.44	0.39	2.630	17.46	285.55	98.81

533	0.09	0.02	14.56	0.39	2.575	17.53	268.09	98.78
508	0.09	0.02	14.68	0.39	2.525	17.60	250.56	98.76
483	0.10	0.02	14.79	0.41	2.473	17.67	232.96	98.73
457	0.10	0.02	14.89	0.41	2.428	17.73	215.29	98.71
432	0.10	0.02	14.99	0.41	2.383	17.78	197.57	98.68
406	0.10	0.02	15.09	0.41	2.341	17.84	179.78	98.66
381	0.10	0.02	15.18	0.42	2.299	17.90	161.94	98.63
356	0.10	0.02	15.27	0.43	2.257	17.95	144.05	98.61
330	0.10	0.02	15.38	0.43	2.207	18.02	126.09	98.58
305	0.00	0.00	0.00	0.00	9.006	9.01	108.07	98.55
279	0.00	0.00	0.00	0.00	9.006	9.01	99.07	98.53
254	0.00	0.00	0.00	0.00	9.006	9.01	90.06	98.50
229	0.00	0.00	0.00	0.00	9.006	9.01	81.06	98.48
203	0.00	0.00	0.00	0.00	9.006	9.01	72.05	98.45
178	0.00	0.00	0.00	0.00	9.006	9.01	63.04	98.43
152	0.00	0.00	0.00	0.00	9.006	9.01	54.04	98.40
127	0.00	0.00	0.00	0.00	9.006	9.01	45.03	98.38
102	0.00	0.00	0.00	0.00	9.006	9.01	36.02	98.35
76	0.00	0.00	0.00	0.00	9.006	9.01	27.02	98.33
51	0.00	0.00	0.00	0.00	9.006	9.01	18.01	98.30
25	0.00	0.00	0.00	0.00	9.006	9.01	9.01	98.28

Project: **D1541 - Catchment #2**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	78	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	97.75	m
Amount of Stone Above Chambers -	160	mm
Amount of Stone Below Chambers -	180	mm
Area of system -	250	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 244.96 sq.meter

StormTech SC-740 Cumulative Storage Volumes

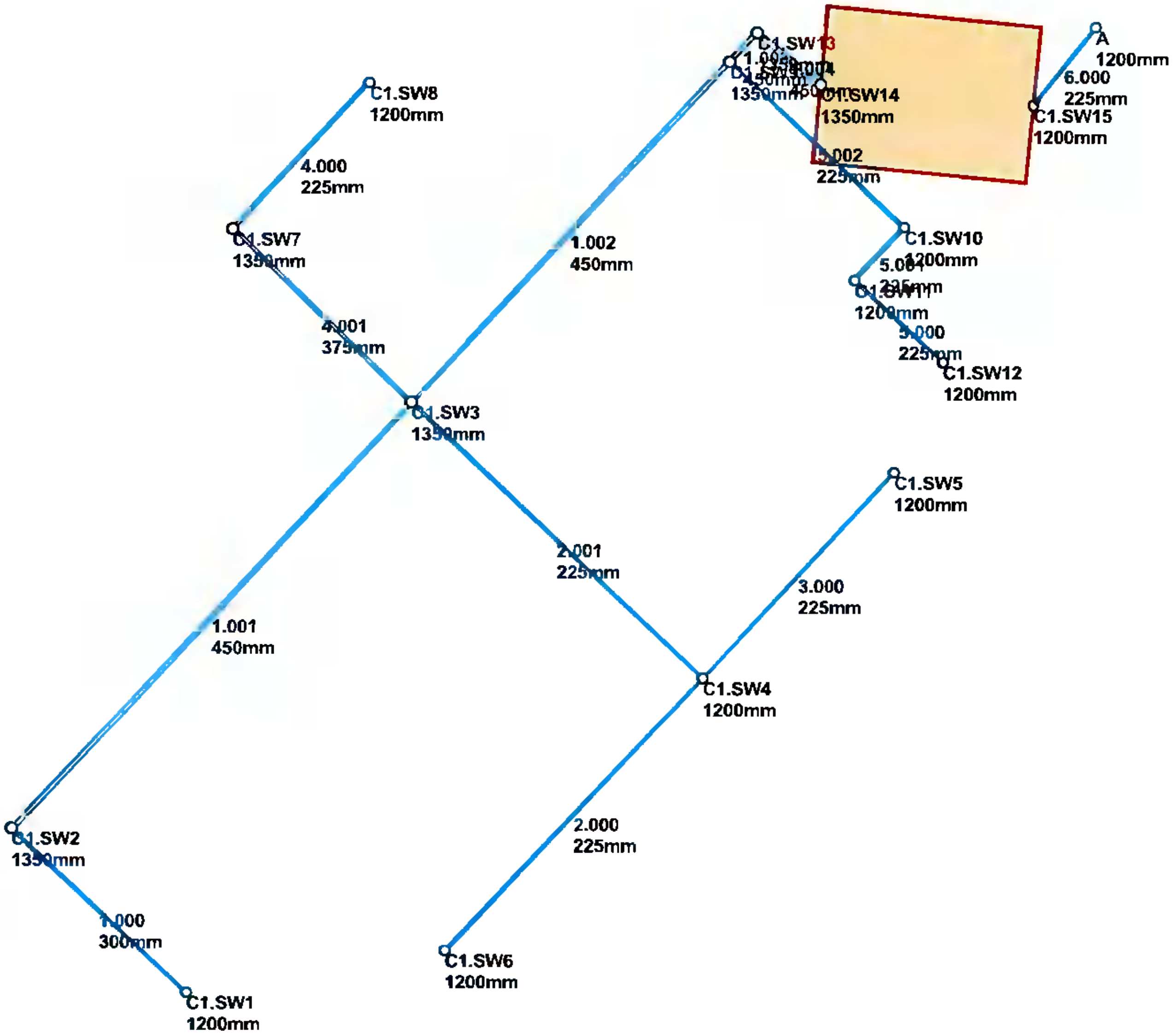
Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1092	0.00	0.00	2.73	2.73	175.263	98.84
1067	0.00	0.00	2.73	2.73	172.533	98.82
1041	0.00	0.00	2.73	2.73	169.802	98.79
1016	0.00	0.00	2.73	2.73	167.072	98.77
991	0.00	0.00	2.73	2.73	164.341	98.74
965	0.00	0.00	2.73	2.73	161.610	98.72
940	0.00	0.12	2.68	2.80	158.880	98.69
914	0.00	0.36	2.58	2.94	156.080	98.66
889	0.01	0.62	2.46	3.09	153.145	98.64
864	0.02	1.33	2.16	3.49	150.059	98.61
838	0.02	1.77	1.97	3.74	146.568	98.59
813	0.03	2.10	1.83	3.93	142.828	98.56
787	0.03	2.37	1.71	4.08	138.901	98.54
762	0.03	2.61	1.61	4.22	134.818	98.51
737	0.04	2.80	1.53	4.32	130.601	98.49
711	0.04	2.99	1.44	4.44	126.277	98.46
686	0.04	3.21	1.35	4.56	121.841	98.44
660	0.04	3.37	1.28	4.65	117.279	98.41
635	0.04	3.49	1.23	4.72	112.629	98.39
610	0.05	3.63	1.17	4.80	107.907	98.36
584	0.05	3.75	1.12	4.87	103.109	98.33
559	0.05	3.87	1.07	4.94	98.238	98.31
533	0.05	3.98	1.02	5.00	93.301	98.28
508	0.05	4.10	0.97	5.07	88.301	98.26
483	0.05	4.18	0.93	5.11	83.235	98.23
457	0.05	4.27	0.89	5.17	78.121	98.21
432	0.06	4.36	0.85	5.22	72.956	98.18
406	0.06	4.44	0.82	5.26	67.739	98.16
381	0.06	4.52	0.79	5.31	62.478	98.13
356	0.06	4.58	0.76	5.34	57.173	98.11
330	0.06	4.65	0.73	5.38	51.830	98.08
305	0.06	4.71	0.71	5.41	46.449	98.05
279	0.06	4.76	0.68	5.44	41.035	98.03
254	0.06	4.81	0.66	5.47	35.593	98.00
229	0.06	4.86	0.64	5.50	30.121	97.98
203	0.06	4.88	0.63	5.51	24.623	97.95
178	0.00	0.00	2.73	2.73	19.114	97.93
152	0.00	0.00	2.73	2.73	16.383	97.90
127	0.00	0.00	2.73	2.73	13.653	97.88

102	0.00	0.00	2.73	2.73	10.922	97.85
76	0.00	0.00	2.73	2.73	8.192	97.83
51	0.00	0.00	2.73	2.73	5.461	97.80
25	0.00	0.00	2.73	2.73	2.731	97.78

KAVANAGH BURKE
CONSULTING ENGINEERS

Surface Water Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Ltd Unit F3 Calmount Park, Ballymount, Dublin 12	File: D1541 - SW #1.pfd Network: Catchment #1_SW N Elena Dragoje 05/11/2021	Page 1 Surface Water Design Catchment #1 Scheme PL2



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.900	Minimum Backdrop Height (m)	1.000
Ratio-R	0.269	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
C1.SW1	0.185	5.00	101.750	1200	701545.124	727710.176	1.250
C1.SW2	0.375	5.00	101.650	1350	701523.311	727730.772	1.550
C1.SW3	0.115	5.00	101.550	1350	701573.425	727783.852	2.200
C1.SW4	0.000		101.850	1200	701609.780	727749.527	1.400
C1.SW5	0.073	5.00	101.850	1200	701633.759	727775.023	1.000
C1.SW6	0.095	5.00	101.850	1200	701577.448	727715.415	1.000
C1.SW7	0.220	5.00	101.300	1350	701551.062	727805.321	1.550
C1.SW8	0.030	5.00	101.300	1200	701568.239	727823.486	1.200
C1.SW9	0.000		101.200	1350	701613.242	727826.026	2.475
C1.SW10	0.030	5.00	101.200	1200	701635.055	727805.430	1.300
C1.SW11	0.000		101.450	1200	701628.877	727798.886	1.450
C1.SW12	0.020	5.00	101.450	1200	701639.886	727788.698	1.350
C1.SW13	0.000		101.100	1350	701616.675	727829.661	2.425
C1.SW14	0.000		101.150	1350	701624.613	727823.201	2.920
C1.SW15	0.000	5.00	101.300	1200	701651.190	727820.559	3.100
A	0.000		100.000	1200	701658.982	727830.250	1.900

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)
1.000	C1.SW1	C1.SW2	30.000	0.600	100.500	100.250	0.250	120.0	300	5.35	50.0
1.001	C1.SW2	C1.SW3	72.999	0.600	100.100	99.350	0.750	97.3	450	5.94	49.8
3.000	C1.SW5	C1.SW4	35.001	0.600	100.850	100.450	0.400	87.5	225	5.42	50.0
2.000	C1.SW6	C1.SW4	47.000	0.600	100.850	100.450	0.400	117.5	225	5.65	50.0
2.001	C1.SW4	C1.SW3	49.999	0.600	100.450	99.850	0.600	83.3	225	6.23	48.9
4.000	C1.SW8	C1.SW7	25.000	0.600	100.100	99.900	0.200	125.0	225	5.36	50.0

Name	Vel (m/s)	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)
1.000	1.434	101.4	25.1	0.950	1.100	1.100	0.185	0.0	1.193
1.001	2.061	327.7	75.7	1.100	1.750	1.750	0.560	0.0	1.689
3.000	1.398	55.6	9.9	0.775	1.175	1.175	0.073	0.0	1.059
2.000	1.205	47.9	12.9	0.775	1.175	1.175	0.095	0.0	1.026
2.001	1.433	57.0	22.3	1.175	1.475	1.475	0.168	0.0	1.350
4.000	1.168	46.4	4.1	0.975	1.175	1.175	0.030	0.0	0.719

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)
4.001	C1.SW7	C1.SW3	31.000	0.600	99.750	99.425	0.325	95.4	375	5.64	50.0
1.002	C1.SW3	C1.SW9	58.000	0.600	99.350	98.725	0.625	92.8	450	6.69	47.5
5.000	C1.SW12	C1.SW11	15.000	0.600	100.100	100.000	0.100	150.0	225	5.23	50.0
5.001	C1.SW11	C1.SW10	9.000	0.600	100.000	99.900	0.100	90.0	225	5.34	50.0
5.002	C1.SW10	C1.SW9	30.000	0.600	99.900	99.600	0.300	100.0	225	5.73	50.0
1.003	C1.SW9	C1.SW13	5.000	0.600	98.725	98.675	0.050	100.0	450	6.73	47.4
1.004	C1.SW13	C1.SW14	10.234	0.600	98.675	98.575	0.100	102.3	450	6.82	47.2
6.000	C1.SW15	A	12.435	0.600	98.200	98.100	0.100	124.4	225	5.18	50.0

Name	Vel (m/s)	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)
4.001	1.855	204.9	33.9	1.175	1.750	1.750	0.250	0.0	1.383
1.002	2.111	335.7	140.8	1.750	2.025	2.025	1.093	0.0	2.020
5.000	1.065	42.3	2.7	1.125	1.225	1.225	0.020	0.0	0.599
5.001	1.379	54.8	2.7	1.225	1.075	1.225	0.020	0.0	0.721
5.002	1.307	52.0	6.8	1.075	1.375	1.375	0.050	0.0	0.911
1.003	2.033	323.3	146.9	2.025	1.975	2.025	1.143	0.0	1.985
1.004	2.009	319.5	146.1	1.975	2.125	2.125	1.143	0.0	1.965
6.000	1.171	46.6	0.0	2.875	1.675	2.875	0.000	0.0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.000	120.0	300	Circular	101.750	100.500	0.950	101.650	100.250	1.100
1.001	72.999	97.3	450	Circular	101.650	100.100	1.100	101.550	99.350	1.750
3.000	35.001	87.5	225	Circular	101.850	100.850	0.775	101.850	100.450	1.175
2.000	47.000	117.5	225	Circular	101.850	100.850	0.775	101.850	100.450	1.175
2.001	49.999	83.3	225	Circular	101.850	100.450	1.175	101.550	99.850	1.475
4.000	25.000	125.0	225	Circular	101.300	100.100	0.975	101.300	99.900	1.175
4.001	31.000	95.4	375	Circular	101.300	99.750	1.175	101.550	99.425	1.750
1.002	58.000	92.8	450	Circular	101.550	99.350	1.750	101.200	98.725	2.025
5.000	15.000	150.0	225	Circular	101.450	100.100	1.125	101.450	100.000	1.225
5.001	9.000	90.0	225	Circular	101.450	100.000	1.225	101.200	99.900	1.075
5.002	30.000	100.0	225	Circular	101.200	99.900	1.075	101.200	99.600	1.375

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	C1.SW1	1200	Manhole	Adoptable	C1.SW2	1350	Manhole	Adoptable
1.001	C1.SW2	1350	Manhole	Adoptable	C1.SW3	1350	Manhole	Adoptable
3.000	C1.SW5	1200	Manhole	Adoptable	C1.SW4	1200	Manhole	Adoptable
2.000	C1.SW6	1200	Manhole	Adoptable	C1.SW4	1200	Manhole	Adoptable
2.001	C1.SW4	1200	Manhole	Adoptable	C1.SW3	1350	Manhole	Adoptable
4.000	C1.SW8	1200	Manhole	Adoptable	C1.SW7	1350	Manhole	Adoptable
4.001	C1.SW7	1350	Manhole	Adoptable	C1.SW3	1350	Manhole	Adoptable
1.002	C1.SW3	1350	Manhole	Adoptable	C1.SW9	1350	Manhole	Adoptable
5.000	C1.SW12	1200	Manhole	Adoptable	C1.SW11	1200	Manhole	Adoptable
5.001	C1.SW11	1200	Manhole	Adoptable	C1.SW10	1200	Manhole	Adoptable
5.002	C1.SW10	1200	Manhole	Adoptable	C1.SW9	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	5.000	100.0	450	Circular	101.200	98.725	2.025	101.100	98.675	1.975
1.004	10.234	102.3	450	Circular	101.100	98.675	1.975	101.150	98.575	2.125
6.000	12.435	124.4	225	Circular	101.300	98.200	2.875	100.000	98.100	1.675

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	C1.SW9	1350	Manhole	Adoptable	C1.SW13	1350	Manhole	Adoptable
1.004	C1.SW13	1350	Manhole	Adoptable	C1.SW14	1350	Manhole	Adoptable
6.000	C1.SW15	1200	Manhole	Adoptable	A	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.900	Drain Down Time (mins)	240
Ratio-R	0.269	Additional Storage (m³/ha)	20.0
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 C1.SW15 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	98.300	Product Number	CTL-SHE-0076-3200-1650-3200
Design Depth (m)	1.650	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.2	Min Node Diameter (mm)	1200

Node C1.SW15 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	30.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	98.200	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets
C1.SW14

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	520.0	0.0	1.750	520.0	0.0	1.760	5.0	0.0

<u>Rainfall</u>

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	254.747	72.085
30 year +20% CC 15 minute winter	178.770	72.085
30 year +20% CC 30 minute summer	175.121	49.553
30 year +20% CC 30 minute winter	122.892	49.553
30 year +20% CC 60 minute summer	122.456	32.361
30 year +20% CC 60 minute winter	81.357	32.361
30 year +20% CC 120 minute summer	78.153	20.654
30 year +20% CC 120 minute winter	51.923	20.654
30 year +20% CC 180 minute summer	61.307	15.776
30 year +20% CC 180 minute winter	39.851	15.776
30 year +20% CC 240 minute summer	49.214	13.006
30 year +20% CC 240 minute winter	32.697	13.006
30 year +20% CC 360 minute summer	38.422	9.887
30 year +20% CC 360 minute winter	24.975	9.887
30 year +20% CC 480 minute summer	30.768	8.131
30 year +20% CC 480 minute winter	20.441	8.131
30 year +20% CC 600 minute summer	25.532	6.984
30 year +20% CC 600 minute winter	17.445	6.984
30 year +20% CC 720 minute summer	23.008	6.166
30 year +20% CC 720 minute winter	15.462	6.166
30 year +20% CC 960 minute summer	19.237	5.066
30 year +20% CC 960 minute winter	12.743	5.066
30 year +20% CC 1440 minute summer	14.321	3.838
30 year +20% CC 1440 minute winter	9.625	3.838
30 year +20% CC 2160 minute summer	10.511	2.905
30 year +20% CC 2160 minute winter	7.242	2.905
30 year +20% CC 2880 minute summer	8.889	2.382
30 year +20% CC 2880 minute winter	5.974	2.382
30 year +20% CC 4320 minute summer	6.884	1.800
30 year +20% CC 4320 minute winter	4.533	1.800
30 year +20% CC 5760 minute summer	5.761	1.475
30 year +20% CC 5760 minute winter	3.729	1.475
30 year +20% CC 7200 minute summer	4.952	1.263
30 year +20% CC 7200 minute winter	3.196	1.263
100 year +20% CC 15 minute summer	330.996	93.660
100 year +20% CC 15 minute winter	232.278	93.660
100 year +20% CC 30 minute summer	228.581	64.681
100 year +20% CC 30 minute winter	160.408	64.681
100 year +20% CC 60 minute summer	158.744	41.951
100 year +20% CC 60 minute winter	105.466	41.951
100 year +20% CC 120 minute summer	100.363	26.523
100 year +20% CC 120 minute winter	66.678	26.523
100 year +20% CC 180 minute summer	78.216	20.128
100 year +20% CC 180 minute winter	50.843	20.128
100 year +20% CC 240 minute summer	62.478	16.511
100 year +20% CC 240 minute winter	41.509	16.511
100 year +20% CC 360 minute summer	48.421	12.460
100 year +20% CC 360 minute winter	31.475	12.460
100 year +20% CC 480 minute summer	38.567	10.192

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 480 minute winter	25.623	10.192
100 year +20% CC 600 minute summer	31.868	8.717
100 year +20% CC 600 minute winter	21.774	8.717
100 year +20% CC 720 minute summer	28.617	7.670
100 year +20% CC 720 minute winter	19.232	7.670
100 year +20% CC 960 minute summer	23.797	6.266
100 year +20% CC 960 minute winter	15.763	6.266
100 year +20% CC 1440 minute summer	17.579	4.711
100 year +20% CC 1440 minute winter	11.814	4.711
100 year +20% CC 2160 minute summer	12.796	3.536
100 year +20% CC 2160 minute winter	8.817	3.536
100 year +20% CC 2880 minute summer	10.754	2.882
100 year +20% CC 2880 minute winter	7.227	2.882
100 year +20% CC 4320 minute summer	8.253	2.158
100 year +20% CC 4320 minute winter	5.435	2.158
100 year +20% CC 5760 minute summer	6.860	1.756
100 year +20% CC 5760 minute winter	4.440	1.756
100 year +20% CC 7200 minute summer	5.867	1.497
100 year +20% CC 7200 minute winter	3.786	1.497

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.71%

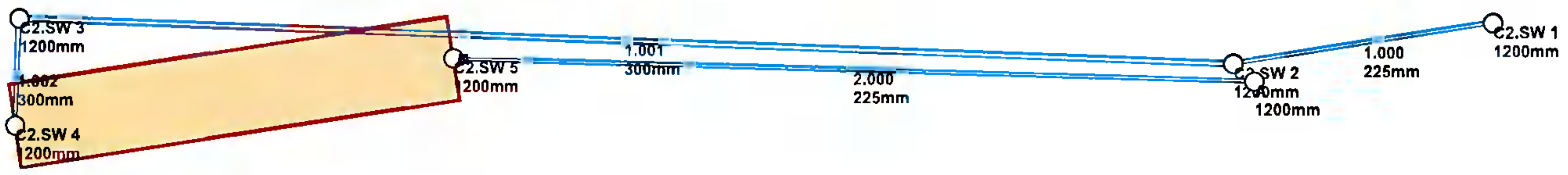
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	C1.SW1	10	100.675	0.175	60.7	0.7162	0.0000	OK
15 minute winter	C1.SW2	10	100.333	0.233	182.1	1.4624	0.0000	OK
15 minute winter	C1.SW3	12	99.992	0.642	347.1	1.5908	0.0000	SURCHARGED
15 minute winter	C1.SW4	11	100.628	0.178	54.3	0.2012	0.0000	OK
15 minute winter	C1.SW5	10	100.951	0.101	23.9	0.2627	0.0000	OK
15 minute winter	C1.SW6	10	100.982	0.132	31.2	0.3987	0.0000	OK
15 minute winter	C1.SW7	12	100.028	0.278	81.7	1.1872	0.0000	OK
15 minute winter	C1.SW8	10	100.171	0.071	9.8	0.1160	0.0000	OK
4320 minute winter	C1.SW9	3300	99.620	0.895	12.1	1.2804	0.0000	SURCHARGED
15 minute winter	C1.SW10	11	99.988	0.088	16.2	0.1398	0.0000	OK
15 minute winter	C1.SW11	10	100.052	0.052	6.5	0.0585	0.0000	OK
15 minute winter	C1.SW12	10	100.162	0.062	6.6	0.0886	0.0000	OK
4320 minute winter	C1.SW13	3300	99.620	0.945	30.3	1.3519	0.0000	SURCHARGED
4320 minute winter	C1.SW14	3300	99.620	1.390	23.2	1.9887	0.0000	OK
4320 minute winter	C1.SW15	3300	99.620	1.420	46.7	1.6057	0.0000	SURCHARGED
15 minute summer	A	1	98.100	0.000	2.5	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)
15 minute winter	C1.SW1	1.000	C1.SW2	59.2	1.457	0.584	1.2249	
15 minute winter	C1.SW2	1.001	C1.SW3	179.9	1.525	0.549	8.7701	
15 minute winter	C1.SW3	1.002	C1.SW9	309.2	1.952	0.921	9.1897	
15 minute winter	C1.SW4	2.001	C1.SW3	52.5	1.607	0.921	1.6368	
15 minute winter	C1.SW5	3.000	C1.SW4	23.5	0.982	0.423	0.8864	
15 minute winter	C1.SW6	2.000	C1.SW4	30.8	1.096	0.642	1.3377	
15 minute winter	C1.SW7	4.001	C1.SW3	80.9	1.249	0.395	3.0676	
15 minute winter	C1.SW8	4.000	C1.SW7	9.5	0.912	0.206	0.4058	
4320 minute winter	C1.SW9	1.003	C1.SW13	29.0	0.873	0.090	0.7922	
15 minute winter	C1.SW10	5.002	C1.SW9	16.0	1.140	0.307	0.4203	
15 minute winter	C1.SW11	5.001	C1.SW10	6.4	0.616	0.117	0.0952	
15 minute winter	C1.SW12	5.000	C1.SW11	6.5	0.827	0.154	0.1182	
4320 minute winter	C1.SW13	1.004	C1.SW14	14.5	0.859	0.045	1.6215	
4320 minute winter	C1.SW14	Flow through pond	C1.SW15	46.7	0.007	0.001	730.4799	
4320 minute winter	C1.SW15	Hydro-Brake®	A	2.9				584.5

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	C1.SW1	12	100.850	0.350	78.8	1.4308	0.0000	SURCHARGED
15 minute winter	C1.SW2	12	100.710	0.610	236.6	3.8275	0.0000	SURCHARGED
15 minute winter	C1.SW3	12	100.420	1.070	397.7	2.6515	0.0000	SURCHARGED
15 minute winter	C1.SW4	12	100.974	0.524	70.4	0.5923	0.0000	SURCHARGED
15 minute winter	C1.SW5	12	101.019	0.169	31.1	0.4375	0.0000	OK
15 minute winter	C1.SW6	12	101.159	0.309	40.5	0.9373	0.0000	SURCHARGED
15 minute winter	C1.SW7	12	100.497	0.746	99.3	3.1875	0.0000	SURCHARGED
15 minute winter	C1.SW8	12	100.517	0.417	19.7	0.6806	0.0000	SURCHARGED
2880 minute winter	C1.SW9	2700	99.959	1.234	19.1	1.7653	0.0000	SURCHARGED
15 minute winter	C1.SW10	10	100.002	0.102	21.1	0.1618	0.0000	OK
15 minute winter	C1.SW11	10	100.059	0.059	8.4	0.0665	0.0000	OK
15 minute winter	C1.SW12	10	100.171	0.071	8.5	0.1012	0.0000	OK
2880 minute winter	C1.SW13	2700	99.959	1.284	18.9	1.8368	0.0000	SURCHARGED
2880 minute winter	C1.SW14	2700	99.959	1.729	20.4	2.4736	0.0000	OK
2880 minute winter	C1.SW15	2700	99.959	1.759	11.6	1.9889	0.0000	SURCHARGED
15 minute summer	A	1	98.100	0.000	2.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	C1.SW1	1.000	C1.SW2	76.8	1.529	0.758	2.1126	
15 minute winter	C1.SW2	1.001	C1.SW3	211.7	1.542	0.646	11.5662	
15 minute winter	C1.SW3	1.002	C1.SW9	366.9	2.316	1.093	9.1897	
15 minute winter	C1.SW4	2.001	C1.SW3	58.4	1.580	1.025	1.9885	
15 minute winter	C1.SW5	3.000	C1.SW4	30.7	1.026	0.552	1.2555	
15 minute winter	C1.SW6	2.000	C1.SW4	39.7	1.152	0.829	1.8692	
15 minute winter	C1.SW7	4.001	C1.SW3	95.9	1.278	0.468	3.4192	
15 minute winter	C1.SW8	4.000	C1.SW7	13.3	0.942	0.286	0.9943	
2880 minute winter	C1.SW9	1.003	C1.SW13	18.9	0.940	0.058	0.7922	
15 minute winter	C1.SW10	5.002	C1.SW9	20.7	1.218	0.398	0.5090	
15 minute winter	C1.SW11	5.001	C1.SW10	8.3	0.654	0.151	0.1153	
15 minute winter	C1.SW12	5.000	C1.SW11	8.4	0.887	0.198	0.1421	
2880 minute winter	C1.SW13	1.004	C1.SW14	20.4	0.926	0.064	1.6215	
2880 minute winter	C1.SW14	Flow through pond	C1.SW15	11.6	0.014	0.000	899.4003	
2880 minute winter	C1.SW15	Hydro-Brake®	A	3.2				441.1



C2.SW 3
1200mm
1.002
300mm
C2.SW 4
1200mm
C2.SW 5
1200mm
1.001
300mm
2.000
225mm
C2.SW 2
1200mm
1200mm
1.000
225mm
C2.SW 1
1200mm

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.900	Minimum Backdrop Height (m)	0.200
Ratio-R	0.269	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
C2.SW 1	0.072	5.00	99.350	1200	701674.418	727834.058	1.000
C2.SW 2	0.252	5.00	99.900	1200	701657.627	727831.398	1.725
C2.SW 3			101.250	1200	701578.690	727834.539	3.375
C2.SW 4			101.300	1200	701578.401	727827.545	3.520
C2.SW 5		5.00	101.150	1200	701607.007	727831.863	3.400
A			100.000	1200	701658.982	727830.250	2.500

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)
1.000	C2.SW 1	C2.SW 2	17.000	0.600	98.350	98.250	0.100	170.0	225	5.28	50.0
1.001	C2.SW 2	C2.SW 3	78.999	0.600	98.175	97.875	0.300	263.3	300	6.65	47.6
1.002	C2.SW 3	C2.SW 4	7.000	0.600	97.875	97.850	0.025	280.0	300	6.77	47.3
2.000	C2.SW 5	A	52.000	0.600	97.750	97.500	0.250	208.0	225	5.96	49.8

Name	Vel (m/s)	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)
1.000	1.000	39.7	9.8	0.775	1.425	1.425	0.072	0.0	0.831
1.001	0.964	68.1	41.8	1.425	3.075	3.075	0.324	0.0	1.012
1.002	0.934	66.1	41.5	3.075	3.150	3.150	0.324	0.0	0.985
2.000	0.903	35.9	0.0	3.175	2.275	3.175	0.000	0.0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	17.000	170.0	225	Circular	99.350	98.350	0.775	99.900	98.250	1.425
1.001	78.999	263.3	300	Circular	99.900	98.175	1.425	101.250	97.875	3.075
1.002	7.000	280.0	300	Circular	101.250	97.875	3.075	101.300	97.850	3.150
2.000	52.000	208.0	225	Circular	101.150	97.750	3.175	100.000	97.500	2.275

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	C2.SW 1	1200	Manhole	Adoptable	C2.SW 2	1200	Manhole	Adoptable
1.001	C2.SW 2	1200	Manhole	Adoptable	C2.SW 3	1200	Manhole	Adoptable
1.002	C2.SW 3	1200	Manhole	Adoptable	C2.SW 4	1200	Manhole	Adoptable
2.000	C2.SW 5	1200	Manhole	Adoptable	A	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.900	Drain Down Time (mins)	240
Ratio-R	0.269	Additional Storage (m³/ha)	20.0
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 C2.SW 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	97.800	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node C2.SW 5 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	30.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	97.750	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets
C2.SW 4

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	159.0	0.0	1.100	159.0	0.0	1.110	2.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	254.747	72.085
30 year +20% CC 15 minute winter	178.770	72.085
30 year +20% CC 30 minute summer	175.121	49.553
30 year +20% CC 30 minute winter	122.892	49.553
30 year +20% CC 60 minute summer	122.456	32.361
30 year +20% CC 60 minute winter	81.357	32.361
30 year +20% CC 120 minute summer	78.153	20.654
30 year +20% CC 120 minute winter	51.923	20.654
30 year +20% CC 180 minute summer	61.307	15.776
30 year +20% CC 180 minute winter	39.851	15.776
30 year +20% CC 240 minute summer	49.214	13.006
30 year +20% CC 240 minute winter	32.697	13.006
30 year +20% CC 360 minute summer	38.422	9.887
30 year +20% CC 360 minute winter	24.975	9.887
30 year +20% CC 480 minute summer	30.768	8.131
30 year +20% CC 480 minute winter	20.441	8.131
30 year +20% CC 600 minute summer	25.532	6.984
30 year +20% CC 600 minute winter	17.445	6.984
30 year +20% CC 720 minute summer	23.008	6.166
30 year +20% CC 720 minute winter	15.462	6.166
30 year +20% CC 960 minute summer	19.237	5.066
30 year +20% CC 960 minute winter	12.743	5.066
30 year +20% CC 1440 minute summer	14.321	3.838
30 year +20% CC 1440 minute winter	9.625	3.838
30 year +20% CC 2160 minute summer	10.511	2.905
30 year +20% CC 2160 minute winter	7.242	2.905
30 year +20% CC 2880 minute summer	8.889	2.382
30 year +20% CC 2880 minute winter	5.974	2.382
30 year +20% CC 4320 minute summer	6.884	1.800
30 year +20% CC 4320 minute winter	4.533	1.800
30 year +20% CC 5760 minute summer	5.761	1.475
30 year +20% CC 5760 minute winter	3.729	1.475
30 year +20% CC 7200 minute summer	4.952	1.263
30 year +20% CC 7200 minute winter	3.196	1.263
100 year +20% CC 15 minute summer	330.996	93.660
100 year +20% CC 15 minute winter	232.278	93.660
100 year +20% CC 30 minute summer	228.581	64.681
100 year +20% CC 30 minute winter	160.408	64.681
100 year +20% CC 60 minute summer	158.744	41.951
100 year +20% CC 60 minute winter	105.466	41.951
100 year +20% CC 120 minute summer	100.363	26.523
100 year +20% CC 120 minute winter	66.678	26.523
100 year +20% CC 180 minute summer	78.216	20.128
100 year +20% CC 180 minute winter	50.843	20.128
100 year +20% CC 240 minute summer	62.478	16.511

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 240 minute winter	41.509	16.511
100 year +20% CC 360 minute summer	48.421	12.460
100 year +20% CC 360 minute winter	31.475	12.460
100 year +20% CC 480 minute summer	38.567	10.192
100 year +20% CC 480 minute winter	25.623	10.192
100 year +20% CC 600 minute summer	31.868	8.717
100 year +20% CC 600 minute winter	21.774	8.717
100 year +20% CC 720 minute summer	28.617	7.670
100 year +20% CC 720 minute winter	19.232	7.670
100 year +20% CC 960 minute summer	23.797	6.266
100 year +20% CC 960 minute winter	15.763	6.266
100 year +20% CC 1440 minute summer	17.579	4.711
100 year +20% CC 1440 minute winter	11.814	4.711
100 year +20% CC 2160 minute summer	12.796	3.536
100 year +20% CC 2160 minute winter	8.817	3.536
100 year +20% CC 2880 minute summer	10.754	2.882
100 year +20% CC 2880 minute winter	7.227	2.882
100 year +20% CC 4320 minute summer	8.253	2.158
100 year +20% CC 4320 minute winter	5.435	2.158
100 year +20% CC 5760 minute summer	6.860	1.756
100 year +20% CC 5760 minute winter	4.440	1.756
100 year +20% CC 7200 minute summer	5.867	1.497
100 year +20% CC 7200 minute winter	3.786	1.497

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	C2.SW 1	11	98.853	0.503	23.6	1.2939	0.0000	SURCHARGED
15 minute winter	C2.SW 2	11	98.821	0.646	97.8	2.6200	0.0000	SURCHARGED
720 minute winter	C2.SW 3	690	98.583	0.708	11.7	0.8008	0.0000	SURCHARGED
720 minute winter	C2.SW 4	690	98.583	0.803	11.3	0.9082	0.0000	OK
720 minute winter	C2.SW 5	690	98.583	0.833	6.6	0.9422	0.0000	SURCHARGED
15 minute summer	A	1	97.500	0.000	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	C2.SW 1	1.000	C2.SW 2	22.7	0.707	0.572	0.6761	
15 minute winter	C2.SW 2	1.001	C2.SW 3	92.7	1.316	1.360	5.5631	
720 minute winter	C2.SW 3	1.002	C2.SW 4	11.3	0.538	0.171	0.4929	
720 minute winter	C2.SW 4	Flow through pond	C2.SW 5	6.6	0.031	0.001	130.0881	
720 minute winter	C2.SW 5	Hydro-Brake®	A	2.0				84.3

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	C2.SW 1	11	99.344	0.994	30.7	2.5562	0.0000	FLOOD RISK
15 minute winter	C2.SW 2	11	99.294	1.119	126.1	4.5370	0.0000	SURCHARGED
960 minute winter	C2.SW 3	885	98.843	0.968	11.2	1.0951	0.0000	SURCHARGED
960 minute winter	C2.SW 4	885	98.843	1.063	10.8	1.2025	0.0000	OK
960 minute winter	C2.SW 5	885	98.843	1.093	6.4	1.2364	0.0000	SURCHARGED
15 minute summer	A	1	97.500	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	C2.SW 1	1.000	C2.SW 2	29.3	0.737	0.738	0.6761	
15 minute winter	C2.SW 2	1.001	C2.SW 3	118.2	1.679	1.735	5.5631	
960 minute winter	C2.SW 3	1.002	C2.SW 4	10.8	0.493	0.163	0.4929	
960 minute winter	C2.SW 4	Flow through pond	C2.SW 5	6.4	0.034	0.001	171.4663	
960 minute winter	C2.SW 5	Hydro-Brake®	A	2.0				117.3

Appendix to Surface Water Design

- Rainfall table for subject's site
- HR Wallingford Greenfield runoff rate estimation report
- Specification/Product Information for:
    - Separators
    - Silt Trap
    - Flow Control Device
- StormTech Chamber Information Sheets: MC-3500™ & SC-740 ™

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 301600, Northing: 227750,

DURATION	Interval 6months,	1year,	Years 2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.7,	4.3,	5.3,	6.0,	6.6,	8.5,	10.6,	12.1,	14.2,	16.1,	17.6,	19.9,	21.8,	23.3,	N/A ,
10 mins	3.4,	5.1,	6.0,	7.4,	8.4,	9.2,	11.8,	14.8,	16.8,	19.8,	22.4,	24.5,	27.8,	30.3,	32.5,	N/A ,
15 mins	4.0,	6.0,	7.1,	8.8,	9.9,	10.8,	13.9,	17.4,	19.8,	23.3,	26.4,	28.8,	32.7,	35.7,	38.2,	N/A ,
30 mins	5.3,	7.8,	9.2,	11.3,	12.8,	13.9,	17.7,	22.2,	25.2,	29.4,	33.3,	36.3,	41.0,	44.7,	47.8,	N/A ,
1 hours	7.0,	10.2,	11.9,	14.6,	16.5,	17.9,	22.7,	28.2,	31.9,	37.2,	42.0,	45.7,	51.5,	56.0,	59.8,	N/A ,
2 hours	9.2,	13.3,	15.5,	18.9,	21.2,	23.0,	29.0,	35.9,	40.5,	47.1,	53.0,	57.6,	64.7,	70.2,	74.9,	N/A ,
3 hours	10.8,	15.5,	18.1,	22.0,	24.6,	26.7,	33.5,	41.4,	46.6,	54.0,	60.7,	65.9,	73.9,	80.2,	85.4,	N/A ,
4 hours	12.1,	17.3,	20.1,	24.4,	27.4,	29.6,	37.2,	45.8,	51.5,	59.6,	66.8,	72.5,	81.2,	88.0,	93.7,	N/A ,
6 hours	14.2,	20.2,	23.5,	28.4,	31.7,	34.4,	42.9,	52.7,	59.2,	68.4,	76.6,	82.9,	92.8,	100.5,	106.9,	N/A ,
9 hours	16.7,	23.6,	27.4,	33.0,	36.8,	39.8,	49.6,	60.7,	68.1,	78.5,	87.7,	94.9,	106.0,	114.7,	121.8,	N/A ,
12 hours	18.7,	26.3,	30.5,	36.7,	40.9,	44.2,	54.9,	67.1,	75.2,	86.5,	96.6,	104.5,	116.5,	125.9,	133.7,	N/A ,
18 hours	21.9,	30.8,	35.5,	42.7,	47.5,	51.2,	63.5,	77.3,	86.4,	99.3,	110.7,	119.5,	133.2,	143.7,	152.5,	N/A ,
24 hours	24.5,	34.3,	39.6,	47.5,	52.8,	56.9,	70.3,	85.5,	95.4,	109.5,	121.9,	131.5,	146.4,	157.9,	167.4,	200.7,
2 days	30.9,	42.0,	47.9,	56.5,	62.2,	66.6,	80.8,	96.6,	106.8,	121.1,	133.6,	143.2,	157.8,	169.1,	178.4,	210.5,
3 days	36.1,	48.3,	54.6,	63.8,	69.9,	74.6,	89.5,	105.9,	116.5,	131.1,	143.8,	153.6,	168.4,	179.7,	189.0,	221.0,
4 days	40.7,	53.8,	60.5,	70.2,	76.7,	81.6,	97.2,	114.1,	125.0,	140.0,	153.0,	162.9,	178.0,	189.4,	198.8,	230.9,
6 days	48.9,	63.4,	70.8,	81.5,	88.5,	93.8,	110.5,	128.5,	140.0,	155.6,	169.2,	179.4,	194.9,	206.7,	216.2,	248.9,
8 days	56.2,	72.0,	80.0,	91.4,	98.8,	104.5,	122.1,	141.1,	153.1,	169.4,	183.4,	193.9,	209.9,	221.9,	231.7,	264.9,
10 days	62.9,	79.8,	88.3,	100.4,	108.3,	114.2,	132.8,	152.5,	164.9,	181.8,	196.2,	207.1,	223.4,	235.7,	245.7,	279.6,
12 days	69.2,	87.2,	96.1,	108.9,	117.1,	123.3,	142.6,	163.0,	175.9,	193.3,	208.1,	219.3,	236.0,	248.5,	258.7,	293.1,
16 days	81.0,	100.8,	110.6,	124.4,	133.3,	139.9,	160.6,	182.4,	196.0,	214.2,	229.8,	241.4,	258.8,	271.9,	282.4,	317.9,
20 days	92.0,	113.4,	123.9,	138.7,	148.1,	155.2,	177.1,	200.0,	214.2,	233.3,	249.5,	261.6,	279.6,	293.0,	303.9,	340.3,
25 days	104.9,	128.2,	139.5,	155.3,	165.4,	173.0,	196.2,	220.3,	235.3,	255.2,	272.1,	284.7,	303.4,	317.3,	328.5,	366.0,

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:	Elena Dragoje
Site name:	Tay Lane
Site location:	Greenogue, Rathcoole, Co Dublin

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.

Site Details

Latitude:	53.29068° N
Longitude:	6.47652° W
Reference:	2250652164
Date:	Nov 04 2021 19:50

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.2

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):	902	902
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):	5.39	5.39
1 in 1 year (l/s):	4.58	4.58
1 in 30 years (l/s):	11.49	11.49
1 in 100 year (l/s):	14.08	14.08
1 in 200 years (l/s):	15.43	15.43

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

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helpingyou@klargester.com to make the right decision or call 028 302 66799

Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

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

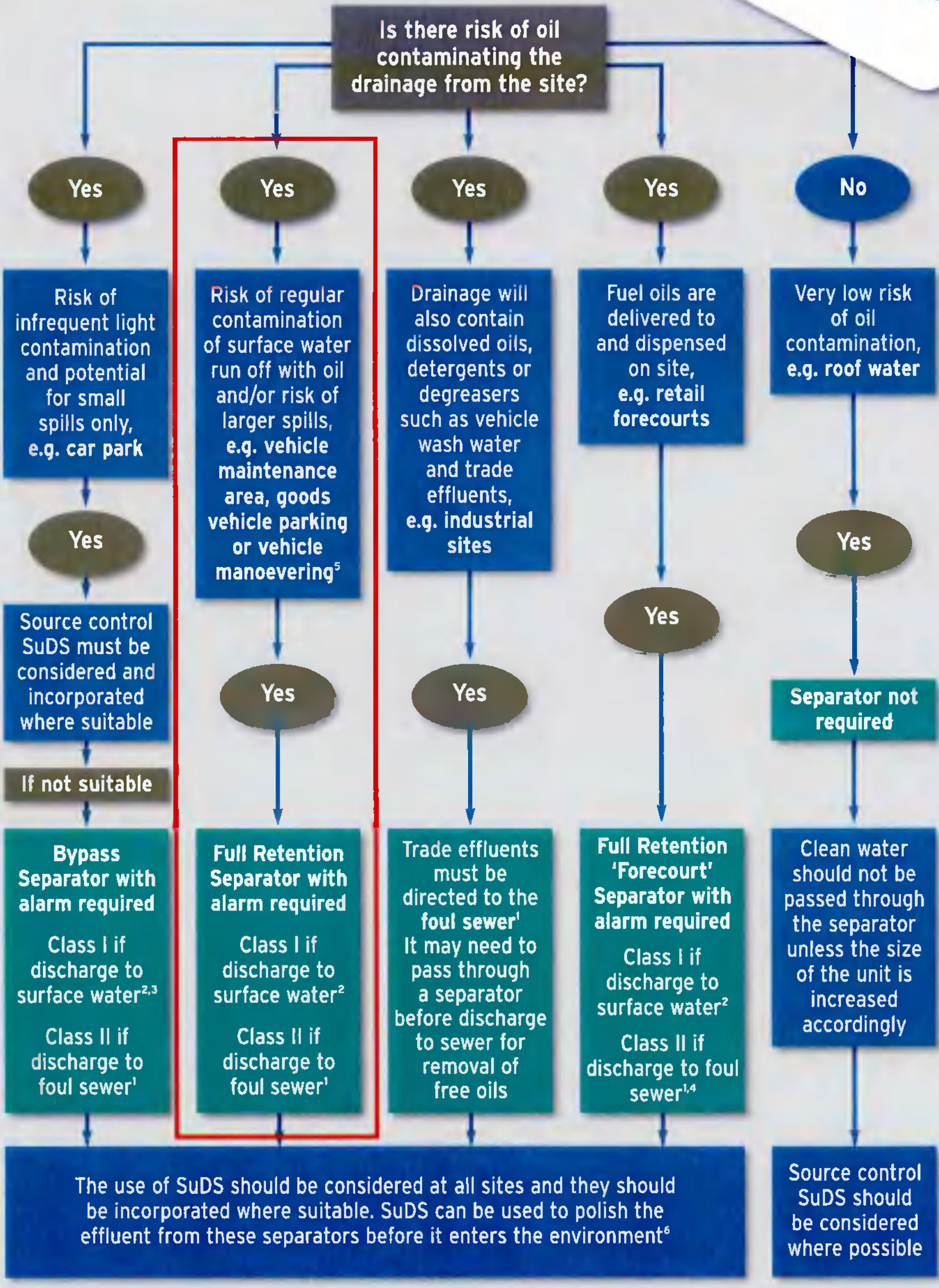
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size 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.
- Oil storage volume.
- Silt storage capacity.
- 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.

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:-

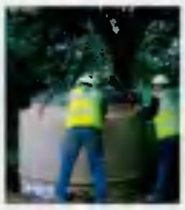
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped .
- The required discharge standard. This will decide whether a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

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
C#2:	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
C#1:	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

Discover more about the Accredited Installers and locate your local expert online.

www.klargester.com/installers

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CARE & MAINTENANCE

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- **HILLMASTER** PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- STORMWATER ATTENUATION SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

Kingspan Water

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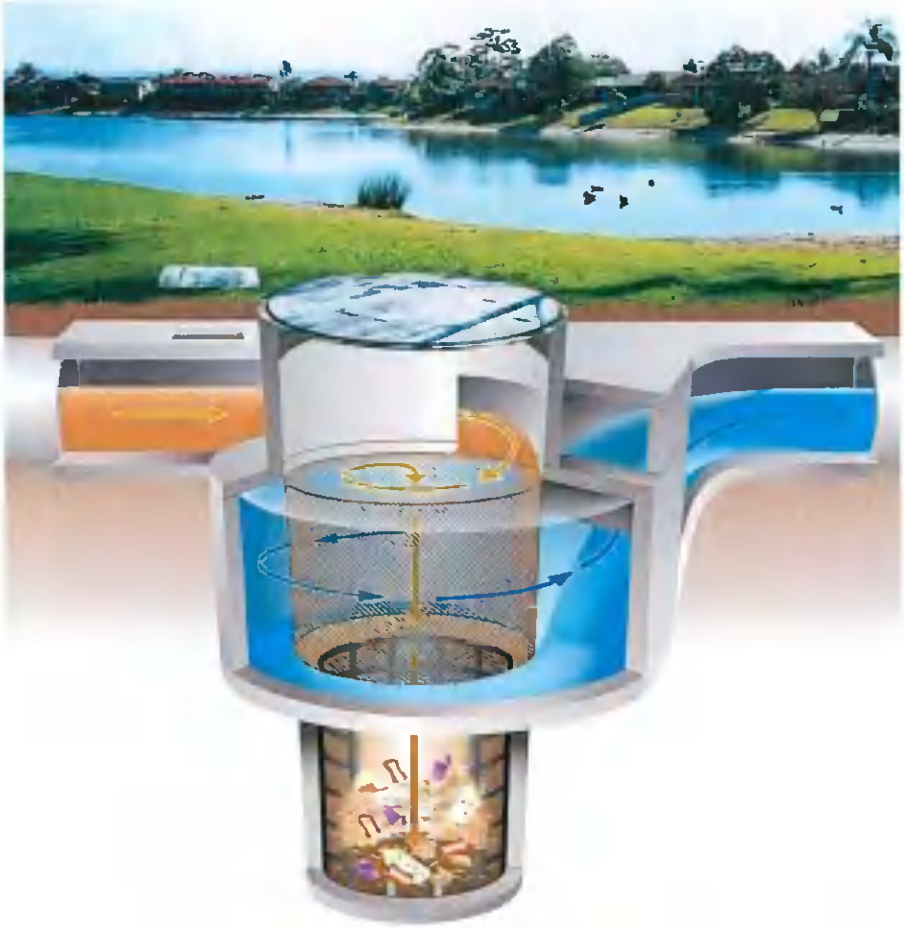
BRITISH WATER

UK GREEN BUILDING COUNCIL

Issue No. 20: August 2014

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.

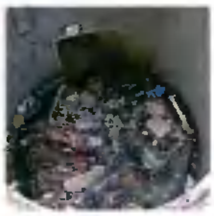
- ***SurfSep*** for Surface Water applications
- ***OverSep*** for Combined Sewer Overflow applications.

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

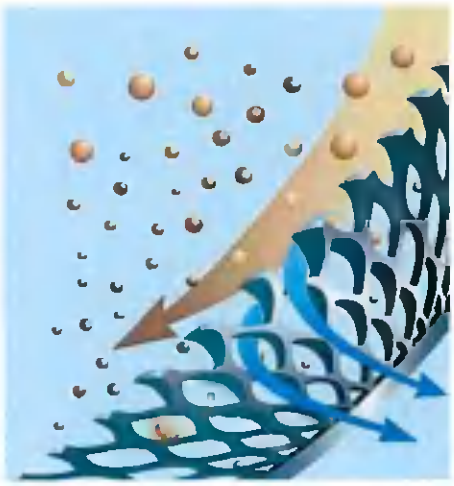
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

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.

CDS TECHNOLOGIES

Flow Control Systems

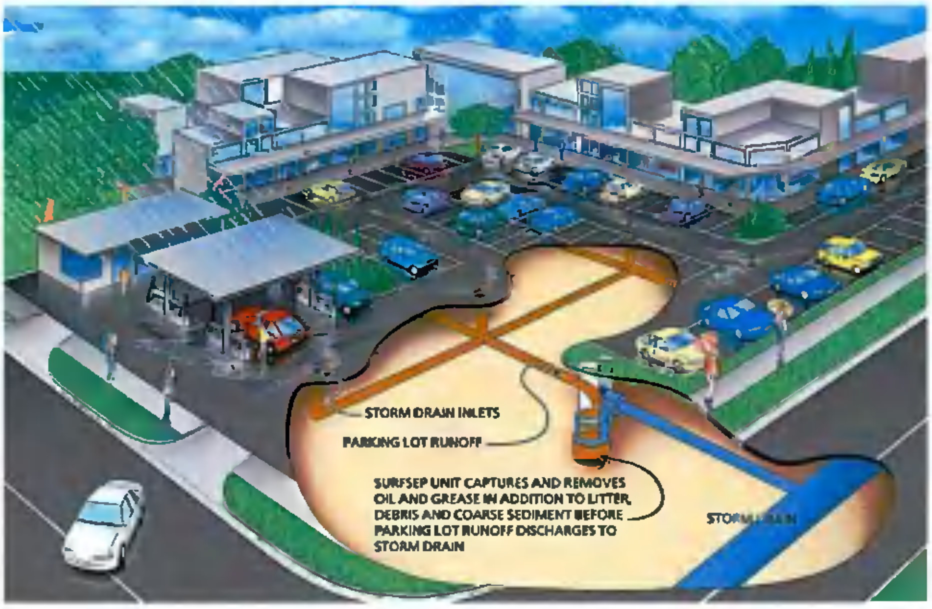
Flow Control

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.



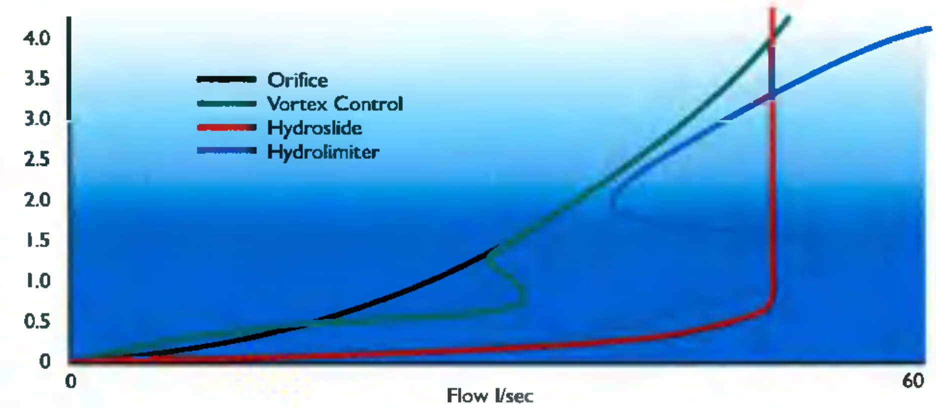
Typical SurfSep installation

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

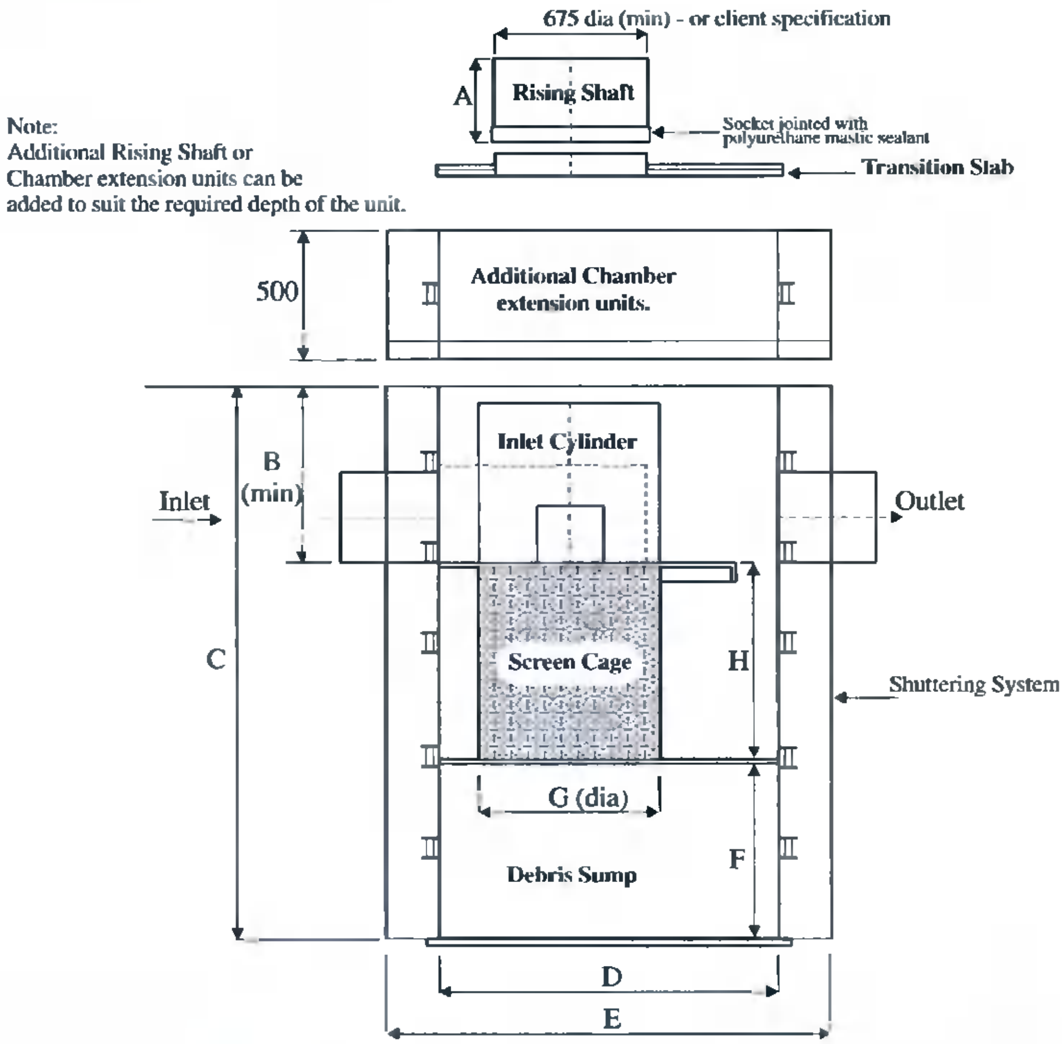
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

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.

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
#2:	SWI 0606 / 01	140	10,000	1200	225 - 375
#1:	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

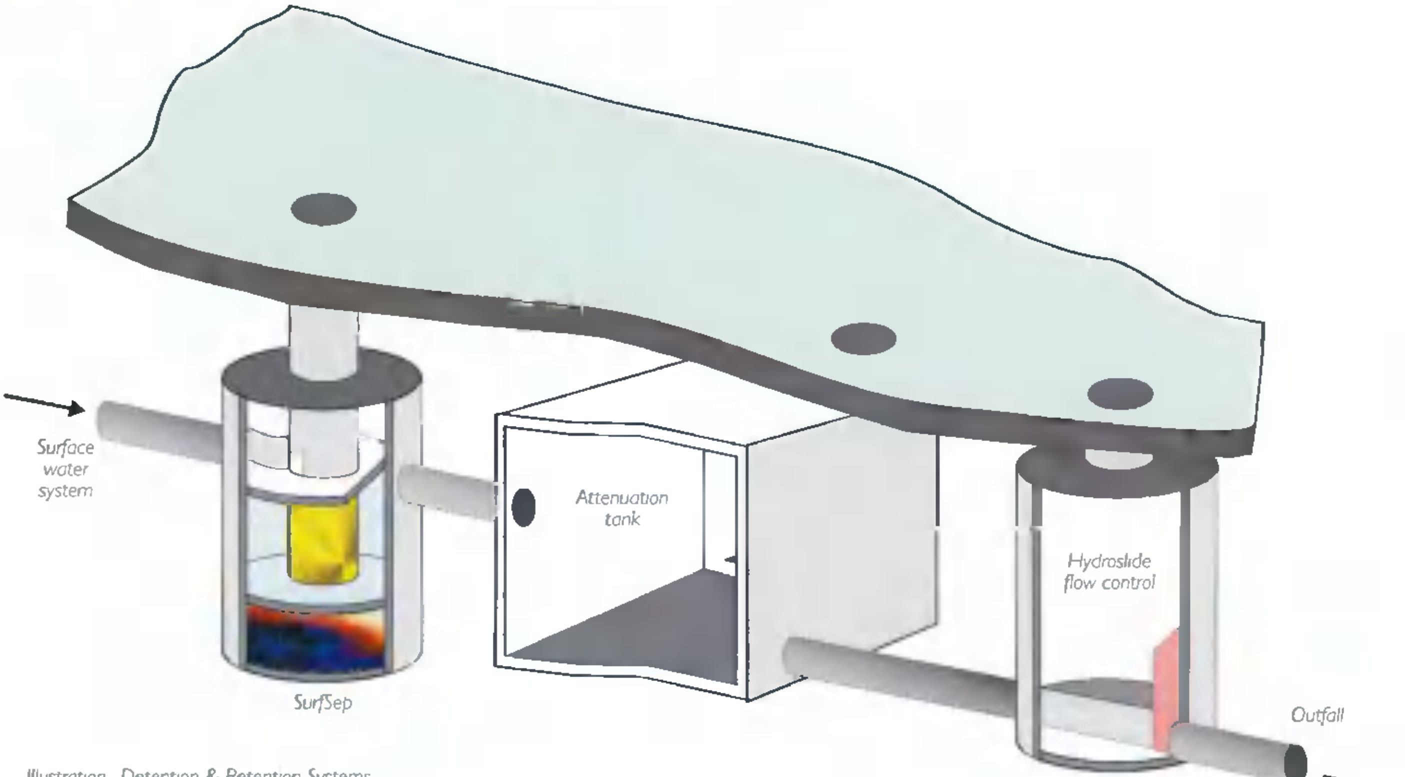


Illustration. Detention & Retention Systems

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 - 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

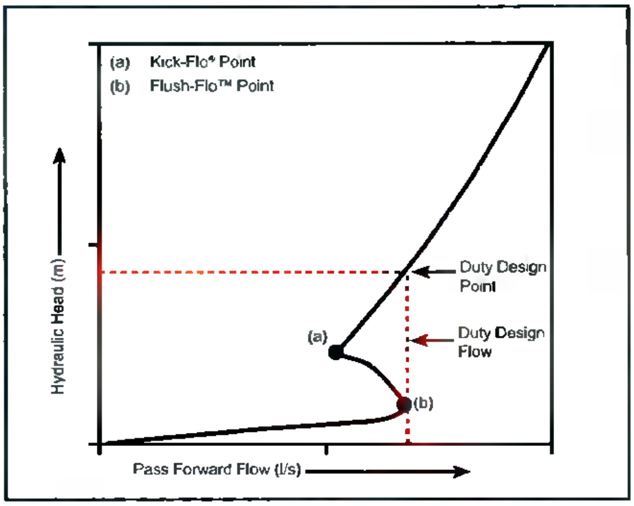
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

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:

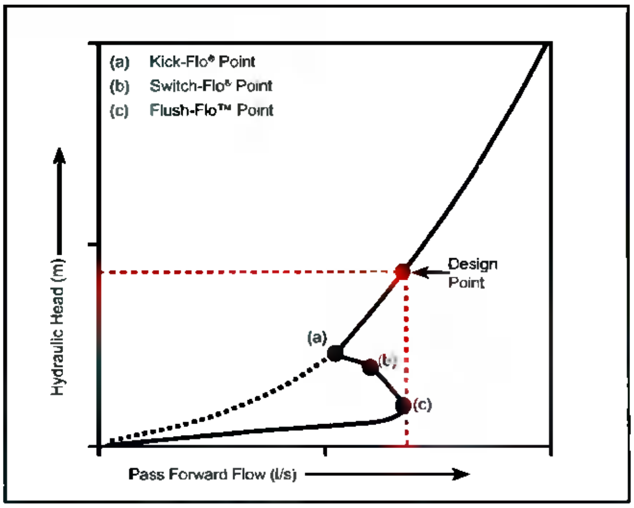
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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 Win*Des*® 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 08/4539

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 Win*Des*® is available on our website:

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

PROVIDE THE FOLLOWING FLOW CONTROL DEVICE AT THE OUTFALL OF
C#1 SW MH 15
&
C#2 SW MH 5

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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HRD Technologies Ltd is a subsidiary of Hydro International plc

STORMTECH MC-3500 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-3500 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
90" x 77" x 45"
2,286 mm x 1,956 mm x 1,143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
175.0 ft³ (4.96 m³)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

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

STORMTECH MC-3500 END CAP
(not to scale)

Nominal End Cap Specifications

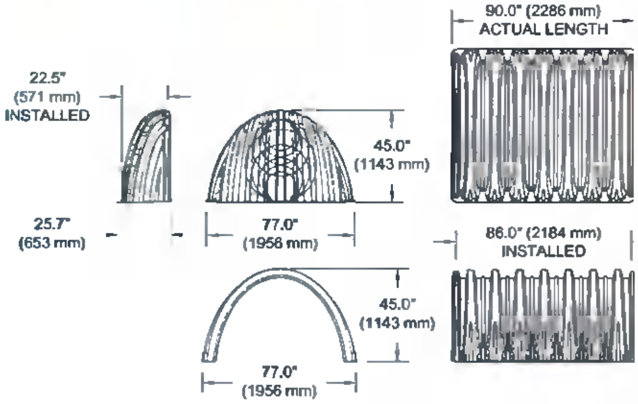
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

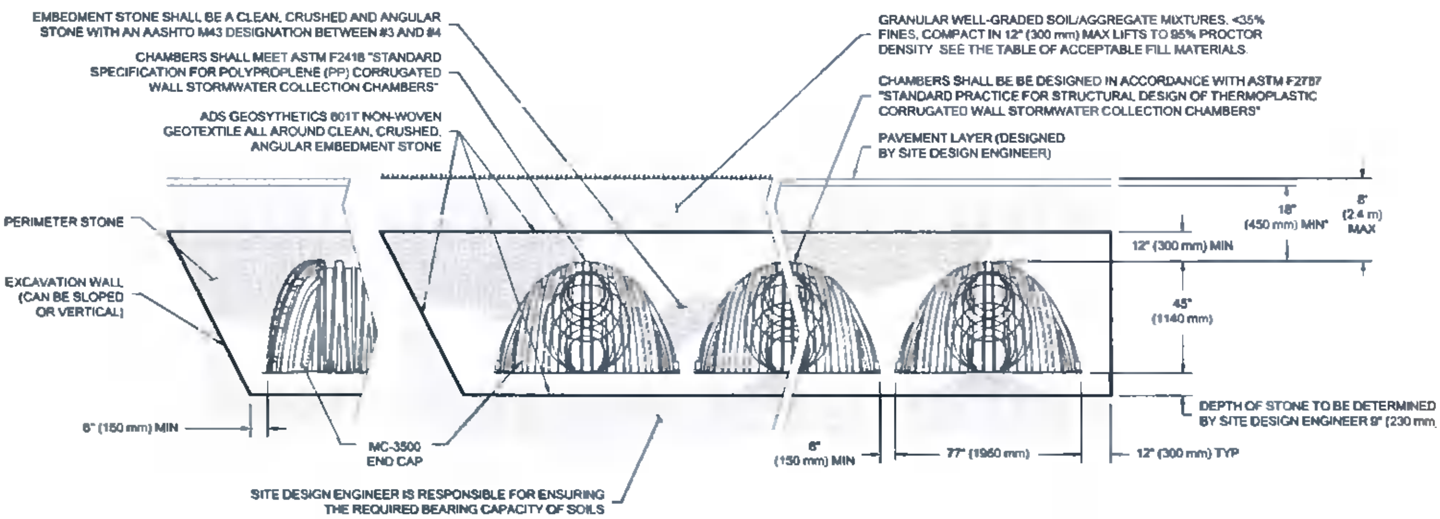
End Cap Storage
14.9 ft³ (0.42 m³)

Min. Installed Storage*
45.1ft³ (1.28 m³)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 6" (150 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 24" (600 mm).

StormTech

ADS

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500 Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
MC-3500 End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC KILOGRAMS (m³)	230 mm	300 mm	375 mm	450 mm
MC-3500 Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
MC-3500 End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-3500 Chamber	11.9 (9.1)	12.4 (9.5)	12.8(9.8)	13.3 (10.2)
MC-3500 End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

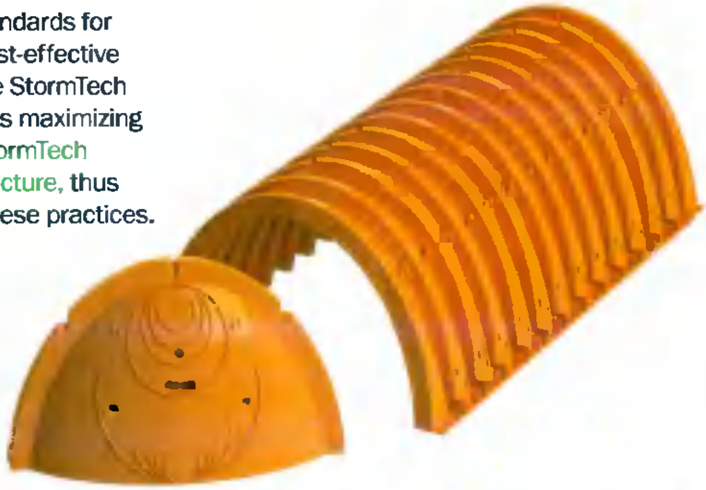
ADS DESIGN TOOL 2.0

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

For more information on the StormTech MC-3500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

STORMTECH SC-740 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 SC-740 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

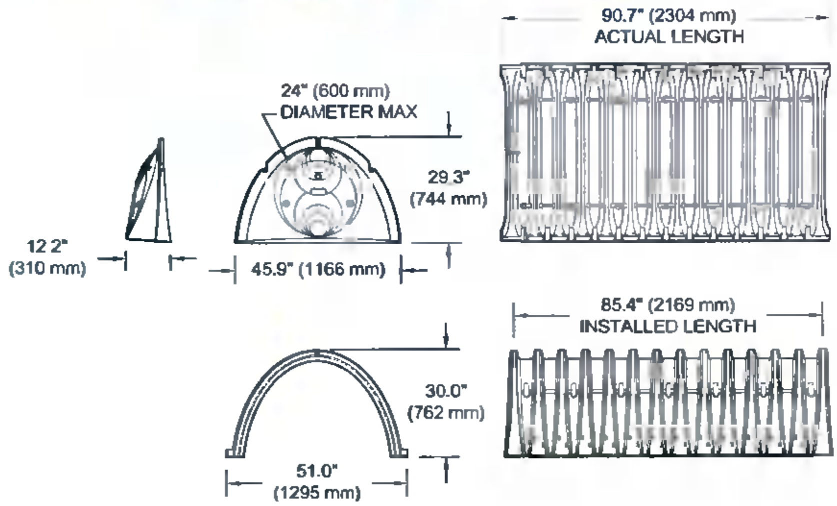
Chamber Storage
45.9 ft³ (1.30 m³)

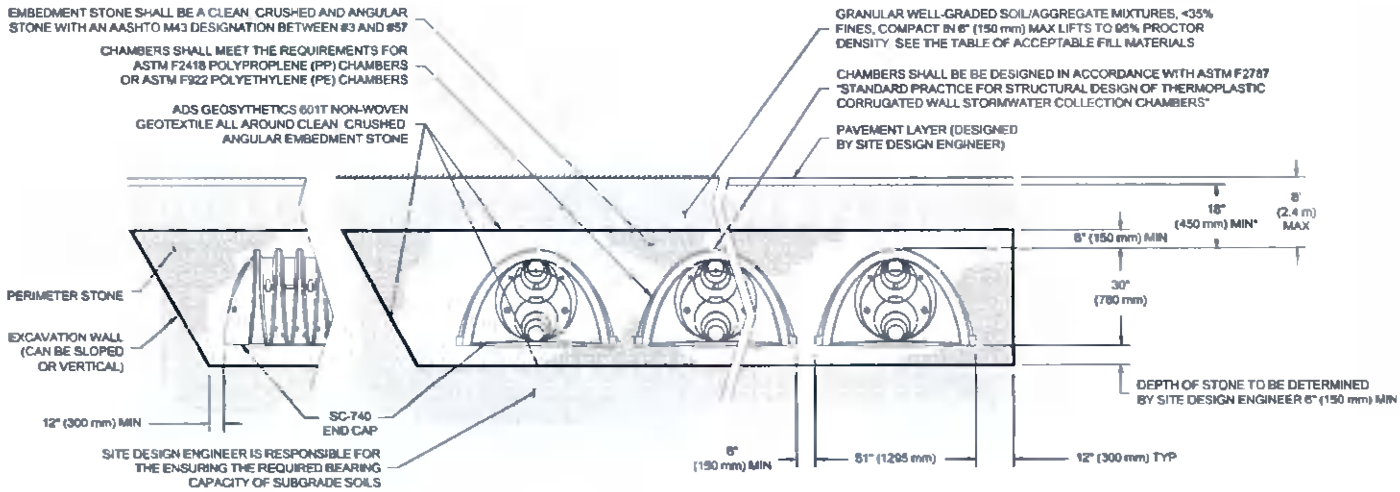
Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)		45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)		45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)		0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)		0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.

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and utilize the StormTech Design To

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

KAVANAGH BURKE
CONSULTING ENGINEERS

Discharge Units Calculation

KAVANAGH BURKE
CONSULTING ENGINEERS

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: ELECTRICAL WASTE MANAGEMENT LTD
Project: INDUSTRIAL DEVELOPMENT AT TAY LANE, GREENOGUE, RATHCOOLE, Co. DUBLIN

Project Ref: **D1541 PL2**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
FRONT OFFICE BLOCK	WB	0.6	4	2.4
GROUND FLOOR PLAN:	WC	2.5	4	10.0
	URINAL	0.8	1	0.8
	DISHWASH	0.8	1	*0.8*
	SINK	1.3	1	1.3
		TOTAL:		***15.3***
FRONT OFFICE BLOCK	WB	0.6	2	1.2
FIRST FLOOR PLAN:	WC	2.5	2	5.0
	URINAL	0.8	1	0.8
	DISHWASH	0.8	0	*0.0*
	SINK	1.3	0	0.0
		TOTAL:		***7.0***
TOTAL NO OF DICHARGE UNITS FOR OFFICE:				***22***
Q (l/sec) =				*3.31*
WAREHOUSE WC FACILITIES	WB	0.6	4	2.4
GROUND FLOOR PLAN:	WC	2.5	3	7.5
	URINAL	0.8	2	1.6
	SHOWER	0.6	2	1.2
	DISHWASH	0.8	1	0.8
	SINK	1.3	1	1.3
		TOTAL:		***14.8***
TOTAL NO OF DICHARGE UNITS FOR WC FACILITIES:				***15***
Q (l/sec) =				*2.69*
WORKSHOP	WB	37.0	1	37.0
GROUND FLOOR PLAN:	WC	2.5	1	2.5
	URINAL	0.8	1	0.8
	SHOWER	0.6	1	0.6
	DISHWASH	0.8	0	0.0
	SINK	1.3	1	1.3
		TOTAL:		***42.2***
TOTAL NO OF DICHARGE UNITS FOR WORKSHOP:				***42***
Q (l/sec) =				*4.55*

NOTE:
Discharge units calculated as per Table C.2. Typical values of discharge units of BS EN 752-4.
Typical frequency factors are taken from Table C.1. (k_{DU}=0.7)
Design flow rate is given by the equation: $Q = kDU \sqrt{\Sigma DU}$

APPENDIX A

EXTERNAL STORAGE AREA	
Area =	*1570 m2*
Rainfall intensity (i) =	*50 mm/h*
Routing Coefficent (Cr) =	*1.3*
Volumetric run-off coefficient (Cv) =	*0.75*
Constant =	*2.78*
DISCHARGE (Q) FLOW (l/s): Q=A x I x Cv x Cr x 2.78 =	***21.28***

→ *Refer to drg. ref. D1541 - D3 rev PL2*

TRUCK WASH AREA	
Area =	*490 m2*
Rainfall intensity (i) =	*50 mm/h*
Routing Coefficent (Cr) =	*1.3*
Volumetric run-off coefficient (Cv) =	*0.75*
Constant =	*2.78*
DISCHARGE (Q) FLOW (l/s): Q=A x I x Cv x Cr x 2.78 =	

→ *Refer to drg. ref. D1541 - D3 rev PL2*

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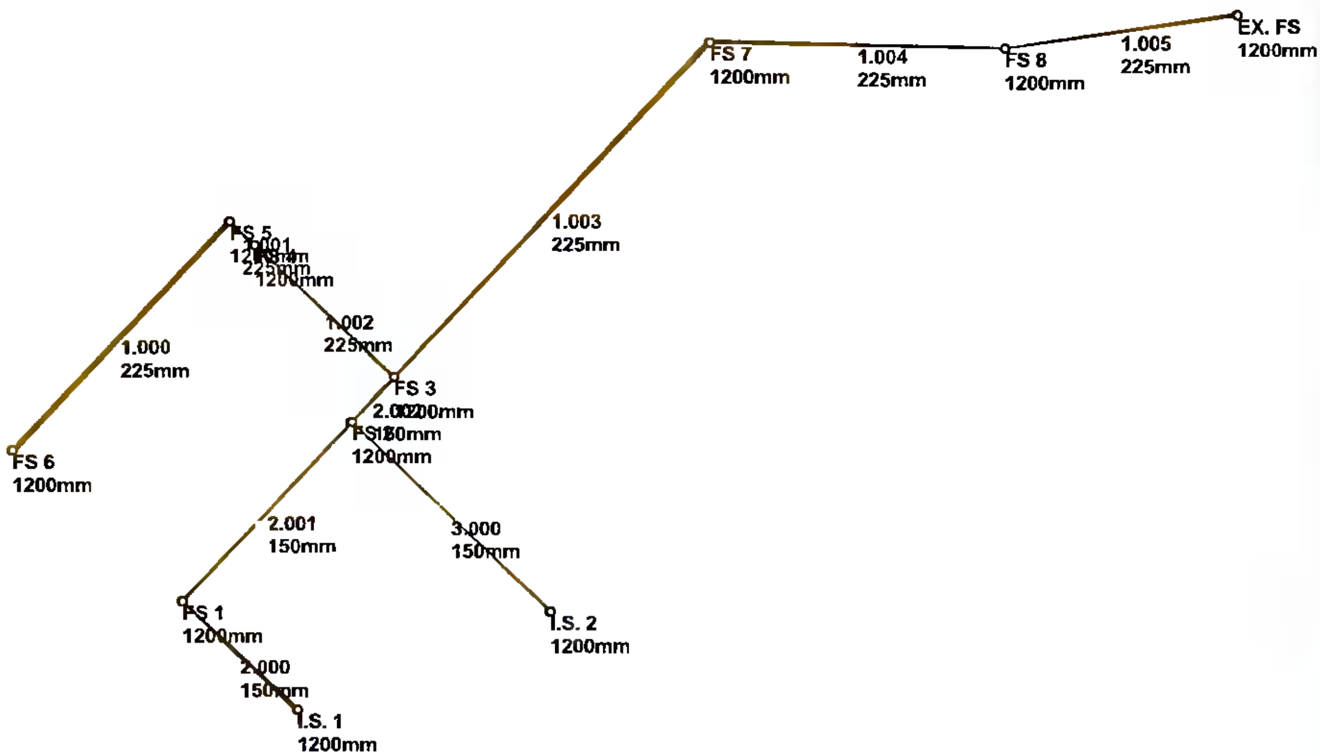
Foul Sewer Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Ltd Unit F3 Calmount Park, Ballymount, Dublin 12	File: D1541 - FS.pfd Network: oul Network Elena Dragoje 05/11/2021	Page 1 Foul Sewer Design Scheme PL2



Design Settings

Frequency of use (kDU)	0.70	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	2700	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Units	Add Inflow (l/s)	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
I.S. 1		2.0	102.000	Adoptable	701558.204	727732.740	1.000
FS 1			101.750	Adoptable	701541.495	727748.545	1.150
FS 2			101.750	Adoptable	701566.216	727774.715	1.750
I.S. 2		2.0	102.000	Adoptable	701595.121	727747.064	1.000
FS 3			101.570	Adoptable	701572.367	727781.286	1.770
FS 4	6.0		101.270	Adoptable	701552.012	727800.515	1.170
FS 5		6.6	101.270	Adoptable	701548.381	727803.952	1.070
FS 6		21.3	101.700	Adoptable	701516.746	727770.550	0.900
FS 7	37.0		101.100	Adoptable	701618.377	727829.989	2.050
FS 8			99.800	Adoptable	701661.367	727829.033	1.300
EX. FS			99.000	Adoptable	701695.118	727833.760	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
2.000	I.S. 1	FS 1	23.000	1.500	101.000	100.600	0.400	57.5	150
2.001	FS 1	FS 2	36.000	1.500	100.600	100.000	0.600	60.0	150
3.000	I.S. 2	FS 2	40.001	1.500	101.000	100.300	0.700	57.1	150
2.002	FS 2	FS 3	9.001	1.500	100.000	99.875	0.125	72.0	150
1.000	FS 6	FS 5	46.005	1.500	100.800	100.200	0.600	76.7	225
1.001	FS 5	FS 4	5.000	1.500	100.200	100.100	0.100	50.0	225
1.002	FS 4	FS 3	28.001	1.500	100.100	99.800	0.300	93.3	225
1.003	FS 3	FS 7	66.999	1.500	99.800	99.050	0.750	89.3	225
1.004	FS 7	FS 8	43.001	1.500	99.050	98.500	0.550	78.2	225
1.005	FS 8	EX. FS	34.080	1.500	98.500	98.000	0.500	68.2	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Velocity (m/s)
2.000	1.157	20.4	2.0	0.850	1.000	1.000	0.000	0	0.0	2.0	0.730
2.001	1.132	20.0	2.0	1.000	1.600	1.600	0.000	0	0.0	2.0	0.714
3.000	1.160	20.5	2.0	0.850	1.300	1.300	0.000	0	0.0	2.0	0.732
2.002	1.033	18.3	4.0	1.600	1.545	1.600	0.000	0	0.0	4.0	0.825
1.000	1.311	52.1	21.3	0.675	0.845	0.845	0.000	0	0.0	21.3	1.243
1.001	1.625	64.6	27.9	0.845	0.945	0.945	0.000	0	0.0	27.9	1.566
1.002	1.188	47.2	29.6	0.945	1.545	1.545	0.000	0	6.0	27.9	1.253
1.003	1.215	48.3	33.6	1.545	1.825	1.825	0.000	0	6.0	31.9	1.312
1.004	1.299	51.6	36.5	1.825	1.075	1.825	0.000	0	43.0	31.9	1.406
1.005	1.391	55.3	36.5	1.075	0.775	1.075	0.000	0	43.0	31.9	1.484

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	23.000	57.5	150	Circular	102.000	101.000	0.850	101.750	100.600	1.000
2.001	36.000	60.0	150	Circular	101.750	100.600	1.000	101.750	100.000	1.600
3.000	40.001	57.1	150	Circular	102.000	101.000	0.850	101.750	100.300	1.300
2.002	9.001	72.0	150	Circular	101.750	100.000	1.600	101.570	99.875	1.545
1.000	46.005	76.7	225	Circular	101.700	100.800	0.675	101.270	100.200	0.845
1.001	5.000	50.0	225	Circular	101.270	100.200	0.845	101.270	100.100	0.945
1.002	28.001	93.3	225	Circular	101.270	100.100	0.945	101.570	99.800	1.545
1.003	66.999	89.3	225	Circular	101.570	99.800	1.545	101.100	99.050	1.825
1.004	43.001	78.2	225	Circular	101.100	99.050	1.825	99.800	98.500	1.075
1.005	34.080	68.2	225	Circular	99.800	98.500	1.075	99.000	98.000	0.775

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	I.S. 1	1200	Manhole	Adoptable	FS 1	1200	Manhole	Adoptable
2.001	FS 1	1200	Manhole	Adoptable	FS 2	1200	Manhole	Adoptable
3.000	I.S. 2	1200	Manhole	Adoptable	FS 2	1200	Manhole	Adoptable
2.002	FS 2	1200	Manhole	Adoptable	FS 3	1200	Manhole	Adoptable
1.000	FS 6	1200	Manhole	Adoptable	FS 5	1200	Manhole	Adoptable
1.001	FS 5	1200	Manhole	Adoptable	FS 4	1200	Manhole	Adoptable
1.002	FS 4	1200	Manhole	Adoptable	FS 3	1200	Manhole	Adoptable
1.003	FS 3	1200	Manhole	Adoptable	FS 7	1200	Manhole	Adoptable
1.004	FS 7	1200	Manhole	Adoptable	FS 8	1200	Manhole	Adoptable
1.005	FS 8	1200	Manhole	Adoptable	EX. FS	1200	Manhole	Adoptable

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Appendix to Foul Sewer Design

- Specification/Product Information for:
    - Separators

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

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Free professional site visit with friendly support and advice.
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to make the right decision
or call 028 302 66799

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

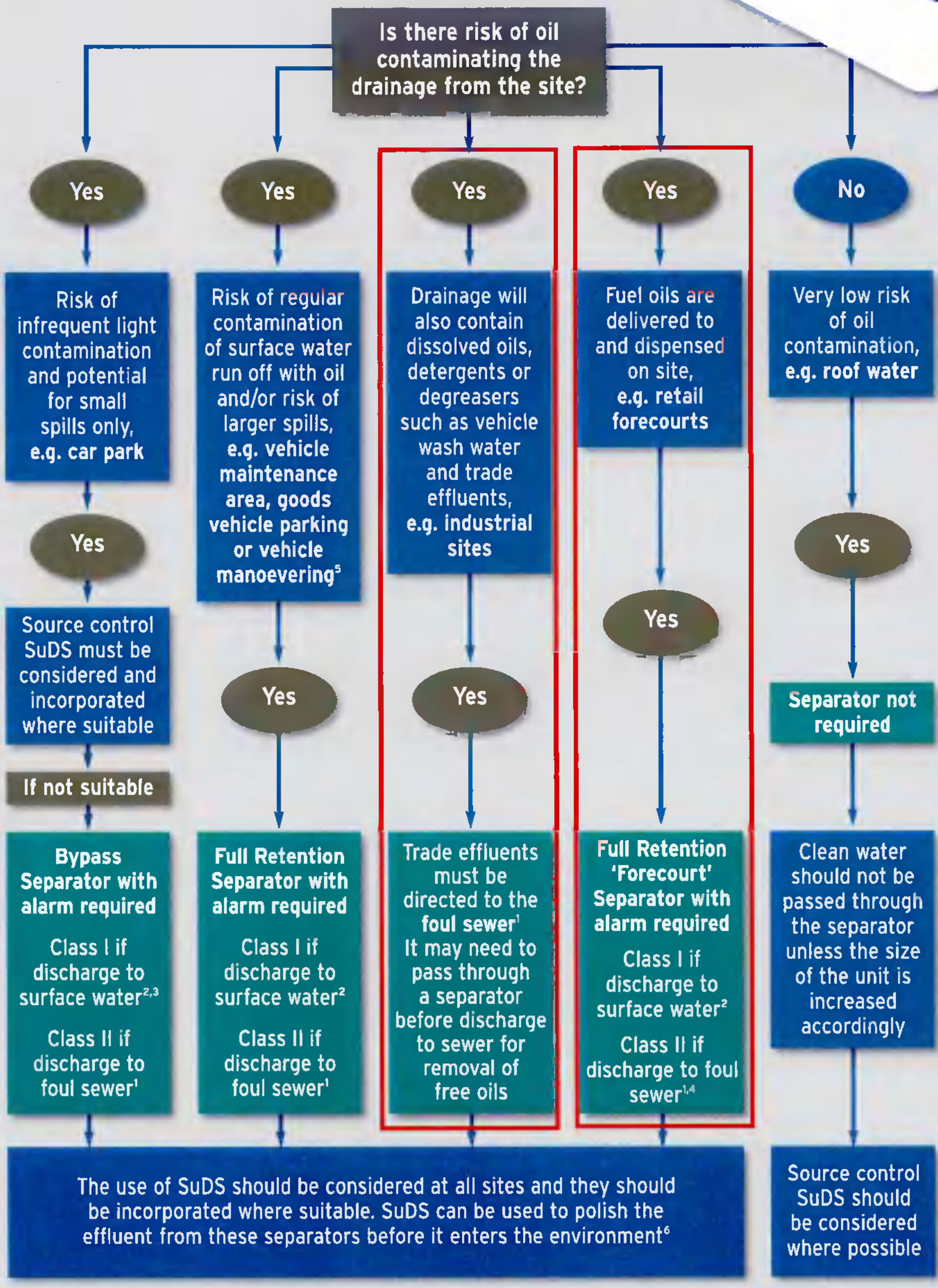
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size 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.

Full Retention NSF RANGE

Kingspan Klargester

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Automatic closure device.
- Oil storage volume.
- Coalescer (Class I units only).

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.

- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

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

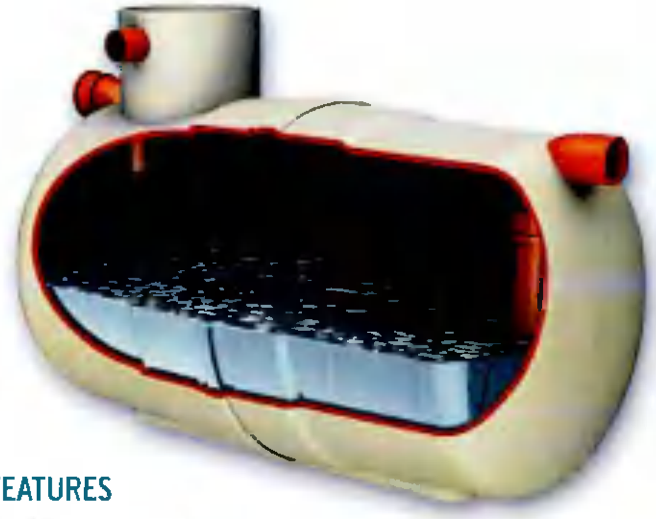
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether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

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m^2) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction *GRP chamber construction*

Washdown & Silt



APPLICATION

This unit can be used in areas such as car wash and other cleaning facilities that discharge directly into a foul drain, which feeds to a municipal treatment facility.

If emulsifiers are present the discharge must not be allowed to enter an NS Class I or Class II unit.

- Car wash.
- Tool hire depots.
- Truck cleansing.
- Construction compounds cleansing points.

PERFORMANCE

Such wash down facilities must not be allowed to discharge directly into surface water but must be directed to a foul connection leading to a municipal treatment works as they utilise emulsifiers, soaps and detergents, which can dissolve and disperse the oils.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

SIZES AND SPECIFICATIONS

REF.	TOTAL CAPACITY (litres)	MAX. REC. SILT	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)	APPROX EMPTY (kg)
W1/010	1000	500	3	1123	1225	460	1150	1100	50	500	160	60
W1/020	2000	1000	5	2074	1225	460	1150	1100	50	500	160	120
W1/030	3000	1500	8	2952	1225	460	1150	1100	50	500	160	150
W1/040	4000	2000	11	3898	1225	460	1150	1100	50	500	160	180
W1/060	6000	3000	16	4530	1440	600	1360	1310	50	500	160	320
W1/080	8000	4000	22	3200	2020	600	2005	1955	50	500	160	585
W1/100	10000	5000	27	3915	2020	600	2005	1955	50	500	160	680
W1/120	12000	6000	33	4640	2020	600	2005	1955	50	500	160	770
W1/150	15000	7500	41	5435	2075	600	1940	1890	50	500	160	965
W1/190	19000	9500	52	6865	2075	600	1940	1890	50	500	160	1200

Car Wash Silt Trap

APPLICATION

Car Wash silt trap is designed for use before a separator in car wash applications to ensure effective silt removal.

FEATURES

- FACTA Class B covers.
- Light and easy to install.
- Maintenance from ground level.

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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