KAVANAGH BURKE
CONSULTING ENGINEERS

Drainage Design Report

for

Warehouse Development

at

**Site R, Jordanstown Road,
Aerodrome Business Park,
Rathcoole, Co. Dublin**

Job No:	D1693
Client:	Exeter Ireland Property IV C Limited
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Local Authority:	South Dublin County Council
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Calmount Park, Ballymount, Dublin 12.

Tel: 353 1 4500694
Fax: 353 1 4264340

www.kavanaghburke.ie

Ulick Burke & Associates Limited.
Registered in Ireland No: 233579
V.A.T. Registration No: IE 82335791

Registered Address: Unit F3, Calmount Park, Ballymount, Dublin 12
Directors: U Burke, R Burke, P Kavanagh

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Contents:

Introduction

This report details the site development works design for a development at Jordanstown Road, Aerodrome Business Park, Rathcoole, Co. Dublin.

The subject site is located on the undeveloped land at Aerodrome Business Park, to the east of Jordanstown Road, which serves Aerodrome Business Park, and to the west of the Casement Airport.

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.

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 facility proposed is "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 D1693-D4. The discharge from site, i.e. the restricted flow from the flow control device will discharge to an existing Aerodrome Business Park surface water manhole at Jordanstown road and ultimately to Griffin River open channel adjacent to the Plaza Roundabout, located further into Greenogue Business Park (approx. 700m further from the existing manhole at Jordanstown Road) .

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 details layout (drawing reference D1693 – D4 - Drainage & Watermain Layout) for review by the Local Authority.

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. In summary, a range of measures have been incorporated into the development as follows:

- Tree Pits
- Rain Water Harvesting
- Porous Asphalt
- Trapped Road Gullies
- Restricted discharge
- Silt trap and petrol interceptor
- Water butts
- Permeable paving

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.

The following figures synopsise the surface water attenuation calculations:

SITE AREA	56,900 m^2
CATCHMENT AREA	47,520 m^2
SAAR	805
SOIL VALUE	0.3

STRUCTURE TYPE	RUNOFF COEFFICIENTS	AREA (ha)
Impermeable Areas *(Roofs; Concrete Yard/Road; Pathways; Permeable paving)*	1.0	4.492
Green Roof (if any)	0.8	0
Landscaping	0.3	0.26
TOTAL	-	4.752

Details of the surface water attenuation system including interceptors, flow restrictions, volume and pipe designs are included in this Drainage Design Report and on the accompanying Drainage Layout (drawing reference D1693 – D4 - Drainage & Watermain Layout) for review by the Local Authority.

A Flood Impact Assessment compiled by JBA Consulting Engineers is enclosed detailing measures proposed for flood mitigation on site.

Foul Sewer:

A new foul sewer has been designed to collect discharge from the proposed development and discharge to the existing foul sewer network at Jordanstown Road, Aerodrome Business Park. This proposed network collects the sewage on site from the proposed warehouse toilet facilities and ancillary offices/staff facilities and a discharge pipe is proposed in a west-east direction of the proposed access road from the Jordanstown Road to the proposed development.

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.

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 200mm private main at Jordanstown Road, exact location show on accompanying drg ref. D1693-D4.

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

- StormTech Cumulative Spreadsheet

Surface Water Attenuation Calculation

1) Areas for Attenuation Calculation

Site Area of development:	56,900 m^2 (5.69 ha)
Catchment area:	47,520 m^2 (4.752 ha)
Contributing Landscaping:	2,600 m^2
Impermeable Areas (roof, concrete yard):	44,920 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.

Design Impermeable Areas:	44,920 m^2 x 0.80 = 35,936 m^2
Total volume for 5mm rainfall:	5mm x 35,936 m^2 = **179.7 m^3**

Therefore, a minimum Interception Storage volume of 179,7 m^3 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 302500, N 228000): <u>805 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 $(805)^{1.17}$ x $(0.3)^{2.17}$ =
107.3 l/sec =
2.15 l/sec/ha

Q_{BAR} for the subject site area:

2.15 l/sec/ha x 4.752 ha =
Q_{BAR} = 10.2 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:

2 l/sec/ha x 4.752 ha = 9.5 l/sec.

<u>Therefore allowable discharge (Q_{BAR}) will be set at **10.2 l/sec.**</u>

4) Attenuation Storage Volume

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): 44,920 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 3758.6m^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}=10.2 l/sec)***	**(m^3) E - F**
15 min	44,920	19.80	21.78	978.36	9.18	969.18
30 min	44,920	25.00	27.50	1235.30	18.36	1216.94
1 hour	44,920	31.70	34.87	1566.36	36.72	1529.64
2 hour	44,920	40.20	44.22	1986.36	73.43	1912.93
4 hour	44,920	50.90	55.99	2515.07	146.86	2368.21
6 hour	44,920	58.50	64.35	2890.60	220.29	2670.31
12 hour	44,920	74.10	81.51	3661.43	440.59	3220.84
1 day	44,920	93.90	103.29	4639.79	881.17	3758.61
2 day	44,920	95.00	104.50	4694.14	1762.35	2931.79

Critical Attenuation Volume = 3758.6 m^3

An allowance to account for the simplifying assumption of head – discharge relationship of 1.25 is applied (due to simple calculations assuming the maximum flow rate can be mobilised immediately for each design return period).

Revised Attenuation Volume: 3,758.6 m^3 x 1.25 = 4,698.2 m^3

Subtract Interception Storage: 4,698.2 m^3 – 179.7 m^3 = **4,518.5 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

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 44,920 m^2 + 30% x 2,600 m^2 =
	= 35,936 m^2 + 780 m^2 =
	= **36,716 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: 82.1 mm
Factor up by 10% for climate change: 90.31 mm

Total Volume of Runoff:	90.31mm x 36,716 m^2	=	3,316 m^3
Deduct discharge at Q_{BAR} for 6hrs:	10.2 l/sec x 6 hrs	=	220 m^3
Storage volume required:	3,316 – 220	=	3,096 m^3
Factor up for head relationship factor:	3,096 x 1.25	=	3,870 m^3
Deduct Interception Storage:	179.7 m^3		
Deduct Attenuation Storage:	4,518.5 m^3		
Temporary Flood Storage required:	3,870 – 179.7 – 4,518.5	<	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 with the exception of indicated flood risk with 0m3.
The detailed results of this analysis are enclosed in this report at Surface Water Network Design.

In summary:

INTERCEPTION STORAGE: 179.7m^3 to be provided by a lowered base to the attenuation system. Attenuation System Area: 3,055m^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: 4,518.5 m^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 4,518.5 m^3.

ATTENUATION VOLUME REQUIRED: 4,518.5 m^3

ATTENUATION VOLUME PROVIDED: 4,538 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.

Project: D1693 - SITE R, AERODROME B.P.

Chamber Model -	MC-3500		
Units -	Metric	Click Here for Imperial	
Number of Chambers -	735		
Number of End Caps -	38		
Voids in the stone (porosity) -	46	%	
Base of Stone Elevation -	91.15	m	☑ Include Perimeter Stone in Calculations
Amount of Stone Above Chambers -	500	mm	
Amount of Stone Below Chambers -	350	mm	
Area of system -	3570	sq.meters	Min. Area - 3567.392 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 Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2007	0.00	0.00	0.00	0.00	41.691	41.69	4538.37	93.16
1981	0.00	0.00	0.00	0.00	41.691	41.69	4496.68	93.13
1956	0.00	0.00	0.00	0.00	41.691	41.69	4454.99	93.11
1930	0.00	0.00	0.00	0.00	41.691	41.69	4413.30	93.08
1905	0.00	0.00	0.00	0.00	41.691	41.69	4371.61	93.06
1880	0.00	0.00	0.00	0.00	41.691	41.69	4329.92	93.03
1854	0.00	0.00	0.00	0.00	41.691	41.69	4288.23	93.00
1829	0.00	0.00	0.00	0.00	41.691	41.69	4246.54	92.98
1803	0.00	0.00	0.00	0.00	41.691	41.69	4204.84	92.95
1778	0.00	0.00	0.00	0.00	41.691	41.69	4163.15	92.93
1753	0.00	0.00	0.00	0.00	41.691	41.69	4121.46	92.90
1727	0.00	0.00	0.00	0.00	41.691	41.69	4079.77	92.88
1702	0.00	0.00	0.00	0.00	41.691	41.69	4038.08	92.85
1676	0.00	0.00	0.00	0.00	41.691	41.69	3996.39	92.83
1651	0.00	0.00	0.00	0.00	41.691	41.69	3954.70	92.80
1626	0.00	0.00	0.00	0.00	41.691	41.69	3913.01	92.78
1600	0.00	0.00	0.00	0.00	41.691	41.69	3871.32	92.75
1575	0.00	0.00	0.00	0.00	41.691	41.69	3829.63	92.72
1549	0.00	0.00	0.00	0.00	41.691	41.69	3787.94	92.70
1524	0.00	0.00	0.00	0.00	41.691	41.69	3746.24	92.67
1499	0.00	0.00	1.21	0.00	41.135	42.34	3704.55	92.65
1473	0.01	0.00	4.04	0.01	39.828	43.88	3662.21	92.62
1448	0.01	0.00	6.12	0.01	38.872	45.00	3618.33	92.60
1422	0.01	0.00	8.40	0.02	37.816	46.24	3573.33	92.57
1397	0.02	0.00	14.30	0.04	35.092	49.44	3527.09	92.55
1372	0.03	0.00	21.40	0.05	31.821	53.28	3477.65	92.52
1346	0.04	0.00	26.01	0.08	29.693	55.78	3424.38	92.50
1321	0.04	0.00	29.60	0.10	28.030	57.73	3368.60	92.47
1295	0.04	0.00	32.74	0.11	26.580	59.43	3310.87	92.45
1270	0.05	0.00	35.53	0.13	25.287	60.95	3251.45	92.42
1245	0.05	0.00	38.06	0.15	24.116	62.32	3190.50	92.39
1219	0.05	0.00	40.33	0.17	23.059	63.56	3128.18	92.37
1194	0.06	0.01	42.48	0.19	22.063	64.73	3064.61	92.34
1168	0.06	0.01	44.43	0.22	21.154	65.80	2999.88	92.32
1143	0.06	0.01	46.29	0.23	20.292	66.81	2934.08	92.29
1118	0.07	0.01	48.01	0.26	19.487	67.76	2867.27	92.27
1092	0.07	0.01	49.63	0.28	18.730	68.64	2799.51	92.24
1067	0.07	0.01	51.18	0.29	18.014	69.49	2730.87	92.22
1041	0.07	0.01	52.62	0.31	17.343	70.27	2661.38	92.19
1016	0.07	0.01	53.98	0.34	16.700	71.03	2591.11	92.17
991	0.08	0.01	55.28	0.36	16.098	71.73	2520.08	92.14
965	0.08	0.01	56.51	0.38	15.523	72.41	2448.35	92.12
940	0.08	0.01	57.68	0.40	14.975	73.05	2375.94	92.09
914	0.08	0.01	58.79	0.42	14.455	73.66	2302.89	92.06
889	0.08	0.01	59.85	0.44	13.958	74.25	2229.22	92.04
864	0.08	0.01	60.86	0.46	13.482	74.81	2154.97	92.01
838	0.08	0.01	61.81	0.48	13.034	75.33	2080.17	91.99
813	0.09	0.01	62.70	0.49	12.622	75.82	2004.84	91.96
787	0.09	0.01	63.55	0.52	12.221	76.29	1929.02	91.94
762	0.09	0.01	64.40	0.53	11.824	76.75	1852.74	91.91
737	0.09	0.01	65.16	0.55	11.466	77.17	1775.99	91.89
711	0.09	0.01	65.89	0.56	11.125	77.57	1698.81	91.86
686	0.09	0.02	66.59	0.58	10.792	77.96	1621.24	91.84
660	0.09	0.02	67.25	0.58	10.489	78.32	1543.28	91.81
635	0.09	0.02	67.88	0.60	10.189	78.67	1464.96	91.79

610	0.09	0.02	68.48	0.61	9.908	79.00	1386.29	91.76
584	0.09	0.02	69.06	0.62	9.638	79.32	1307.29	91.73
559	0.09	0.02	69.60	0.62	9.387	79.61	1227.97	91.71
533	0.10	0.02	70.11	0.65	9.143	79.90	1148.35	91.68
508	0.10	0.02	70.61	0.65	8.914	80.17	1068.45	91.66
483	0.10	0.02	71.07	0.66	8.698	80.42	988.29	91.63
457	0.10	0.02	71.53	0.66	8.483	80.67	907.86	91.61
432	0.10	0.02	71.97	0.67	8.280	80.91	827.19	91.58
406	0.10	0.02	72.40	0.68	8.074	81.15	746.28	91.56
381	0.10	0.02	72.95	0.68	7.821	81.45	665.12	91.53
356	0.00	0.00	0.00	0.00	41.691	41.69	583.67	91.51
330	0.00	0.00	0.00	0.00	41.691	41.69	541.98	91.48
305	0.00	0.00	0.00	0.00	41.691	41.69	500.29	91.45
279	0.00	0.00	0.00	0.00	41.691	41.69	458.60	91.43
254	0.00	0.00	0.00	0.00	41.691	41.69	416.91	91.40
229	0.00	0.00	0.00	0.00	41.691	41.69	375.22	91.38
203	0.00	0.00	0.00	0.00	41.691	41.69	333.53	91.35
178	0.00	0.00	0.00	0.00	41.691	41.69	291.84	91.33
152	0.00	0.00	0.00	0.00	41.691	41.69	250.15	91.30
127	0.00	0.00	0.00	0.00	41.691	41.69	208.45	91.28
102	0.00	0.00	0.00	0.00	41.691	41.69	166.76	91.25
76	0.00	0.00	0.00	0.00	41.691	41.69	125.07	91.23
51	0.00	0.00	0.00	0.00	41.691	41.69	83.38	91.20
25	0.00	0.00	0.00	0.00	41.691	41.69	41.69	91.18

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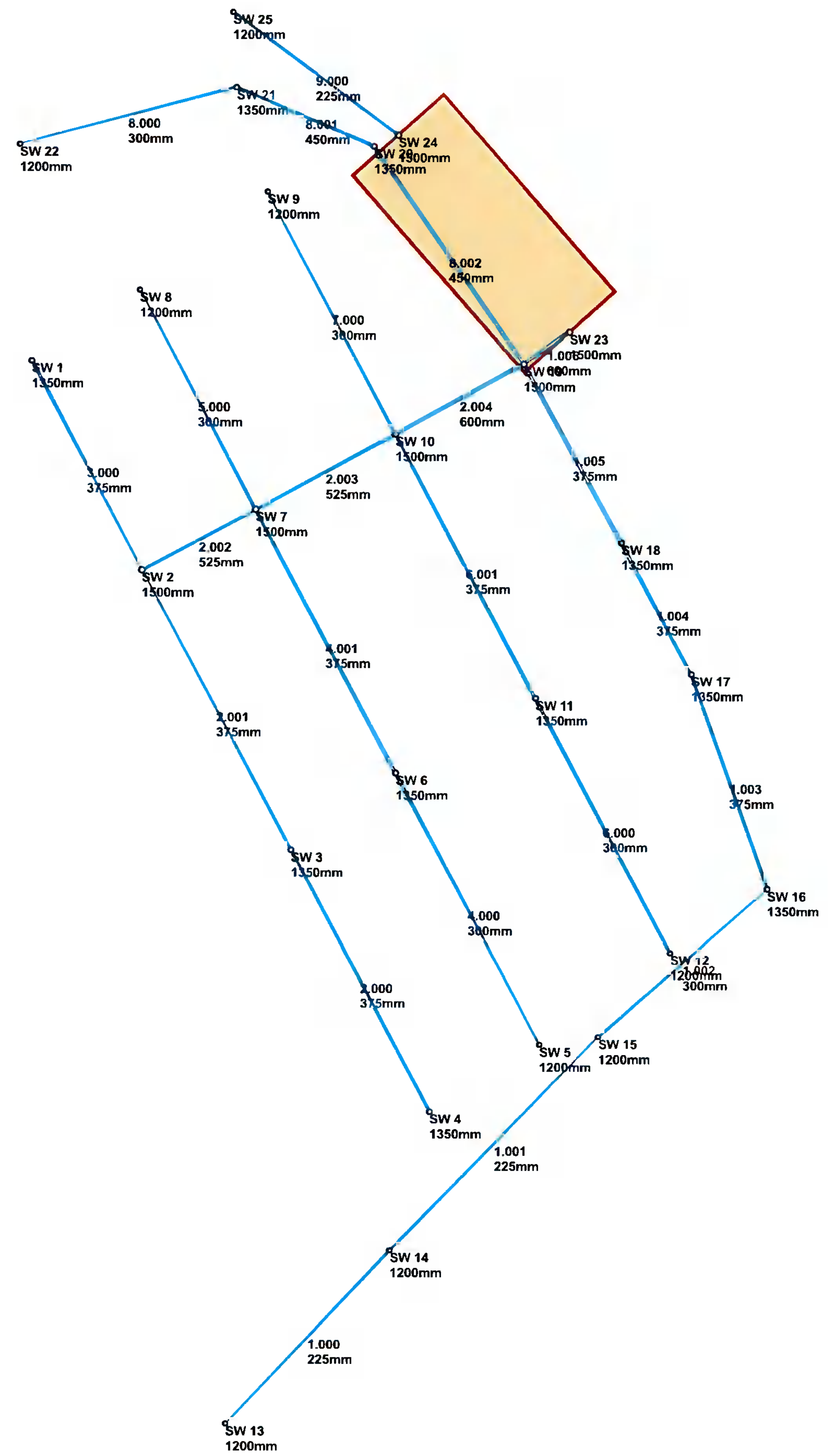
Surface Water Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Unit F3 Block F, Calmount Park, Ballymount, Dublin 12, D12PX28	File: D1693 - SW Network.pfd Network: SURFACE WATER Elena Dragoje 27/05/2021	Page 1 Surface Water Network Scheme



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)	17.700	Minimum Backdrop Height (m)	1.000
Ratio-R	0.271	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)
SW 13	0.080	5.00	95.825	1200	702442.188	727764.981	1.425
SW 14	0.040	5.00	95.500	1200	702486.257	727811.392	1.450
SW 15	0.040	5.00	95.000	1200	702542.276	727868.504	1.550
SW 16	0.080	5.00	94.900	1350	702587.677	727907.731	1.825
SW 17	0.200	5.00	94.760	1350	702567.356	727965.247	1.935
SW 18	0.160	5.00	94.510	1350	702548.575	728000.563	1.960
SW 4	0.130	5.00	95.100	1350	702496.922	727848.508	1.400
SW 3	0.130	5.00	95.000	1350	702459.829	727918.258	1.650
SW 1	0.200	5.00	94.900	1350	702390.339	728048.930	1.575
SW 2	0.100	5.00	95.000	1500	702419.919	727993.306	2.150
SW 5	0.130	5.00	94.950	1200	702526.404	727866.407	1.500
SW 6	0.140	5.00	95.200	1350	702487.941	727938.827	2.225
SW 8	0.130	5.00	95.200	1200	702419.409	728067.743	1.500
SW 7	0.165	5.00	95.200	1500	702450.398	728009.470	2.750
SW 12	0.120	5.00	94.900	1200	702561.627	727890.847	1.500
SW 11	0.135	5.00	95.200	1350	702525.467	727958.826	2.275
SW 9	0.160	5.00	94.900	1200	702453.608	728093.903	1.500
SW 10	0.165	5.00	95.200	1500	702487.904	728029.462	3.050
SW 22	0.140	5.00	93.800	1200	702387.156	728106.485	1.100
SW 21	0.070	5.00	94.125	1350	702445.254	728121.469	1.825
SW 20	0.140	5.00	94.850	1350	702482.086	728105.867	2.750
SW 19	0.380	5.00	94.760	1500	702522.249	728047.938	3.110
SW 23			94.800	1500	702534.576	728056.485	3.600
SW 24		5.00	94.650	1500	702488.591	728108.834	3.500
SW 25			93.500	1200	702444.327	728141.478	2.600

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Lateral Area (ha)
1.000	SW 13	SW 14	64.000	0.600	94.400	94.050	0.350	182.9	225	Circular	6.11	48.9	
1.001	SW 14	SW 15	79.999	0.600	94.050	93.525	0.525	152.4	225	Circular	7.37	45.3	0.040
1.002	SW 15	SW 16	60.000	0.600	93.450	93.150	0.300	200.0	300	Circular	8.27	43.1	0.040
1.003	SW 16	SW 17	61.000	0.600	93.075	92.825	0.250	244.0	375	Circular	9.15	41.1	
1.004	SW 17	SW 18	39.999	0.600	92.825	92.550	0.275	145.5	375	Circular	9.60	40.2	0.200
1.005	SW 18	SW 19	54.198	0.600	92.550	92.100	0.450	120.4	375	Circular	10.14	39.2	0.160
2.000	SW 4	SW 3	79.000	0.600	93.700	93.350	0.350	225.7	375	Circular	6.10	49.0	0.140
2.001	SW 3	SW 2	85.000	0.600	93.350	93.000	0.350	242.9	375	Circular	7.32	45.4	0.140
3.000	SW 1	SW 2	63.000	0.600	93.325	93.000	0.325	193.8	375	Circular	5.81	49.9	0.100

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
1.000	SW 13	SW 14	38.3	10.6	1.200	1.225	1.225	0.080	0.0	0.824
1.001	SW 14	SW 15	42.0	19.6	1.225	1.250	1.250	0.160	0.0	1.041
1.002	SW 15	SW 16	78.3	28.0	1.250	1.450	1.450	0.240	0.0	1.019
1.003	SW 16	SW 17	127.6	35.7	1.450	1.560	1.560	0.320	0.0	0.995
1.004	SW 17	SW 18	165.7	78.5	1.560	1.585	1.585	0.720	0.0	1.482
1.005	SW 18	SW 19	182.2	110.5	1.585	2.285	2.285	1.040	0.0	1.726
2.000	SW 4	SW 3	132.7	35.8	1.025	1.275	1.275	0.270	0.0	1.027
2.001	SW 3	SW 2	127.9	66.5	1.275	1.625	1.625	0.540	0.0	1.168
3.000	SW 1	SW 2	143.3	40.6	1.200	1.625	1.625	0.300	0.0	1.121

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Lateral Area (ha)
2.002	SW 2	SW 7	34.500	0.600	92.850	92.450	0.400	86.2	525	Circular	7.56	44.8	
4.000	SW 5	SW 6	82.000	0.600	93.450	93.050	0.400	205.0	300	Circular	6.25	48.5	0.150
4.001	SW 6	SW 7	79.999	0.600	92.975	92.600	0.375	213.3	375	Circular	7.33	45.4	0.130
5.000	SW 8	SW 7	66.000	0.600	93.700	93.400	0.300	220.0	300	Circular	6.04	49.1	0.100
2.003	SW 7	SW 10	42.502	0.600	92.450	92.225	0.225	188.9	525	Circular	7.99	43.7	
6.000	SW 12	SW 11	76.998	0.600	93.400	93.000	0.400	192.5	300	Circular	6.14	48.8	0.120
6.001	SW 11	SW 10	80.003	0.600	92.925	92.425	0.500	160.0	375	Circular	7.07	46.1	0.130
7.000	SW 9	SW 10	72.999	0.600	93.400	92.900	0.500	146.0	300	Circular	5.94	49.5	0.150
2.004	SW 10	SW 19	38.999	0.600	92.150	91.925	0.225	173.3	600	Circular	8.35	42.9	
8.000	SW 22	SW 21	59.999	0.600	92.700	92.450	0.250	240.0	300	Circular	5.99	49.3	0.150
8.001	SW 21	SW 20	40.000	0.600	92.300	92.100	0.200	200.0	450	Circular	6.45	47.8	0.070
8.002	SW 20	SW 19	70.490	0.600	92.100	91.800	0.300	235.0	450	Circular	7.34	45.3	0.150
1.006	SW 19	SW 23	15.000	0.600	91.650	91.450	0.200	75.0	600	Circular	10.23	39.1	
9.000	SW 24	SW 25	54.999	0.600	91.150	90.900	0.250	220.0	225	Circular	6.04	49.1	

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
2.002	SW 2	SW 7	522.2	114.1	1.625	2.225	2.225	0.940	0.0	1.950
4.000	SW 5	SW 6	77.3	36.8	1.200	1.850	1.850	0.280	0.0	1.081
4.001	SW 6	SW 7	136.5	67.7	1.850	2.225	2.225	0.550	0.0	1.233
5.000	SW 8	SW 7	74.6	30.6	1.200	1.500	1.500	0.230	0.0	1.006
2.003	SW 7	SW 10	352.0	223.3	2.225	2.450	2.450	1.885	0.0	1.717
6.000	SW 12	SW 11	79.8	31.8	1.200	1.900	1.900	0.240	0.0	1.067
6.001	SW 11	SW 10	157.9	63.1	1.900	2.400	2.400	0.505	0.0	1.352
7.000	SW 9	SW 10	91.8	41.6	1.200	2.000	2.000	0.310	0.0	1.268
2.004	SW 10	SW 19	522.1	333.1	2.450	2.235	2.450	2.865	0.0	1.952
8.000	SW 22	SW 21	71.4	38.8	0.800	1.375	1.375	0.290	0.0	1.030
8.001	SW 21	SW 20	228.0	55.8	1.375	2.300	2.300	0.430	0.0	1.192
8.002	SW 20	SW 19	210.2	88.5	2.300	2.510	2.510	0.720	0.0	1.267
1.006	SW 19	SW 23	795.5	529.8	2.510	2.750	2.750	5.005	0.0	3.001
9.000	SW 24	SW 25	34.9	0.0	3.275	2.375	3.275	0.000	0.0	0.000

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.700	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.271	Skip Steady State	x	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 %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	20	0	0	100	20	0	0

Node SW 24 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	91.300	Product Number	CTL-SHE-0134-1020-1900-1020
Design Depth (m)	1.900	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	10.2	Min Node Diameter (mm)	1500

Node SW 24 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	50.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	91.150	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets
SW 23

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	2260.0	0.0	2.000	2260.0	0.0	2.010	5.0	0.0

<u>Rainfall</u>

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	252.399	71.420	100 year +20% CC 15 minute summer	327.866	92.775
30 year +20% CC 15 minute winter	177.122	71.420	100 year +20% CC 15 minute winter	230.081	92.775
30 year +20% CC 30 minute summer	173.433	49.076	100 year +20% CC 30 minute summer	226.423	64.070
30 year +20% CC 30 minute winter	121.707	49.076	100 year +20% CC 30 minute winter	158.893	64.070
30 year +20% CC 60 minute summer	121.151	32.017	100 year +20% CC 60 minute summer	157.105	41.518
30 year +20% CC 60 minute winter	80.490	32.017	100 year +20% CC 60 minute winter	104.377	41.518
30 year +20% CC 120 minute summer	77.247	20.414	100 year +20% CC 120 minute summer	99.253	26.230
30 year +20% CC 120 minute winter	51.321	20.414	100 year +20% CC 120 minute winter	65.941	26.230
30 year +20% CC 180 minute summer	60.557	15.583	100 year +20% CC 180 minute summer	77.308	19.894
30 year +20% CC 180 minute winter	39.363	15.583	100 year +20% CC 180 minute winter	50.252	19.894
30 year +20% CC 240 minute summer	48.590	12.841	100 year +20% CC 240 minute summer	61.728	16.313
30 year +20% CC 240 minute winter	32.282	12.841	100 year +20% CC 240 minute winter	41.011	16.313
30 year +20% CC 360 minute summer	37.910	9.756	100 year +20% CC 360 minute summer	47.813	12.304
30 year +20% CC 360 minute winter	24.643	9.756	100 year +20% CC 360 minute winter	31.080	12.304
30 year +20% CC 480 minute summer	30.344	8.019	100 year +20% CC 480 minute summer	38.066	10.060
30 year +20% CC 480 minute winter	20.160	8.019	100 year +20% CC 480 minute winter	25.290	10.060
30 year +20% CC 600 minute summer	25.171	6.885	100 year +20% CC 600 minute summer	31.444	8.601
30 year +20% CC 600 minute winter	17.198	6.885	100 year +20% CC 600 minute winter	21.485	8.601
30 year +20% CC 720 minute summer	22.675	6.077	100 year +20% CC 720 minute summer	28.228	7.565
30 year +20% CC 720 minute winter	15.239	6.077	100 year +20% CC 720 minute winter	18.971	7.565
30 year +20% CC 960 minute summer	18.949	4.990	100 year +20% CC 960 minute summer	23.462	6.178
30 year +20% CC 960 minute winter	12.552	4.990	100 year +20% CC 960 minute winter	15.541	6.178
30 year +20% CC 1440 minute summer	14.097	3.778	100 year +20% CC 1440 minute summer	17.321	4.642
30 year +20% CC 1440 minute winter	9.474	3.778	100 year +20% CC 1440 minute winter	11.641	4.642
30 year +20% CC 2160 minute summer	10.341	2.858	100 year +20% CC 2160 minute summer	12.602	3.483
30 year +20% CC 2160 minute winter	7.125	2.858	100 year +20% CC 2160 minute winter	8.683	3.483
30 year +20% CC 2880 minute summer	8.741	2.343	100 year +20% CC 2880 minute summer	10.587	2.838
30 year +20% CC 2880 minute winter	5.874	2.343	100 year +20% CC 2880 minute winter	7.115	2.838
30 year +20% CC 4320 minute summer	6.765	1.769	100 year +20% CC 4320 minute summer	8.121	2.123
30 year +20% CC 4320 minute winter	4.455	1.769	100 year +20% CC 4320 minute winter	5.348	2.123
30 year +20% CC 5760 minute summer	5.659	1.449	100 year +20% CC 5760 minute summer	6.748	1.727
30 year +20% CC 5760 minute winter	3.663	1.449	100 year +20% CC 5760 minute winter	4.367	1.727
30 year +20% CC 7200 minute summer	4.863	1.241	100 year +20% CC 7200 minute summer	5.769	1.472
30 year +20% CC 7200 minute winter	3.139	1.241	100 year +20% CC 7200 minute winter	3.723	1.472

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW 13	10	94.531	0.131	26.0	0.2964	0.0000	OK
15 minute winter	SW 14	13	94.217	0.167	38.1	0.2807	0.0000	OK
15 minute winter	1.001:50%	12	94.131	0.343	49.8	0.0000	0.0000	SURCHARGED
15 minute winter	SW 15	12	93.891	0.441	58.0	0.7257	0.0000	SURCHARGED
15 minute winter	1.002:50%	12	93.842	0.542	72.8	0.0000	0.0000	SURCHARGED
15 minute winter	SW 16	12	93.764	0.689	87.1	1.5908	0.0000	SURCHARGED
15 minute winter	SW 17	13	93.674	0.849	126.0	2.9717	0.0000	SURCHARGED
15 minute winter	1.004:50%	13	93.602	0.914	178.7	10.7366	0.0000	SURCHARGED
15 minute winter	SW 18	13	93.453	0.903	184.3	2.7679	0.0000	SURCHARGED
15 minute winter	1.005:50%	12	93.202	0.877	215.0	0.0000	0.0000	SURCHARGED
15 minute winter	SW 4	13	94.037	0.337	42.2	1.1087	0.0000	OK
15 minute winter	2.000:50%	13	94.021	0.496	86.8	0.0000	0.0000	SURCHARGED
15 minute winter	SW 3	13	93.970	0.620	127.1	1.8657	0.0000	SURCHARGED
15 minute winter	2.001:50%	13	93.893	0.718	143.2	0.0000	0.0000	SURCHARGED
15 minute winter	SW 1	13	93.790	0.465	65.0	1.8466	0.0000	SURCHARGED
15 minute winter	3.000:50%	13	93.796	0.633	98.5	5.5955	0.0000	SURCHARGED
15 minute winter	SW 2	13	93.751	0.901	230.1	2.4287	0.0000	SURCHARGED
15 minute winter	SW 5	12	94.142	0.692	42.2	1.9807	0.0000	SURCHARGED
15 minute winter	4.000:50%	12	94.108	0.858	86.7	0.0000	0.0000	SURCHARGED
15 minute winter	SW 6	12	93.915	0.940	114.2	2.5292	0.0000	SURCHARGED
15 minute winter	4.001:50%	13	93.836	1.049	148.7	11.4013	0.0000	SURCHARGED
15 minute winter	SW 8	10	93.858	0.158	42.2	0.4530	0.0000	OK
15 minute winter	5.000:50%	11	93.790	0.240	73.9	0.0000	0.0000	OK
15 minute winter	SW 7	12	93.670	1.220	403.5	3.6199	0.0000	SURCHARGED
15 minute winter	SW 12	12	93.744	0.344	39.0	0.9391	0.0000	SURCHARGED
15 minute winter	6.000:50%	12	93.716	0.516	77.2	0.0000	0.0000	SURCHARGED
15 minute winter	SW 11	12	93.576	0.651	118.6	1.7031	0.0000	SURCHARGED
15 minute winter	6.001:50%	12	93.480	0.805	138.5	0.0000	0.0000	SURCHARGED
15 minute winter	SW 9	10	93.558	0.158	52.0	0.5157	0.0000	OK
15 minute winter	7.000:50%	12	93.515	0.365	99.8	0.0000	0.0000	SURCHARGED
15 minute winter	SW 10	12	93.305	1.155	637.6	3.2916	0.0000	SURCHARGED

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	SW 13	1.000	SW 14	25.2	0.924	0.657	1.7582	
15 minute winter	SW 14	1.001	1.001:50%	37.6	1.065	0.895	1.4267	
15 minute winter	SW 14	1.001	SW 15	45.8	1.224	1.091	1.5908	
15 minute winter	SW 15	1.002	1.002:50%	60.6	1.080	0.774	2.1126	
15 minute winter	SW 15	1.002	SW 16	61.1	1.223	0.780	2.1126	
15 minute winter	SW 16	1.003	SW 17	83.5	0.946	0.655	6.7281	
15 minute winter	SW 17	1.004	1.004:50%	126.0	1.233	0.761	2.2059	
15 minute winter	SW 17	1.004	SW 18	167.0	1.514	1.008	2.2059	
15 minute winter	SW 18	1.005	1.005:50%	190.3	1.726	1.045	2.9889	
15 minute winter	SW 18	1.005	SW 19	216.1	1.960	1.186	2.9889	
15 minute winter	SW 4	2.000	2.000:50%	41.4	0.789	0.312	4.2407	
15 minute winter	SW 4	2.000	SW 3	84.9	1.019	0.640	4.3567	
15 minute winter	SW 3	2.001	2.001:50%	100.4	1.121	0.785	4.6876	
15 minute winter	SW 3	2.001	SW 2	125.5	1.373	0.981	4.6876	
15 minute winter	SW 1	3.000	3.000:50%	66.0	1.040	0.461	3.4744	
15 minute winter	SW 1	3.000	SW 2	91.8	1.312	0.641	3.4744	
15 minute winter	SW 2	2.002	SW 7	245.1	1.253	0.469	7.4531	
15 minute winter	SW 5	4.000	4.000:50%	38.1	0.788	0.492	2.8872	
15 minute winter	SW 5	4.000	SW 6	72.7	1.270	0.940	2.8872	
15 minute winter	SW 6	4.001	4.001:50%	108.9	1.161	0.797	4.4119	
15 minute winter	SW 6	4.001	SW 7	138.2	1.497	1.012	4.4119	
15 minute winter	SW 8	5.000	5.000:50%	41.4	0.844	0.555	1.6057	
15 minute winter	SW 8	5.000	SW 7	72.7	1.281	0.974	2.0017	
15 minute winter	SW 7	2.003	SW 10	417.5	1.933	1.186	9.1818	
15 minute winter	SW 12	6.000	6.000:50%	38.3	0.828	0.479	2.7111	
15 minute winter	SW 12	6.000	SW 11	74.7	1.238	0.935	2.7111	
15 minute winter	SW 11	6.001	6.001:50%	98.7	1.277	0.625	4.4120	
15 minute winter	SW 11	6.001	SW 10	122.6	1.440	0.777	4.4120	
15 minute winter	SW 9	7.000	7.000:50%	51.2	0.980	0.557	1.9628	
15 minute winter	SW 9	7.000	SW 10	94.3	1.493	1.028	2.5703	
15 minute winter	SW 10	2.004	SW 19	637.2	2.262	1.221	10.9851	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW 22	12	93.297	0.597	45.5	2.1929	0.0000	SURCHARGED
15 minute winter	8.000:50%	12	93.255	0.680	84.4	0.0000	0.0000	SURCHARGED
15 minute winter	SW 21	12	93.099	0.799	97.1	1.7568	0.0000	SURCHARGED
15 minute winter	8.001:50%	12	93.083	0.883	116.4	8.5158	0.0000	SURCHARGED
15 minute winter	SW 20	12	93.047	0.947	145.2	2.3201	0.0000	SURCHARGED
15 minute winter	8.002:50%	12	92.964	1.014	180.4	0.0000	0.0000	SURCHARGED
15 minute winter	SW 19	12	92.837	1.187	1126.9	4.9993	0.0000	SURCHARGED
4320 minute winter	SW 23	3960	92.760	1.560	121.1	2.7563	0.0000	OK
4320 minute winter	SW 24	3960	92.760	1.610	166.9	2.8446	0.0000	SURCHARGED
15 minute summer	SW 25	1	90.900	0.000	8.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW 22	8.000	8.000:50%	38.5	0.727	0.539	2.1126	
15 minute winter	SW 22	8.000	SW 21	76.1	1.253	1.065	2.1126	
15 minute winter	SW 21	8.001	8.001:50%	95.1	1.107	0.417	3.1689	
15 minute winter	SW 21	8.001	SW 20	119.1	1.033	0.522	3.1689	
15 minute winter	SW 20	8.002	8.002:50%	148.4	1.108	0.706	5.5843	
15 minute winter	SW 20	8.002	SW 19	179.9	1.247	0.856	5.5843	
15 minute winter	SW 19	1.006	SW 23	1125.8	3.997	1.415	4.1824	
4320 minute winter	SW 23	Flow through pond	SW 24	166.9	0.013	0.001	3582.2800	
4320 minute winter	SW 24	Hydro-Brake®	SW 25	10.2				1884.2

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW 13	13	94.987	0.587	33.8	1.3235	0.0000	SURCHARGED
15 minute winter	SW 14	13	94.882	0.832	49.6	1.4005	0.0000	SURCHARGED
15 minute winter	1.001:50%	13	94.733	0.945	54.9	0.0000	0.0000	SURCHARGED
15 minute winter	SW 15	13	94.471	1.021	63.1	1.6809	0.0000	SURCHARGED
15 minute winter	1.002:50%	13	94.399	1.099	72.8	0.0000	0.0000	SURCHARGED
15 minute winter	SW 16	13	94.298	1.223	95.1	2.8221	0.0000	SURCHARGED
15 minute winter	SW 17	13	94.186	1.361	162.7	4.7621	0.0000	SURCHARGED
15 minute winter	1.004:50%	13	94.087	1.400	230.3	25.1633	0.0000	SURCHARGED
15 minute winter	SW 18	13	93.915	1.365	212.8	4.1833	0.0000	SURCHARGED
15 minute winter	1.005:50%	12	93.603	1.278	242.4	0.0000	0.0000	SURCHARGED
15 minute winter	SW 4	12	94.901	1.200	85.0	3.9484	0.0000	FLOOD RISK
15 minute winter	2.000:50%	12	94.897	1.372	104.5	0.0000	0.0000	SURCHARGED
15 minute winter	SW 3	12	94.832	1.482	152.5	4.4553	0.0000	FLOOD RISK
15 minute winter	2.001:50%	12	94.639	1.464	171.5	0.0000	0.0000	SURCHARGED
15 minute winter	SW 1	13	94.419	1.094	84.4	4.3439	0.0000	SURCHARGED
15 minute winter	3.000:50%	13	94.401	1.239	118.1	21.4359	0.0000	SURCHARGED
15 minute winter	SW 2	13	94.351	1.501	243.6	4.0473	0.0000	SURCHARGED
15 minute winter	SW 5	12	94.852	1.402	54.9	4.0149	0.0000	FLOOD RISK
15 minute winter	4.000:50%	12	94.790	1.540	99.7	0.0000	0.0000	SURCHARGED
15 minute winter	SW 6	13	94.536	1.561	151.8	4.2002	0.0000	SURCHARGED
15 minute winter	4.001:50%	13	94.411	1.623	192.3	27.3078	0.0000	SURCHARGED
15 minute winter	SW 8	12	94.399	0.699	54.9	2.0013	0.0000	SURCHARGED
15 minute winter	5.000:50%	12	94.353	0.803	88.1	0.0000	0.0000	SURCHARGED
15 minute winter	SW 7	13	94.235	1.785	478.9	5.2948	0.0000	SURCHARGED
15 minute winter	SW 12	12	94.576	1.176	50.7	3.2113	0.0000	SURCHARGED
15 minute winter	6.000:50%	12	94.511	1.311	93.0	0.0000	0.0000	SURCHARGED
15 minute winter	SW 11	12	94.278	1.353	130.0	3.5434	0.0000	SURCHARGED
15 minute winter	6.001:50%	12	94.098	1.423	172.3	0.0000	0.0000	SURCHARGED
15 minute winter	SW 9	12	94.244	0.844	67.5	2.7546	0.0000	SURCHARGED
15 minute winter	7.000:50%	12	94.143	0.993	119.9	0.0000	0.0000	SURCHARGED
15 minute winter	SW 10	12	93.779	1.629	747.7	4.6401	0.0000	SURCHARGED

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	SW 13	1.000	SW 14	32.7	0.964	0.852	2.5453	
15 minute winter	SW 14	1.001	1.001:50%	39.0	1.083	0.928	1.5908	
15 minute winter	SW 14	1.001	SW 15	46.2	1.221	1.099	1.5908	
15 minute winter	SW 15	1.002	1.002:50%	56.9	1.089	0.726	2.1126	
15 minute winter	SW 15	1.002	SW 16	63.3	1.228	0.809	2.1126	
15 minute winter	SW 16	1.003	SW 17	96.9	1.004	0.760	6.7281	
15 minute winter	SW 17	1.004	1.004:50%	150.8	1.367	0.910	2.2059	
15 minute winter	SW 17	1.004	SW 18	197.5	1.791	1.192	2.2059	
15 minute winter	SW 18	1.005	1.005:50%	220.3	1.998	1.209	2.9889	
15 minute winter	SW 18	1.005	SW 19	243.9	2.212	1.339	2.9889	
15 minute winter	SW 4	2.000	2.000:50%	48.9	0.821	0.369	4.3567	
15 minute winter	SW 4	2.000	SW 3	100.8	1.021	0.760	4.3567	
15 minute winter	SW 3	2.001	2.001:50%	125.3	1.136	0.980	4.6876	
15 minute winter	SW 3	2.001	SW 2	170.2	1.544	1.331	4.6876	
15 minute winter	SW 1	3.000	3.000:50%	78.4	1.057	0.547	3.4744	
15 minute winter	SW 1	3.000	SW 2	139.7	1.299	0.975	3.4744	
15 minute winter	SW 2	2.002	SW 7	252.9	1.339	0.484	7.4531	
15 minute winter	SW 5	4.000	4.000:50%	41.3	0.810	0.534	2.8872	
15 minute winter	SW 5	4.000	SW 6	96.2	1.367	1.244	2.8872	
15 minute winter	SW 6	4.001	4.001:50%	140.6	1.275	1.029	4.4119	
15 minute winter	SW 6	4.001	SW 7	170.4	1.545	1.248	4.4119	
15 minute winter	SW 8	5.000	5.000:50%	48.4	0.861	0.648	2.3238	
15 minute winter	SW 8	5.000	SW 7	81.3	1.281	1.090	2.3238	
15 minute winter	SW 7	2.003	SW 10	489.0	2.264	1.389	9.1818	
15 minute winter	SW 12	6.000	6.000:50%	45.3	0.850	0.567	2.7111	
15 minute winter	SW 12	6.000	SW 11	81.7	1.226	1.024	2.7111	
15 minute winter	SW 11	6.001	6.001:50%	126.9	1.275	0.804	4.4120	
15 minute winter	SW 11	6.001	SW 10	170.1	1.543	1.078	4.4120	
15 minute winter	SW 9	7.000	7.000:50%	60.3	1.004	0.656	2.5703	
15 minute winter	SW 9	7.000	SW 10	107.1	1.522	1.167	2.5703	
15 minute winter	SW 10	2.004	SW 19	745.9	2.648	1.429	10.9851	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	SW 22	12	93.800	1.100	59.1	4.0430	0.0000	FLOOD RISK
15 minute winter	8.000:50%	12	93.740	1.165	106.3	0.0000	0.0000	SURCHARGED
15 minute winter	SW 21	12	93.491	1.191	131.5	2.6192	0.0000	SURCHARGED
15 minute winter	8.001:50%	13	93.465	1.265	154.3	17.4847	0.0000	SURCHARGED
15 minute winter	SW 20	12	93.424	1.324	176.6	3.2427	0.0000	SURCHARGED
15 minute winter	8.002:50%	12	93.317	1.367	212.5	0.0000	0.0000	SURCHARGED
15 minute winter	SW 19	12	93.142	1.492	1319.6	6.2809	0.0000	SURCHARGED
4320 minute winter	SW 23	4020	93.137	1.937	89.2	3.4223	0.0000	OK
4320 minute winter	SW 24	4020	93.137	1.987	108.9	3.5106	0.0000	SURCHARGED
15 minute summer	SW 25	1	90.900	0.000	9.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	SW 22	8.000	8.000:50%	46.7	0.727	0.654	2.1126	
15 minute winter	SW 22	8.000	SW 21	103.7	1.472	1.451	2.1126	
15 minute winter	SW 21	8.001	8.001:50%	126.5	1.132	0.555	3.1689	
15 minute winter	SW 21	8.001	SW 20	153.0	1.010	0.671	3.1689	
15 minute winter	SW 20	8.002	8.002:50%	182.4	1.151	0.868	5.5843	
15 minute winter	SW 20	8.002	SW 19	213.7	1.349	1.017	5.5843	
15 minute winter	SW 19	1.006	SW 23	1318.6	4.682	1.658	4.1824	
4320 minute winter	SW 23	Flow through pond	SW 24	108.9	0.014	0.001	4417.2070	
4320 minute winter	SW 24	Hydro-Brake®	SW 25	10.2				2059.2

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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™

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 302500, Northing: 228000,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.4,	3.6,	4.3,	5.3,	6.0,	6.6,	8.4,	10.6,	12.1,	14.2,	16.1,	17.6,	20.0,	21.8,	23.4,	N/A ,
10 mins	3.4,	5.0,	6.0,	7.4,	8.4,	9.1,	11.7,	14.8,	16.8,	19.7,	22.4,	24.5,	27.8,	30.4,	32.6,	N/A ,
15 mins	4.0,	5.9,	7.0,	8.7,	9.8,	10.7,	13.8,	17.4,	19.8,	23.2,	26.4,	28.9,	32.7,	35.8,	38.3,	N/A ,
30 mins	5.2,	7.7,	9.1,	11.2,	12.6,	13.8,	17.6,	22.1,	25.0,	29.3,	33.2,	36.2,	41.0,	44.7,	47.9,	N/A ,
1 hours	6.9,	10.0,	11.8,	14.4,	16.3,	17.7,	22.5,	28.0,	31.7,	37.0,	41.8,	45.5,	51.4,	55.9,	59.7,	N/A ,
2 hours	9.0,	13.1,	15.3,	18.6,	20.9,	22.8,	28.7,	35.6,	40.2,	46.7,	52.6,	57.2,	64.3,	69.9,	74.6,	N/A ,
3 hours	10.6,	15.2,	17.8,	21.6,	24.3,	26.3,	33.1,	41.0,	46.2,	53.6,	60.2,	65.4,	73.4,	79.7,	84.9,	N/A ,
4 hours	11.9,	17.0,	19.8,	24.1,	27.0,	29.2,	36.7,	45.2,	50.9,	59.0,	66.2,	71.9,	80.6,	87.4,	93.1,	N/A ,
6 hours	13.9,	19.8,	23.1,	27.9,	31.2,	33.8,	42.3,	52.0,	58.5,	67.6,	75.8,	82.1,	91.9,	99.6,	105.9,	N/A ,
9 hours	16.3,	23.2,	26.9,	32.4,	36.2,	39.2,	48.8,	59.9,	67.2,	77.5,	86.7,	93.8,	104.9,	113.5,	120.6,	N/A ,
12 hours	18.3,	25.8,	29.9,	36.1,	40.2,	43.5,	54.1,	66.1,	74.1,	85.3,	95.4,	103.1,	115.2,	124.5,	132.2,	N/A ,
18 hours	21.4,	30.1,	34.8,	41.9,	46.6,	50.3,	62.4,	76.1,	85.1,	97.8,	109.1,	117.9,	131.4,	141.9,	150.5,	N/A ,
24 hours	24.0,	33.6,	38.8,	46.5,	51.8,	55.8,	69.1,	84.0,	93.9,	107.7,	120.0,	129.6,	144.2,	155.6,	165.1,	198.1,
2 days	30.2,	41.2,	46.9,	55.4,	61.0,	65.4,	79.4,	95.0,	105.1,	119.2,	131.5,	141.0,	155.5,	166.7,	175.9,	207.8,
3 days	35.3,	47.3,	53.5,	62.6,	68.6,	73.2,	87.9,	104.1,	114.6,	129.0,	141.6,	151.2,	165.9,	177.1,	186.3,	218.0,
4 days	39.8,	52.7,	59.3,	68.9,	75.2,	80.0,	95.4,	112.2,	122.9,	137.7,	150.6,	160.4,	175.2,	186.6,	195.9,	227.7,
6 days	47.8,	62.1,	69.3,	79.8,	86.7,	91.9,	108.4,	126.2,	137.5,	153.0,	166.3,	176.5,	191.8,	203.4,	212.9,	245.2,
8 days	54.8,	70.4,	78.2,	89.5,	96.8,	102.3,	119.7,	138.4,	150.2,	166.3,	180.1,	190.6,	206.3,	218.2,	227.9,	260.8,
10 days	61.3,	78.0,	86.3,	98.2,	106.0,	111.8,	130.0,	149.5,	161.7,	178.4,	192.6,	203.4,	219.5,	231.6,	241.5,	274.9,
12 days	67.5,	85.1,	93.9,	106.4,	114.5,	120.6,	139.6,	159.7,	172.4,	189.5,	204.1,	215.2,	231.6,	244.0,	254.1,	288.1,
16 days	78.9,	98.3,	107.9,	121.5,	130.2,	136.7,	157.1,	178.5,	191.8,	209.8,	225.1,	236.6,	253.8,	266.6,	277.0,	312.0,
20 days	89.5,	110.5,	120.8,	135.3,	144.5,	151.5,	173.0,	195.5,	209.5,	228.3,	244.2,	256.1,	273.8,	287.1,	297.8,	333.6,
25 days	102.0,	124.7,	135.8,	151.3,	161.2,	168.7,	191.4,	215.1,	229.8,	249.4,	266.0,	278.4,	296.8,	310.5,	321.5,	358.4,

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

Greenfield runoff rate estimation for sites

HR Wallingford
Working with water

www.uksuds.com | Greenfield runoff tool

alculated by:	Elena Dragoje
te name:	Site R
te location:	Aerodrome Business Park, Rathcoole, Co Dublin

is is an estimation of the greenfield runoff rates that are used to meet normal best ıctice criteria in line with Environment Agency guidance "Rainfall runoff management developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and ː non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may ː basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.29294° N
Longitude:	6.46266° W
Reference:	3034731267
Date:	May 21 2021 15:28

unoff estimation approach

IH124

te characteristics

tal site area (ha): 4.75

ethodology

3AR estimation method:	Calculate from SPR and SAAR
ᴾR estimation method:	Calculate from SOIL type

oil characteristics

	Default	Edited
ƆIL type:	2	2
ƆST class:	N/A	N/A
ᴾR/SPRHOST:	0.3	0.3

ydrological characteristics

	Default	Edited
∖AR (mm):	884	805
⁄drological region:	12	12
·owth curve factor 1 year:	0.85	0.85
·owth curve factor 30 years:	2.13	2.13
·owth curve factor 100 years:	2.61	2.61
·owth 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.

reenfield runoff rates

	Default	Edited
3AR (l/s):	11.37	10.19
in 1 year (l/s):	9.67	8.67
in 30 years (l/s):	24.23	21.71
in 100 year (l/s):	29.69	26.61
in 200 years (l/s):	32.53	29.16

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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.

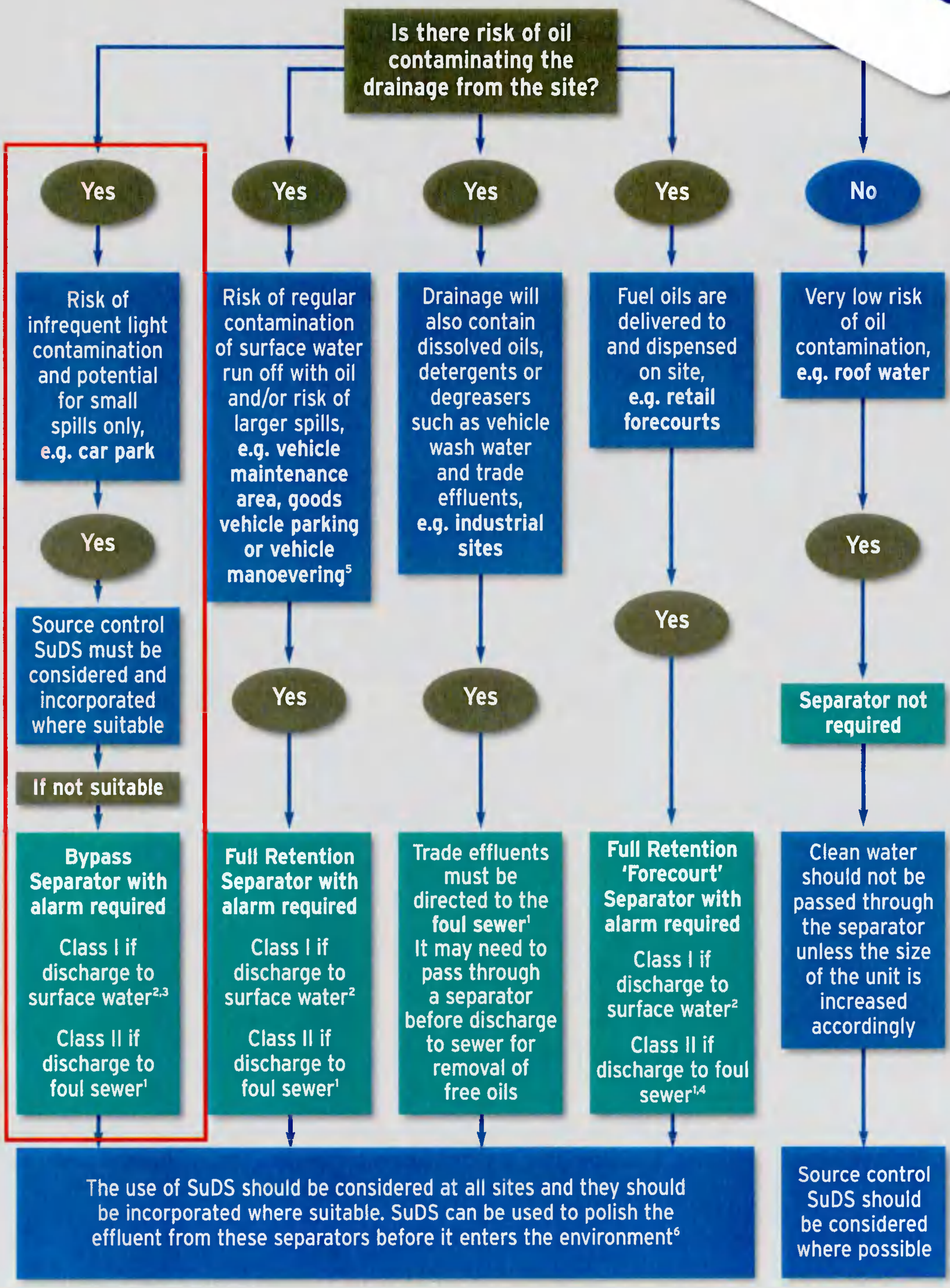
SELECTING THE RIGHT SEPARATOR

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.

Kingspan Klargester



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
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

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

PROFESSIONAL INSTALLERS

Klargester Accredited Installers

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

Services include :

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

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

www.klargester.com/installers

Kingspan Klargester
Accredited Installer

CARE & MAINTENANCE

Kingspan Environmental Services

Who better to look after your treatment plant than the people who designed and built it?

Kingspan Environmental have a dedicated service division providing maintenance for wastewater products.

Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

To find out more about protecting your investment and ensuring peace of mind, call us on:

0844 846 0500

or visit us online:

www.kingspanenvservice.com

Kingspan Environmental Services

Kingspan Klargester

COMMERCIAL WASTEWATER SOLUTIONS

- **BIODISC®, BIOTEC™ & ENVIROSAFE** HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- **HILLMASTER** PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- STORMWATER ATTENUATION SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

Kingspan Water

NEW BUILD & RETROFIT SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

PROVIDE KLARGESTER CLASS I BYPASS PETROL INTERCEPTOR REF. NSBE075.

Klargester

UK: College Road North, Aston Clinton, Aylesbury, Buckinghamshire HP22 5EW

Tel: +44 (0) 1296 633000 Fax: +44 (0) 1296 633001 Scottish Office: Tel: +44 (0) 1355 248484
email: info@klargester.com

Ireland: Unit 1a, Derryboy Road, Carnbane Business Park, Newry, Co. Down BT35 6QH

NI Tel : +44 (0) 28 302 66799 Fax: +44 (0) 28 302 60046 ROI Tel: 048 302 66799 Fax: 048 302 60046
email: info@klargester.ie

Visit our website **www.klargester.com**, or our company website **www.kingspanenv.com**

Part of Kingspan Environmental

BSI UKAS QUALITY MANAGEMENT 003 — *Certificate No FM 563603*

BSI UKAS MANAGEMENT SYSTEMS HEALTH AND SAFETY — *Certificate No OHS 563604*

RIBA CPD PROVIDERS NETWORK

BRITISH WATER

UK GREEN BUILDING COUNCIL

Issue No. 20: August 2014

Specialists in Wastewater Treatment & Stormwater Management

Surface Water Treatment SUDs Protector

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

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

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

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

Applications

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

www.cdstech.com.au

Rapid installation

Primary features

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

Surface Water System

Hydraulic Analysis

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

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

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

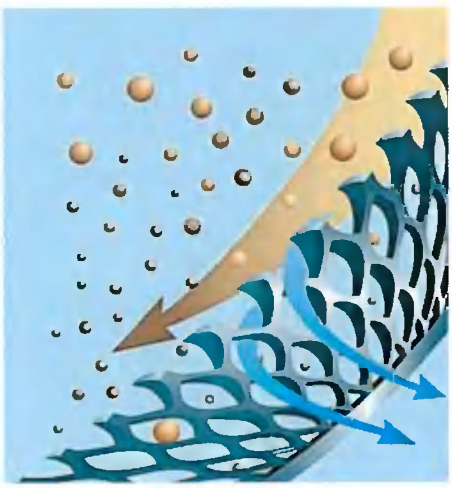
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

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

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

How it works

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



Surface Water Treatment Systems

Hydraulic Design

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

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

The Ultimate SUDs Protector

There a four principal areas of proprietary SUDs technology;

• Infiltration • Flow Control • Storage/attenuation • Treatment

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

SurfSeps have been successfully installed in front of;

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

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

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

Infiltration

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

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

Detention & Retention Systems

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

Applications

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

Purpose

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

Flow Control Systems

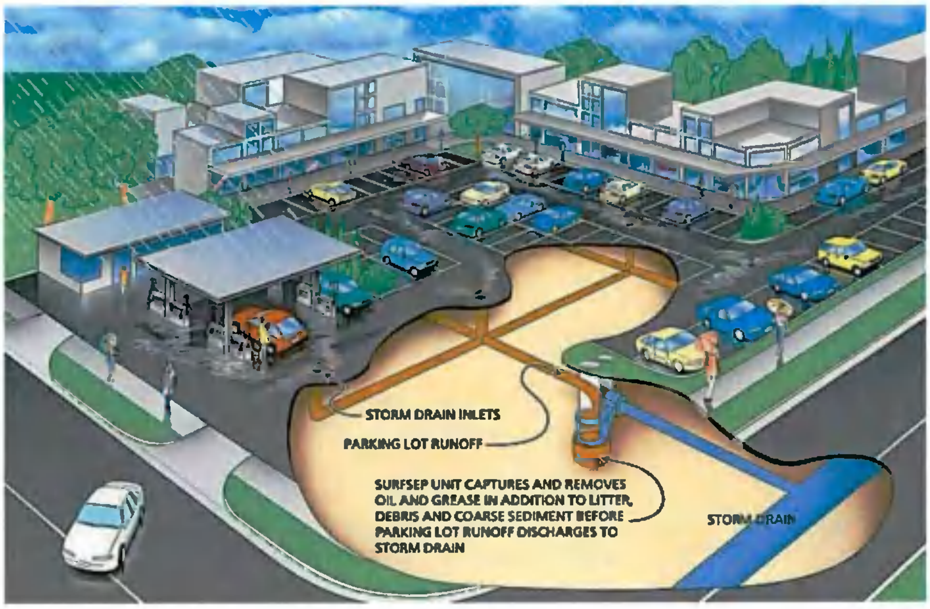
Flow Control

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

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

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

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



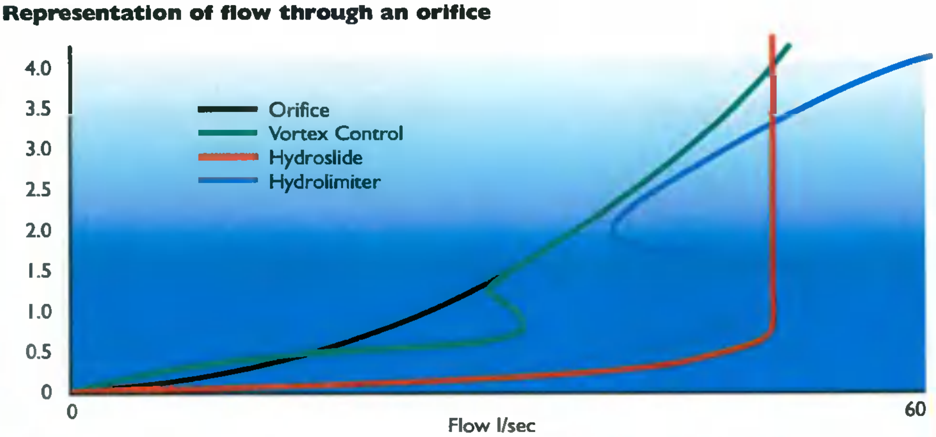
Typical SurfSep installation

Flow Control Technical Design

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

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

Representation of flow through an orifice



Operation & Performance

Performance Criteria

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

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

Typical 1.2 mm aperture Performance

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

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

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

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

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

Maintenance

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

Since this is seldom the case we recommend;

New Installations

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

Ongoing Operation

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

Cleaning Methods

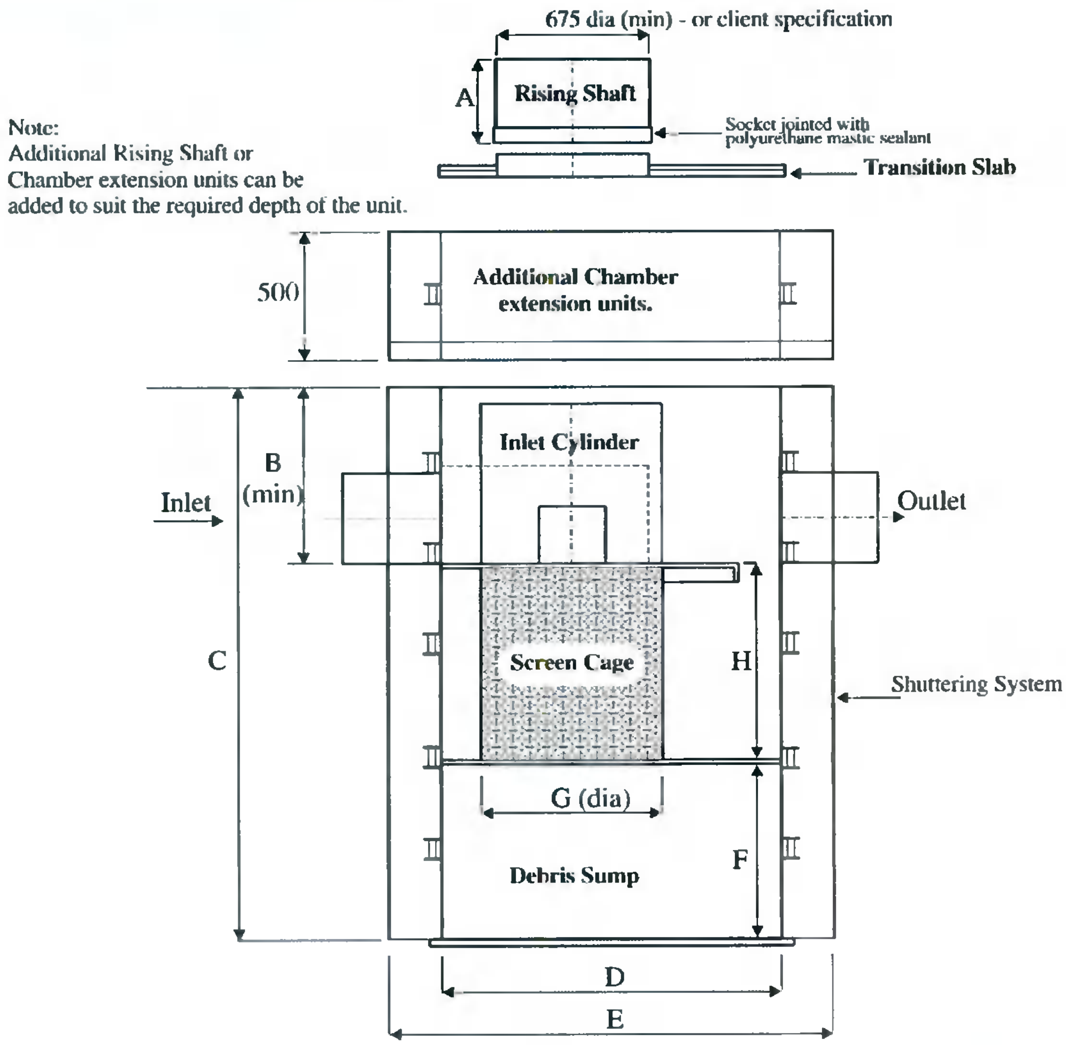
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

Maintenance Cycle

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

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

SurfSep Dimensions



SurfSep Dimensions (mm)

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

Selection Table - *SurfSep*

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

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

In-Line *SurfSep* Units (SWI)

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

Off-Line *SurfSep* Units (SWO)

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

Model Designation

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

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

Surface Water Treatment

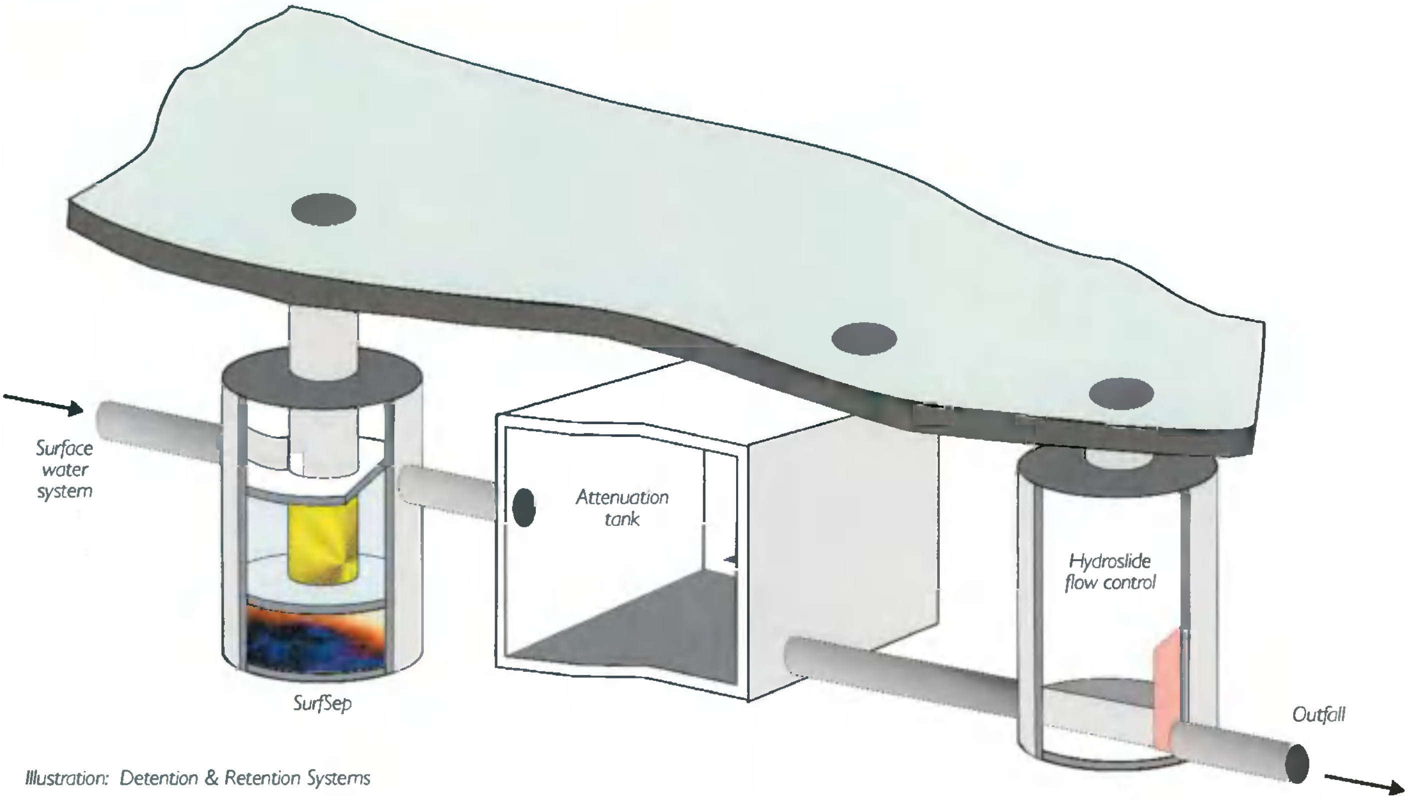


Illustration: Detention & Retention Systems

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

* BBA - 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.

 Issue 1001/100206

Hydro-Brake® Flow Control

Modelling Guide

Unit Selection Design Guide

Overview

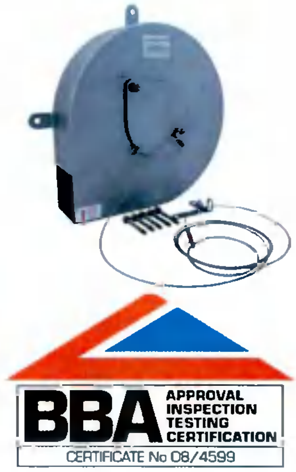
Hydro-Brake® Flow Controls restrict the flow in surface/storm water or foul/combined sewer systems by inducing a vortex flow pattern in the water passing through the device, having the effect of increasing back-pressure.

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

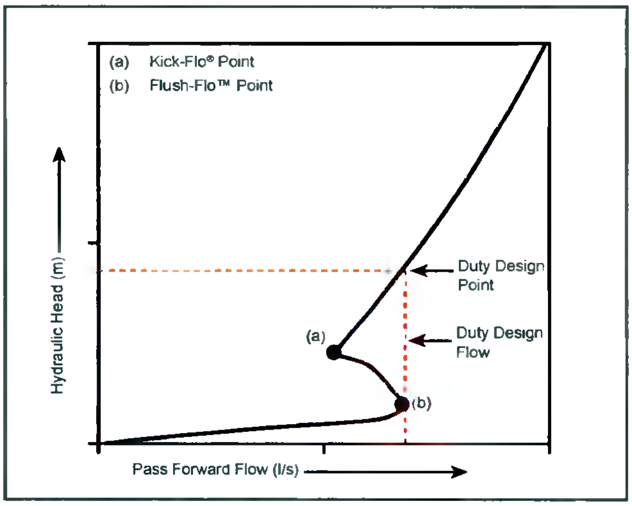


See back cover for details.

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:

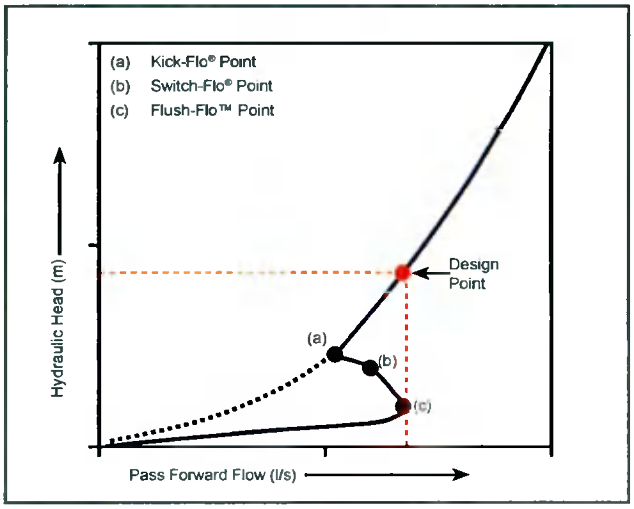
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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 08/4599

STH Range of Hydro-Brake® Flow Controls

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

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

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

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

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

turning water around ...®

HRD Technologies Ltd

HRD Technologies Ltd • Tootenhill House • Rathcoole • Co. Dublin • Ireland
Tel: +353 (0) 1 4013964 • Fax: +353 (0) 1 4013978 • www.hrdtec.com
HRD Technologies Ltd is a subsidiary of Hydro International plc

UKAS QUALITY MANAGEMENT 001

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 ft^3 (3.11 m^3)

Min. Installed Storage*
175.0 ft^3 (4.96 m^3)

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

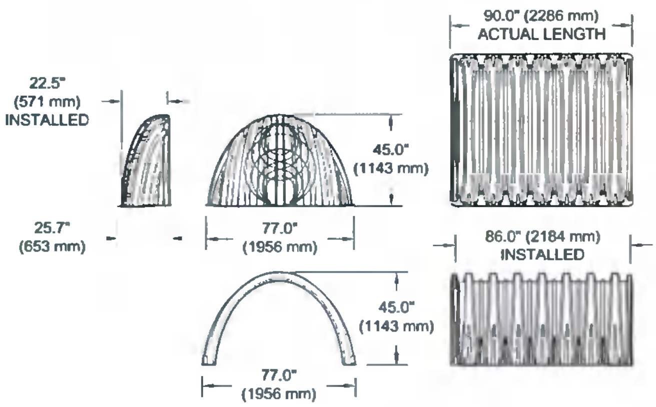
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

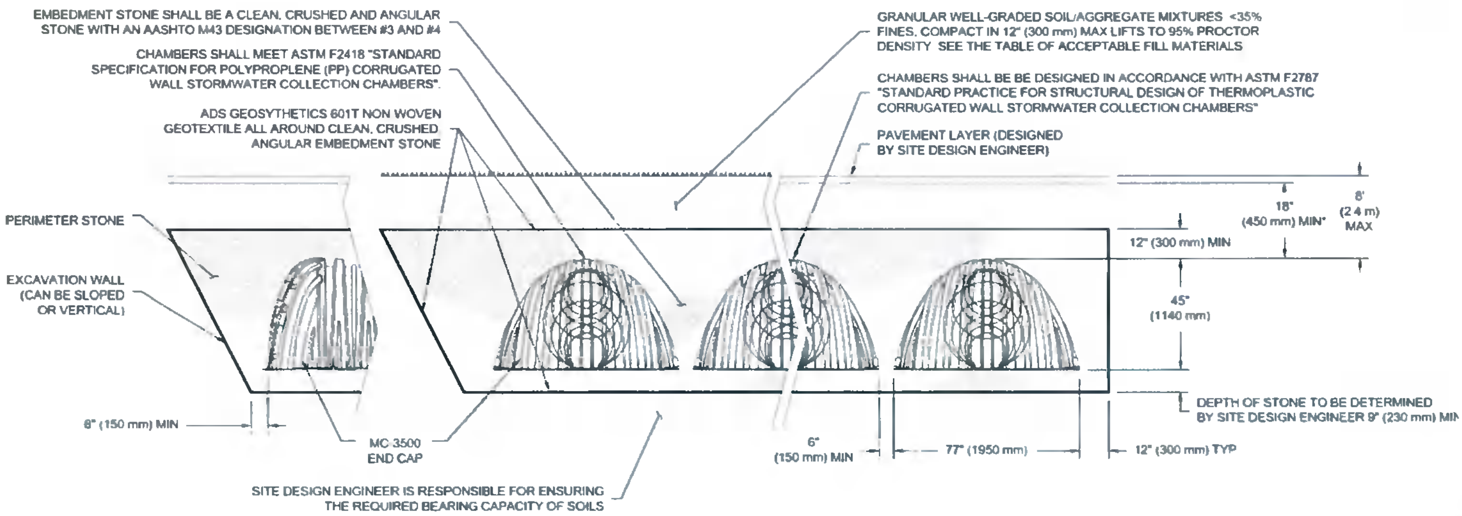
End Cap Storage
14.9 ft^3 (0.42 m^3)

Min. Installed Storage*
45.1 ft^3 (1.28 m^3)

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.

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KAVANAGH BURKE
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Discharge Units Calculation

KAVANAGH BURKE
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INPUT FOR FOUL SEWER NETWORK DESIGN

Client: Exeter Ireland Propoerty IV C ltd

Project: WAREHOUSE DEVELOPMENT AT SITE R,
JORDANSTOWN ROAD, AERODROME BUSINESS PARK,
RATHCOOLE, Co. DUBLIN

Project Ref: **D1693 PL1 - OFFICE BLOCK**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
GROUND FLOOR PLAN:	WB	0.6	8	4.8
	WC	2.5	8	20.0
	URINAL	0.8	2	1.6
	SINK	1.3	1	1.3
	DISHWASHER	0.8	1	0.8
	SHOWER	0.6	2	1.2
		TOTAL:		***29.7***
FIRST FLOOR PLAN:	WB	0.6	6	3.6
	WC	2.5	6	15.0
	URINAL	0.8	1	0.8
	SINK	1.3	1	1.3
	DISHWASHER	0.8	1	0.8
		TOTAL:		***21.5***
SECOND FLOOR PLAN:	WB	0.6	6	3.6
	WC	2.5	6	15.0
	URINAL	0.8	1	0.8
	SINK	1.3	1	1.3
	DISHWASHER	0.8	1	0.8
		TOTAL:		***21.5***
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 2:				***73***
Q (l/sec) =				*5.97*

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: $Q = kDU \sqrt{\Sigma DU}$

KAVANAGH BURKE
CONSULTING ENGINEERS

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: Exeter Ireland Propoerty IV C ltd

Project: WAREHOUSE DEVELOPMENT AT SITE R,
JORDANSTOWN ROAD, AERODROME BUSINESS PARK,
RATHCOOLE, Co. DUBLIN

Project Ref: **D1693 PL1 - DRIVERS OFFICE BLOCK & WAREHOUSE TOILET BLOCKS**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
DRIVERS OFFICE/STAFF FACILITIES				
GROUND FLOOR PLAN:	WB	0.6	2	1.2
	WC	2.5	2	5.0
	SINK	1.3	0	0.0
		TOTAL:		***6.2***
FIRST FLOOR PLAN:	WB	0.6	0	0.0
	WC	2.5	0	0.0
		TOTAL:		***0.0***
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 1:				***6***
			Q (l/sec) =	*1.74*
WAREHOUSE TOILET BLOCK (2NO)				
GROUND FLOOR PLAN:	WB	0.6	10	6.0
	WC	2.5	6	15.0
	URINAL	0.8	5	4.0
TOTAL NO OF DICHARGE UNITS FOR 1 NO WAREHOUSE TOILET BLOCK:				***25***
			Q (l/sec) =	*3.50*

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: $Q = kDU \sqrt{\Sigma DU}$

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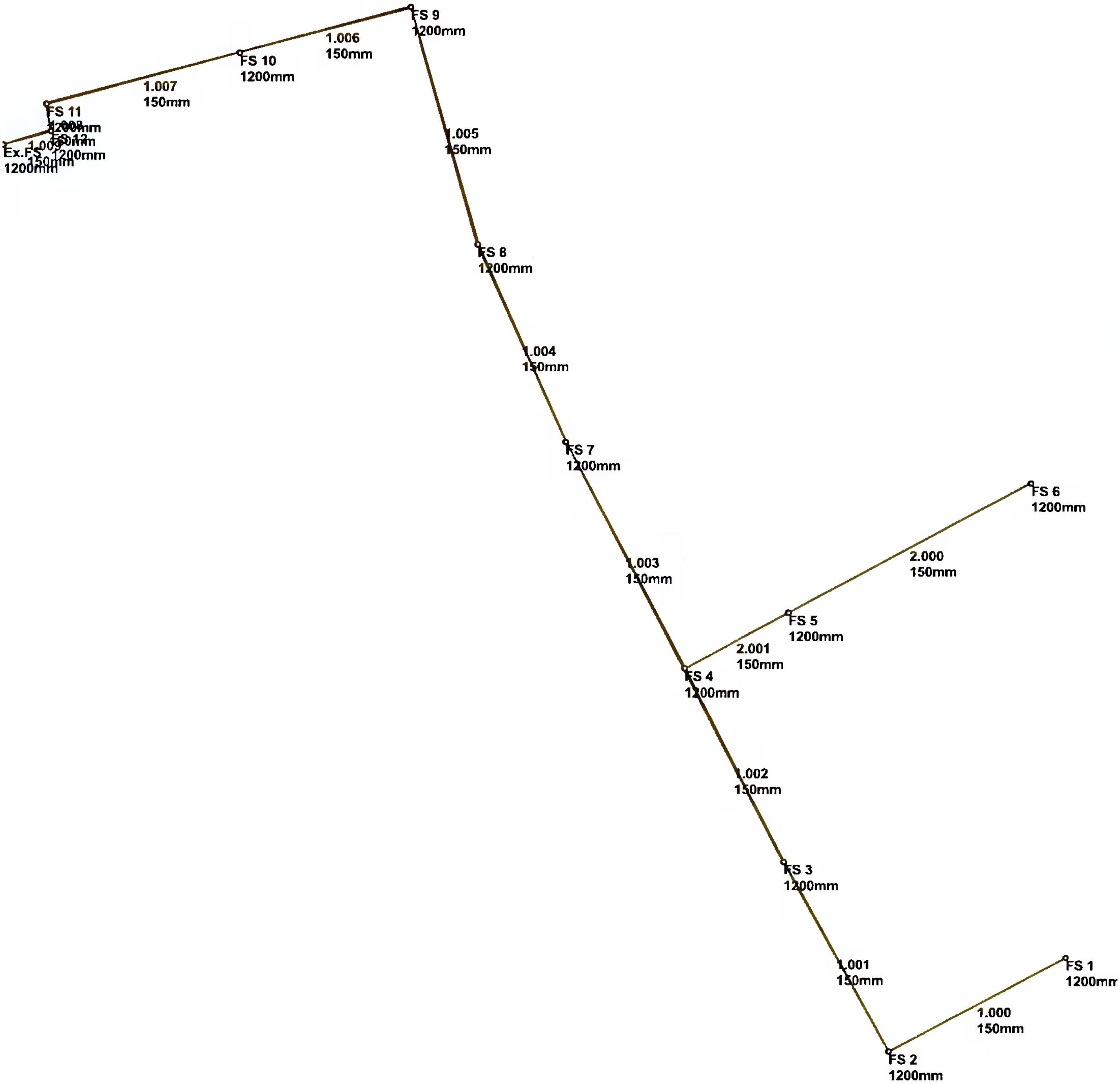
Foul Sewer Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Unit F3 Block F, Calmount Park, Ballymount, Dublin 12, D12PX28	File: D1693 - FS Network.pfd Network: Foul Network Elena Dragoje 25/05/2021	Page 1 FS Network Scheme



Design Settings

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

Nodes

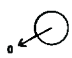
Name	Units	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
FS 1	73.0	94.900	Adoptable	702537.653	727877.779	1.000
FS 2		95.050	Adoptable	702492.523	727854.025	1.550
FS 3		94.900	Adoptable	702465.870	727902.135	1.850
FS 4	25.0	94.900	Adoptable	702440.693	727951.034	2.300
FS 5		95.200	Adoptable	702467.181	727965.120	2.100
FS 6	6.0	95.200	Adoptable	702528.985	727997.987	0.950
FS 7		94.900	Adoptable	702410.430	728008.559	2.770
FS 8	25.0	94.900	Adoptable	702388.106	728058.825	3.170
FS 9		93.300	Adoptable	702371.047	728118.952	2.020
FS 10		92.650	Adoptable	702327.561	728107.374	1.670
FS 11		92.600	Adoptable	702278.236	728094.413	1.960
FS 12		92.700	Adoptable	702279.385	728087.508	2.110
Ex.FS		92.730	Adoptable	702267.277	728084.079	2.230

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FS 1	FS 2	51.000	1.500	93.900	93.500	0.400	127.5	150
1.001	FS 2	FS 3	55.000	1.500	93.500	93.050	0.450	122.2	150
1.002	FS 3	FS 4	55.000	1.500	93.050	92.600	0.450	122.2	150
2.000	FS 6	FS 5	70.000	1.500	94.250	93.100	1.150	60.9	150
2.001	FS 5	FS 4	30.000	1.500	93.100	92.600	0.500	60.0	150
1.003	FS 4	FS 7	65.000	1.500	92.600	92.130	0.470	138.3	150
1.004	FS 7	FS 8	55.000	1.500	92.130	91.730	0.400	137.5	150
1.005	FS 8	FS 9	62.500	1.500	91.730	91.280	0.450	138.9	150
1.006	FS 9	FS 10	45.001	1.500	91.280	90.980	0.300	150.0	150
1.007	FS 10	FS 11	50.999	1.500	90.980	90.640	0.340	150.0	150
1.008	FS 11	FS 12	7.000	1.500	90.640	90.590	0.050	140.0	150
1.009	FS 12	Ex.FS	12.584	1.500	90.590	90.500	0.090	139.8	150

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Velocity (m/s)
1.000	FS 1	FS 2	13.7	6.0	0.850	1.400	1.400	0.000	73.0	0.0	0.749
1.001	FS 2	FS 3	14.0	6.0	1.400	1.700	1.700	0.000	73.0	0.0	0.759
1.002	FS 3	FS 4	14.0	6.0	1.700	2.150	2.150	0.000	73.0	0.0	0.759
2.000	FS 6	FS 5	19.9	1.7	0.800	1.950	1.950	0.000	6.0	0.0	0.685
2.001	FS 5	FS 4	20.0	1.7	1.950	2.150	2.150	0.000	6.0	0.0	0.681
1.003	FS 4	FS 7	13.1	7.1	2.150	2.620	2.620	0.000	104.0	0.0	0.759
1.004	FS 7	FS 8	13.2	7.1	2.620	3.020	3.020	0.000	104.0	0.0	0.762
1.005	FS 8	FS 9	13.1	8.0	3.020	1.870	3.020	0.000	129.0	0.0	0.777
1.006	FS 9	FS 10	12.6	8.0	1.870	1.520	1.870	0.000	129.0	0.0	0.755
1.007	FS 10	FS 11	12.6	8.0	1.520	1.810	1.810	0.000	129.0	0.0	0.755
1.008	FS 11	FS 12	13.1	8.0	1.810	1.960	1.960	0.000	129.0	0.0	0.776
1.009	FS 12	Ex.FS	13.1	8.0	1.960	2.080	2.080	0.000	129.0	0.0	0.777

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FS 1	702537.653	727877.779	94.900	1.000	1200	 0	1.000	93.900	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FS 2	702492.523	727854.025	95.050	1.550	1200	1	1.000	93.500	150
						0	1.001	93.500	150
FS 3	702465.870	727902.135	94.900	1.850	1200	1	1.001	93.050	150
						0	1.002	93.050	150
FS 4	702440.693	727951.034	94.900	2.300	1200	1	2.001	92.600	150
						2	1.002	92.600	150
						0	1.003	92.600	150
FS 5	702467.181	727965.120	95.200	2.100	1200	1	2.000	93.100	150
						0	2.001	93.100	150
FS 6	702528.985	727997.987	95.200	0.950	1200				
						0	2.000	94.250	150
FS 7	702410.430	728008.559	94.900	2.770	1200	1	1.003	92.130	150
						0	1.004	92.130	150
FS 8	702388.106	728058.825	94.900	3.170	1200	1	1.004	91.730	150
						0	1.005	91.730	150
FS 9	702371.047	728118.952	93.300	2.020	1200	1	1.005	91.280	150
						0	1.006	91.280	150
FS 10	702327.561	728107.374	92.650	1.670	1200	1	1.006	90.980	150
						0	1.007	90.980	150
FS 11	702278.236	728094.413	92.600	1.960	1200	1	1.007	90.640	150
						0	1.008	90.640	150
FS 12	702279.385	728087.508	92.700	2.110	1200	1	1.008	90.590	150
						0	1.009	90.590	150
Ex.FS	702267.277	728084.079	92.730	2.230	1200	1	1.009	90.500	150