KAVANAGH BURKE
CONSULTING ENGINEERS

Drainage Design Report

for

Development

at

Broomhill Road,
Dublin 24

Job No: D1679
Date: April 2022
Local Authority: South Dublin County Council
Revision: PL2




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Contents:

Introduction

SURFACE WATER RUNOFF MANAGEMENT

The surface water runoff generated from the proposed development will be routed through a series of Sustainable Urban Drainage System (SuDS) elements. These elements will promote runoff interception, detention and infiltration at source before runoff reaches the underground (StormTech or equivalent type) attenuation system with integrated interception storage catering for all rainfall events up to 5mm. The flow control device will be installed on the outfall of the proposed site drainage system designed to drain and attenuate 1 in 100 year storm event of any duration. Therefore, no flooding on or off the site will be caused by the runoff originating from the development in the event of storm up to 1in100 year return. Since the temporary flood storage forms a part of the overall attenuation tank, the maximum allowable discharge was limited to the green filed runoff rate QBAR (see calculations in the succeeding chapters) as per criterion 4.3 “River Flood Protection” chapter 6.3.4 of GDSDS. All flows and volumes for the storm water network design and the attenuation sizing were calculated with a 20% climate change factor applied to all rainfall intensities. The interception of the first flush runoff (capturing first 5mm or more of every rainfall event) will be provided in the lowered base of the permeable surfacing, in green roof substrate, tree pits, bioretention areas and in the base of the proposed attenuation system. The proposed attenuation system will be equipped with a horizontal isolator row (inspection tunnel) to enable access for inspection and maintenance activities such as jetting and debris removal in the unlikely event of such debris passing through the proposed SUDS features, trapped gullies, vortex type silt trap/debris separator and the proprietary petrol interceptor. A proprietary Petrol Interceptor and Silt Trap will be provided on the inlet to the proposed attenuation to improve the quality of the discharge by capturing all possible debris and hydrocarbons pollution from this development. The “hydrobrake” or equivalent flow control device provided on the outfall pipe of the attenuation system is designed to control the flow to green field runoff rate QBAR=3.0 l/sec as described in this report.

RUNOFF TREATMENT MANAGEMENT TRAIN

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

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

Source control – To detain and infiltrate the runoff as close as possible to the point of origin, we have included the following infiltration SUDS devices:

- Extensive green roofs
- Permeable surfacing
- Irrigation tree pits
- Bioretention Areas

The above mentioned devices are explained in greater detail in the next chapter.

Site control – To deal with as much of the runoff as possible within the site, all storm water runoff will be intercepted in the Suds devices (permeable surfacing, tree pits, green roofs and bioretention areas). However, interception storage is designed into the proposed attenuation tank. This interception storage volume is designed to capture the first 5mm of any rainfall and store it in the lowered portion of the attenuation system where it will dissipate by infiltration to the soil beneath. A conservative approach was taken and all suds devices upstream of the tank were not taken into account for sizing of the interception storage in the attenuation tank. This will further reduce the quantity of water that discharges from the site.

Regional control – to mimic the behaviour of the green field site and protect the receiving watercourse, the attenuation tank is designed to cater for all durations of rainfall up to 100-year return period for the purpose of minimising on-site and offsite flooding.

SUDS DEVICES

During the surface water drainage design process, a matrix of possible SUDS devices and their environmental benefits were analysed to decide on which of these elements were suitable for inclusion in the proposed development. The following is our review of these devices;

Excluded SUDS devices:

Ponds, Wetlands, Detention basins, Infiltration Basins are not suitable for the site of this size and its location and nature (relatively small brown field site within existing business park to be redeveloped to high density accommodation apartment complex).

Any deep infiltration device like soakaways and infiltration trenches are not feasible due to the nature of the site and the proximity to proposed and existing surrounding structures.

Linear surface infiltration devices like swales, filter strips and filter drains are not incorporated however bio-retention basins and irrigation tree pits are included which provide similar SUDS function of allowing runoff pass through for filtration and possible runoff reduction benefits.

SUDS devices incorporated in the storm water network and attenuation design:

Pervious paving is proposed to all carparking spaces and pedestrian circulation areas throughout the development allowing storm water infiltration into underlying stone and soil. This device not only reduces the quantity of runoff but it also has a positive impact on runoff quality. Due to the shallow nature of the underlying build-up, permeable paving can be utilised even on sites with high ground water levels where other deeper infiltration devices would not work. According to CIRIA 697 SUDS Manual: “Pervious surfaces, together with their associated substructures, intercept surface water runoff and provide a pollutant treatment

medium prior to discharge to receiving waters. Treatment processes that occur within the surface structure, the subsurface matrix (including soil layers where infiltration is allowed) and the geotextile layers include:

- filtration
- adsorption
- biodegradation
- sedimentation."

Extensive green roof is proposed to the roofs of the proposed apartment blocks as shown on the drainage layout submitted as part of this application. This roof type allows for storm water interception and disposal through transpiration and evaporation. In addition to quantity reduction, the green roofs will improve the quality of the runoff and will become a wildlife habitat, improve biodiversity and boost the environmental credentials of the development. According to CIRIA 679 SUDS Manual, typical green roof should attenuate storms up to a two-year return period event. Sustainable drainage studies indicate that Green Roofs reduce annual run-off from roofs by at least 50%, and more usually by 60-70%. Moreover, the rate of release following heavy rainfall will be slower thus assisting with issues relating to storm surges. Rainfall runoff from roofs can contain pollutants for example, from bird droppings; atmospheric pollution; as well as standard roof covering such as bitumen which give off a range of pollutants under heat stress, which then are carried along with the runoff. One of the roles of a sustainable urban drainage system is to remove some if not all of this pollution. Green roofs can retain and bind contaminants that fall on their surface either as dust or dissolved in rainwater. Research by (Johnston et al, 2004) found that 95% of heavy metals are removed from runoff by green roofs and nitrogen levels can be reduced.

Bioretention Areas formed by providing shallow depressed vegetated areas are incorporated into planting areas where there are no underground services. These areas area designed to collect and treat surface water runoff before discharging it to the surface water drainage network through low level underdrain pipes. Bioretention areas will intercept the runoff from hardstanding surfaces and slow down the outflow to the drainage network. The runoff quality is improved by filtering it through enhanced vegetation and the underlying soil. Since the soil (filtration medium) is engineered, bioretention areas can be installed on sites with low soil permeability. Bioretention areas, while having a moderate impact on the total runoff volume reduction, have high potential to remove suspended solids, heavy metals, nutrients (phosphorous, nitrogen) and to treat fine suspended sediments and dissolved pollutants.

Irrigation Tree Pits are proposed to collect the runoff from the proposed access road and other hardstanding areas. The proposed tree pits will have a positive impact on the total storm water runoff reduction by allowing for runoff infiltration to sub soil. These tree pits will be provided with overflow pipes discharging excess runoff to the proposed on-site attenuation tank.

In addition to the above SuDS devices, pre-treatment components such as "Surf-Sep" or equivalent vortex debris and silt particle separator and "Klargester" or equivalent oil separator are proposed to collect sediments and pollutants and treat the surface water runoff from areas of possible hydrocarbons spills that are exposed to rainfall. All runoff from carriageways, roofs and any hardstanding areas will pass through the Surf-sep vortex debris and silt particle separator which according to manufacturer's specification has potential for capturing more than 95% of solid pollutants (see brochure attached). Housing developments

are low risk in relation to hydrocarbon polluted runoff however the interception precaution will be included.

An underground surface water attenuation tank is proposed as the main runoff quantity reducing device. The attenuation facility proposed is a "StormTech" (or equivalent) proprietary system formed with thermoplastic arches backfilled in specified drainage stone and wrapped in a pervious geotextile. Downstream of this tank, a flow control device will be provided which is designed to restrict the discharge off site to ensure the green field runoff rate is not exceeded. It is also important to note that the proposed surface water attenuation system incorporates an "isolator row" on the inlet. This isolator row is a single row within the tank of chambers surrounded with proprietary filter fabric, connected to an access manhole, which is designed as an additional line of defence against debris and suspended solids. Together with the proprietary pre-treatment devices of petrol interceptor and silt trap, good quality discharge will be provided with ease of inspection and maintenance ensuring a long efficient service life.

Rainwater harvesting systems

During the detailed design stage of the proposed development Environmental Design Partnership (M&E consulting engineers) will evaluate the storage and consumption of potable water. The general application of harvested storm water, particularly in sanitary applications, will be assessed to ensure compliance with SDCC and water authority recommendations and requirements and to achieve optimum reclamation of rainwater.

The detailed design stage calculations will include:

- Rainwater yield for the catchment area

- Predicted WC/Urinal flushing demand

- Size (litres) of the rainwater collection tank

The design calculations listed above will provide a cost/benefit analysis which will help to evaluate the suitability of the rainwater harvesting system for the proposed development.

FOUL SEWER

The proposed foul sewer, fully separated from the proposed storm water drainage, is designed for sewage and wastewater collection from the proposed buildings. The entire wastewater network was designed using the hydraulic modelling computer program to calculate pipe gradients in order to achieve minimum self-cleansing velocities of 0.75m/s throughout the proposed network. In accordance with the BS EN 752.

A pre-connection enquiry application was made to Irish Water and the response to the enquiry was issued stating that the connection is feasible subject to condition of introducing sewage flow management. The proposed pumping station will store and control the discharge from the proposed development to the Local Authority gravity network to ensure that the development will not have detrimental effect on the capacity of the downstream network.

The flow control and storage measures will be installed, owned and operated by the developer until the public network upgrade (currently at preliminary design stage) is delivered and additional capacity in the network becomes available. The confirmation of feasibility letter is included as part of this planning submission.

The proposed foul sewer network and the proposed pumping station was designed to allow decommissioning of the pumping station and fully gravity-based discharge of the effluent once the capital upgrade projects is delivered. For details refer to the attached Drainage Layout Drg. Ref. D1679-D1-PL2.

WATERMAIN

The water supply to the proposed development will be provided through a new 150ø watermain connection to the existing Local Authority located in Broomhill Road to the west of the site. A bulk water meter will be provided on the new watermain connection and to all individual connections to the building B+C. A number of hydrants for firefighting and loop flushing purpose is proposed on-site on the 150 watermain as detailed on the attached Watermain Layout Drg. Ref. D1679-D2-PL2. A pre-connection enquiry application was made to Irish Water and the response to the enquiry was issued stating that the connection is feasible subject to upgrades. The confirmation of feasibility letter is included as part of this planning submission.

Surface Water Attenuation Calculations

Surface Water Attenuation Calculations:

1) Interception Storage

Calculate runoff from 5mm of rainfall on developed area.
For this calculation 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 depth of rainfall. The Interception Storage on this subject site will be provided through the extensive use of green roofs, permeable surfacing and through the base of attenuation tank located along the eastern and southern boundaries of the development.

Catchment Area:	14599m^2 (1.46 ha)
Landscaping	4577m^2
Road	1280m^2
Roof Areas	4364m^2
Footpaths and Pedestrian Areas (permeable paving)	4378m^2
Total Impermeable Areas:	10022 m^2

Despite the majority of the hardstanding surfaces (car parking and pedestrian areas) being permeable for the purpose of interception and attenuation storage calculations all hard standing areas are deemed impervious.

Design Impermeable Areas for Interception storage calculations:	10022m^2 x 0.8 = 8018m^2
Total volume for 5mm rainfall:	5mm x 8018m^2 = **40m^3**

Therefore a minimum Interception Storage volume of 40m^3 should be provided. This will prevent discharge from the site during rainfall events of up to 5mm rainfall. For the basis of this calculation infiltration will be provided through the base of the attenuation tank. The soft landscaping and permeable surfacing on site will also be a significant source of rainfall infiltration.

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

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

SAAR (309000E, 228000N): 771 mm

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% $Soil_2$ as per online Wallingford Procedure Greenfield runoff estimation tool on www.uksuds.com

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

QBAR:

As the site area is less than 50 hectares;

QBAR for 50 hectares is firstly calculated,

QBAR (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 $(771)^{1.17}$ x $(0.3)^{2.17}$
102.03 l/sec
2.04 l/sec/Ha

QBAR for the smaller area (i.e. the subject site area):

2.04 l/sec/ha x 1.46 ha
3.0 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 l/s/ha or the average annual peak flow rate QBAR, whichever is greater.

3) Attenuation storage volume

Refer to Appendix A for detailed storm water network modelling and attenuation storage volume check with a specific Hydrobrake flow control device included in the analysis

In summary:

Interception Storage: 40m^3 to be provided by a lowered base to the attenuation system. Attenuation System Area: 858m^2. Therefore the Interception Storage Depth will equal 108mm. A lowered base level to the attenuation tank allowing base infiltration will facilitate on site discharge of this interception volume.

Required Attenuation Volume: 917m^3 to be provided within the attenuation system on site.

Temporary Flood Storage: The proposed attenuation storage will accommodate all rainfall events of all durations up to 1 in 100 years return. Therefore no separate flood storage is needed.

Total volume required: 917m^3

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: **Tank A**

Chamber Model -	MC-3500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	81	
Number of End Caps -	16	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	89.90	m
Amount of Stone Above Chambers -	380	mm
Amount of Stone Below Chambers -	280	mm
Area of system -	494	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 411.874 sq.meters

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)*
1803	0.00	0.00	0.00	0.00	5.393	5.39	530.67	91.70
1778	0.00	0.00	0.00	0.00	5.393	5.39	525.28	91.68
1753	0.00	0.00	0.00	0.00	5.393	5.39	519.88	91.65
1727	0.00	0.00	0.00	0.00	5.393	5.39	514.49	91.63
1702	0.00	0.00	0.00	0.00	5.393	5.39	509.10	91.60
1676	0.00	0.00	0.00	0.00	5.393	5.39	503.71	91.58
1651	0.00	0.00	0.00	0.00	5.393	5.39	498.31	91.55
1626	0.00	0.00	0.00	0.00	5.393	5.39	492.92	91.53
1600	0.00	0.00	0.00	0.00	5.393	5.39	487.53	91.50
1575	0.00	0.00	0.00	0.00	5.393	5.39	482.13	91.47
1549	0.00	0.00	0.00	0.00	5.393	5.39	476.74	91.45
1524	0.00	0.00	0.00	0.00	5.393	5.39	471.35	91.42
1499	0.00	0.00	0.00	0.00	5.393	5.39	465.96	91.40
1473	0.00	0.00	0.00	0.00	5.393	5.39	460.56	91.37
1448	0.00	0.00	0.00	0.00	5.393	5.39	455.17	91.35
1422	0.00	0.00	0.13	0.00	5.335	5.47	449.78	91.32
1397	0.01	0.00	0.45	0.00	5.199	5.65	444.31	91.30
1372	0.01	0.00	0.67	0.00	5.101	5.78	438.66	91.27
1346	0.01	0.00	0.93	0.01	4.991	5.93	432.88	91.25
1321	0.02	0.00	1.58	0.02	4.707	6.30	426.96	91.22
1295	0.03	0.00	2.36	0.02	4.369	6.75	420.65	91.20
1270	0.04	0.00	2.87	0.03	4.147	7.04	413.90	91.17
1245	0.04	0.00	3.26	0.04	3.972	7.28	406.86	91.14
1219	0.04	0.00	3.61	0.05	3.822	7.48	399.58	91.12
1194	0.05	0.00	3.92	0.05	3.686	7.66	392.11	91.09
1168	0.05	0.00	4.19	0.06	3.562	7.82	384.45	91.07
1143	0.05	0.00	4.44	0.07	3.450	7.97	376.63	91.04
1118	0.06	0.01	4.68	0.08	3.345	8.11	368.67	91.02
1092	0.06	0.01	4.90	0.09	3.248	8.24	360.56	90.99
1067	0.06	0.01	5.10	0.10	3.158	8.35	352.32	90.97
1041	0.07	0.01	5.29	0.11	3.071	8.47	343.97	90.94
1016	0.07	0.01	5.47	0.12	2.990	8.58	335.50	90.92
991	0.07	0.01	5.64	0.12	2.915	8.68	326.92	90.89
965	0.07	0.01	5.80	0.13	2.843	8.77	318.24	90.87
940	0.07	0.01	5.95	0.14	2.772	8.87	309.47	90.84
914	0.08	0.01	6.09	0.15	2.709	8.95	300.60	90.81
889	0.08	0.01	6.23	0.16	2.647	9.03	291.65	90.79
864	0.08	0.01	6.36	0.17	2.587	9.11	282.62	90.76
838	0.08	0.01	6.48	0.18	2.531	9.19	273.51	90.74
813	0.08	0.01	6.60	0.19	2.477	9.26	264.32	90.71
787	0.08	0.01	6.71	0.19	2.425	9.33	255.06	90.69
762	0.08	0.01	6.81	0.20	2.376	9.39	245.74	90.66
737	0.09	0.01	6.91	0.21	2.332	9.45	236.34	90.64
711	0.09	0.01	7.00	0.22	2.288	9.51	226.89	90.61
686	0.09	0.01	7.10	0.22	2.245	9.56	217.39	90.59
660	0.09	0.01	7.18	0.23	2.206	9.62	207.82	90.56

Project: **Tank B**

Chamber Model -	MC-3500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	59	
Number of End Caps -	14	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	89.90	m
Amount of Stone Above Chambers -	350	mm
Amount of Stone Below Chambers -	280	mm
Area of system -	365	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 303.727 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1778	0.00	0.00	0.00	0.00	3.985	3.98	387.15	91.68
1753	0.00	0.00	0.00	0.00	3.985	3.98	383.17	91.65
1727	0.00	0.00	0.00	0.00	3.985	3.98	379.19	91.63
1702	0.00	0.00	0.00	0.00	3.985	3.98	375.20	91.60
1676	0.00	0.00	0.00	0.00	3.985	3.98	371.22	91.58
1651	0.00	0.00	0.00	0.00	3.985	3.98	367.23	91.55
1626	0.00	0.00	0.00	0.00	3.985	3.98	363.25	91.53
1600	0.00	0.00	0.00	0.00	3.985	3.98	359.26	91.50
1575	0.00	0.00	0.00	0.00	3.985	3.98	355.28	91.47
1549	0.00	0.00	0.00	0.00	3.985	3.98	351.29	91.45
1524	0.00	0.00	0.00	0.00	3.985	3.98	347.31	91.42
1499	0.00	0.00	0.00	0.00	3.985	3.98	343.32	91.40
1473	0.00	0.00	0.00	0.00	3.985	3.98	339.34	91.37
1448	0.00	0.00	0.00	0.00	3.985	3.98	335.36	91.35
1422	0.00	0.00	0.10	0.00	3.943	4.04	331.37	91.32
1397	0.01	0.00	0.32	0.00	3.843	4.17	327.33	91.30
1372	0.01	0.00	0.49	0.00	3.772	4.27	323.16	91.27
1346	0.01	0.00	0.67	0.01	3.691	4.37	318.89	91.25
1321	0.02	0.00	1.15	0.02	3.484	4.65	314.52	91.22
1295	0.03	0.00	1.72	0.02	3.237	4.98	309.87	91.20
1270	0.04	0.00	2.09	0.03	3.075	5.19	304.90	91.17
1245	0.04	0.00	2.38	0.04	2.947	5.36	299.71	91.14
1219	0.04	0.00	2.63	0.04	2.837	5.51	294.35	91.12
1194	0.05	0.00	2.85	0.05	2.738	5.64	288.84	91.09
1168	0.05	0.00	3.05	0.06	2.647	5.76	283.20	91.07
1143	0.05	0.00	3.24	0.06	2.565	5.87	277.45	91.04
1118	0.06	0.01	3.41	0.07	2.488	5.97	271.58	91.02
1092	0.06	0.01	3.57	0.08	2.417	6.06	265.61	90.99
1067	0.06	0.01	3.72	0.08	2.351	6.15	259.55	90.97
1041	0.07	0.01	3.85	0.10	2.286	6.24	253.40	90.94
1016	0.07	0.01	3.98	0.10	2.227	6.31	247.16	90.92
991	0.07	0.01	4.11	0.11	2.172	6.39	240.85	90.89
965	0.07	0.01	4.22	0.11	2.119	6.46	234.46	90.87
940	0.07	0.01	4.33	0.13	2.067	6.53	228.00	90.84
914	0.08	0.01	4.44	0.13	2.020	6.59	221.48	90.81
889	0.08	0.01	4.54	0.14	1.974	6.65	214.89	90.79
864	0.08	0.01	4.63	0.15	1.931	6.71	208.24	90.76
838	0.08	0.01	4.72	0.15	1.889	6.76	201.53	90.74
813	0.08	0.01	4.80	0.16	1.849	6.82	194.77	90.71
787	0.08	0.01	4.89	0.17	1.811	6.87	187.95	90.69
762	0.08	0.01	4.96	0.18	1.774	6.91	181.09	90.66
737	0.09	0.01	5.03	0.18	1.742	6.96	174.17	90.64
711	0.09	0.01	5.10	0.19	1.709	7.00	167.22	90.61
686	0.09	0.01	5.17	0.19	1.678	7.04	160.22	90.59
660	0.09	0.01	5.23	0.20	1.649	7.08	153.17	90.56
635	0.09	0.01	5.29	0.21	1.622	7.12	146.09	90.54
610	0.09	0.02	5.35	0.21	1.594	7.15	138.98	90.51

Design Specification/Product Information for;

a) **Petrol Interceptor**

b) **Silt Trap**

c) **Flow Control Devices**

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

ADVANCED ROTOMOULDED CONSTRUCTION ON SELECTED MODELS!

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to make the right decision or call 028 302 66799

Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

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

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

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

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

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

SEPARATOR STANDARDS AND TYPES

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

SEPARATOR CLASSES

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

CLASS I

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

CLASS II

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

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

FULL RETENTION SEPARATORS

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

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

BYPASS SEPARATORS

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

FORECOURT SEPARATORS

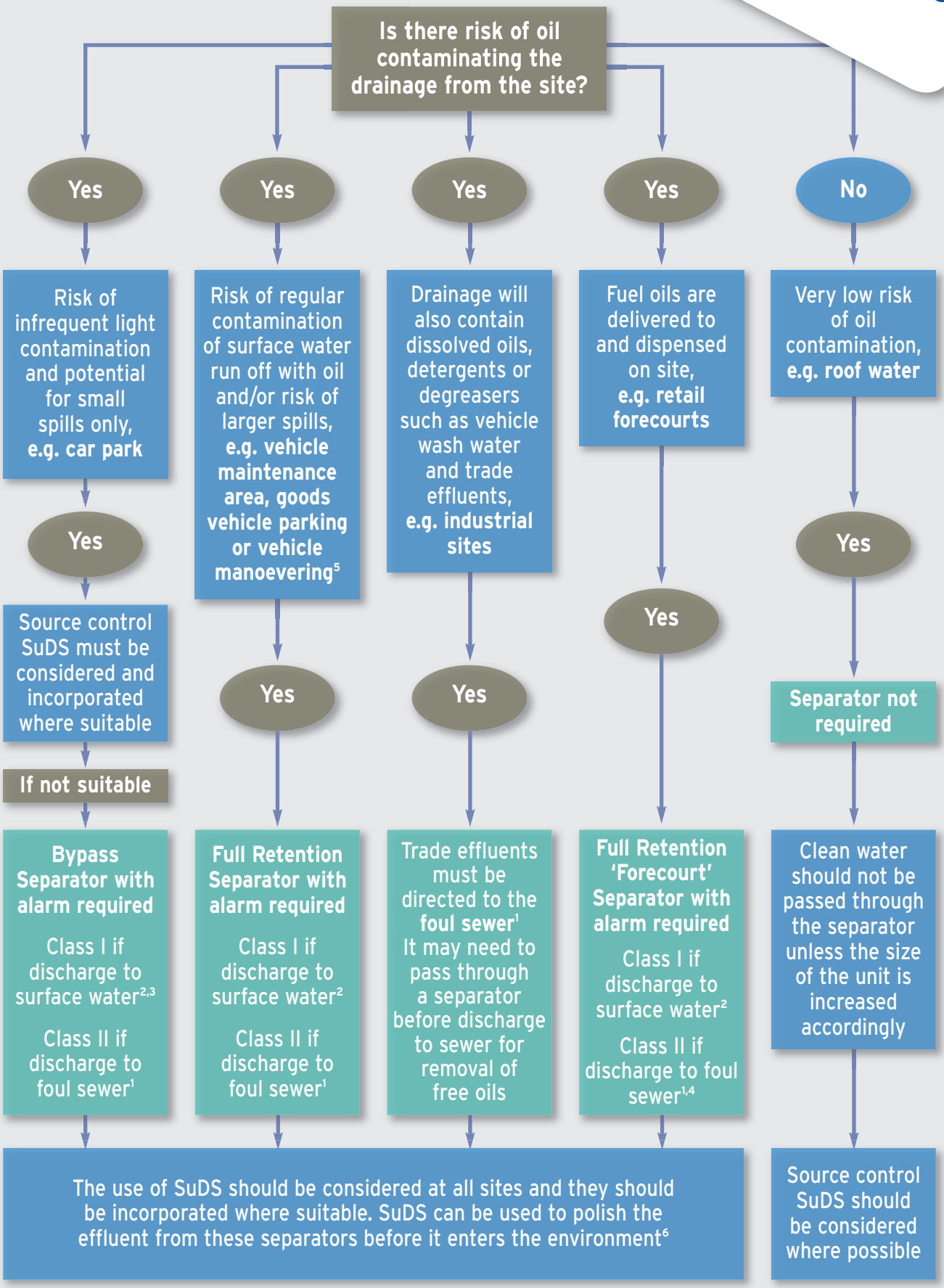
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size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

SELECTING THE RIGHT SEPARATOR

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

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

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



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

Bypass NSB RANGE

APPLICATION

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

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

PERFORMANCE

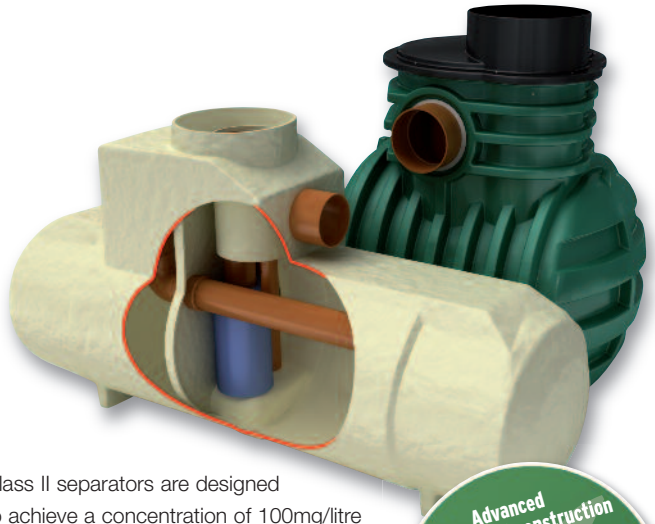
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI)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

Each bypass separator design includes the necessary volume requirements for:

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

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

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



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

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

FEATURES

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

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

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

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m^2)	STORAGE CAPACITY (litres) SILT	STORAGE CAPACITY (litres) 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.*

Full Retention NSF RANGE

APPLICATION

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

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

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

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

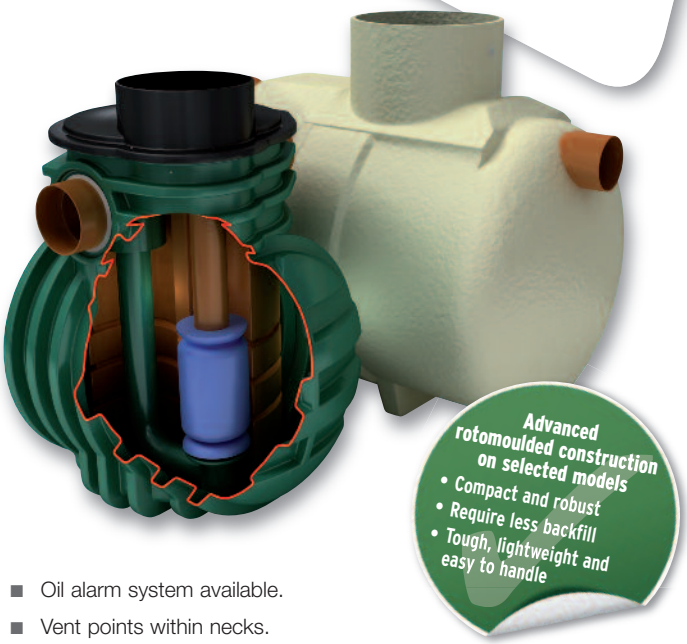
Each full retention separator design includes the necessary volume requirements for:

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

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

FEATURES

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



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

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

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

SIZES AND SPECIFICATIONS

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

Rotomoulded chamber construction *GRP chamber construction*

PROFESSIONAL INSTALLERS

Klargester Accredited Installers

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

Services include :

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

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

www.klargester.com/installers

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

Kingspan Water

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- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

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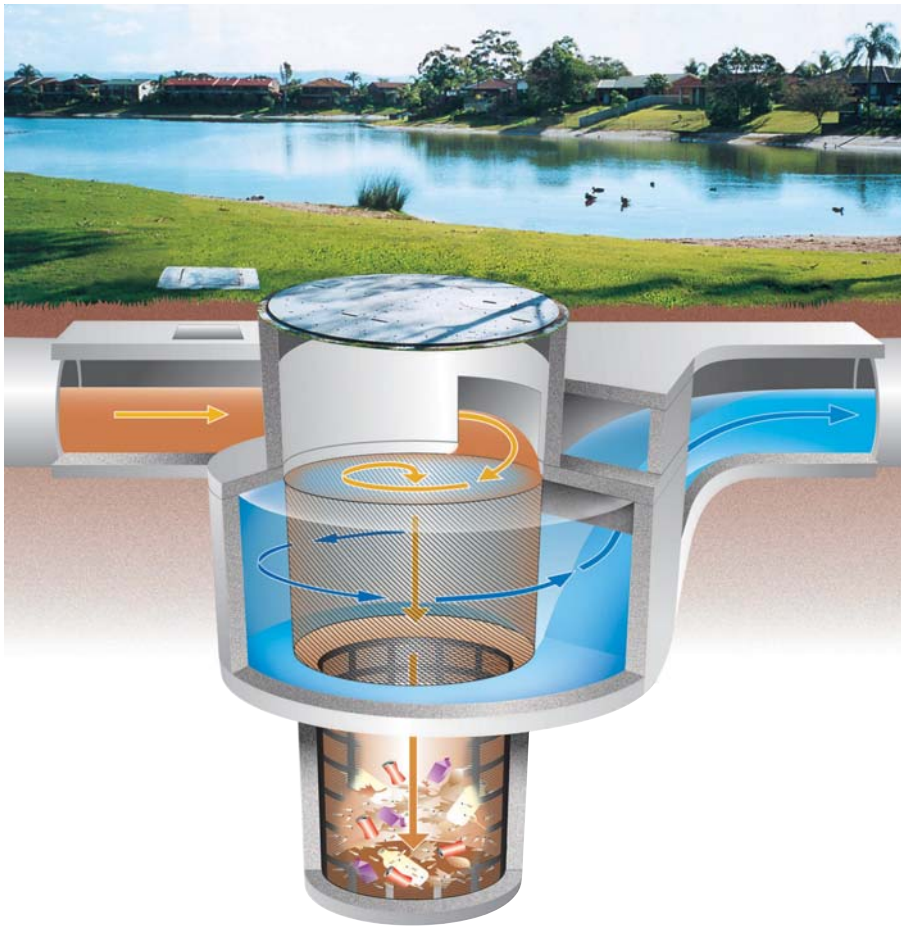
Issue No. 20: August 2014

Specialists in Wastewater Treatment & Stormwater Management

Surface Water Treatment SUDs Protector



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

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

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

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

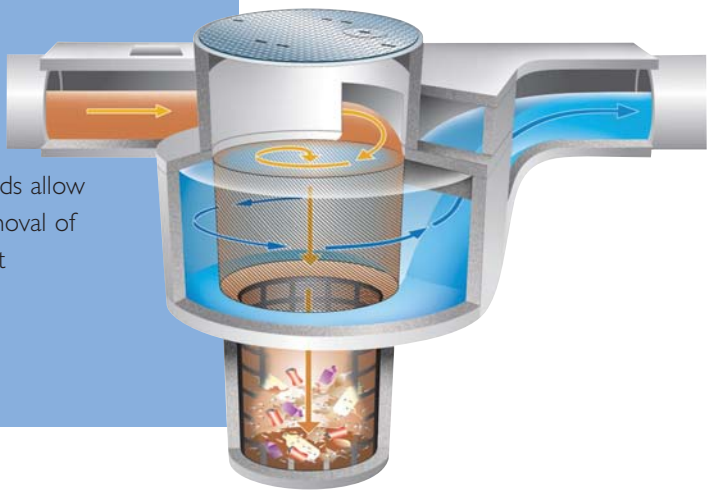
Applications

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

Rapid installation

Primary features

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



Surface Water System

Hydraulic Analysis

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

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

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

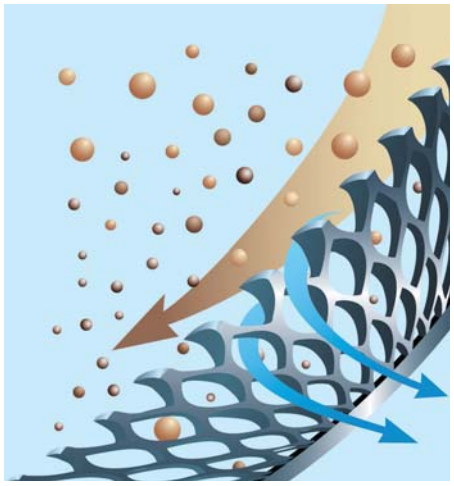
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

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

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

How it works

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



Surface Water Treatment Systems

Hydraulic Design

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

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

The Ultimate SUDs Protector

There a four principal areas of proprietary SUDs technology;

• Infiltration • Flow Control • Storage/attenuation • Treatment

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

SurfSeps have been successfully installed in front of;

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

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

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

Infiltration

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

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

Detention & Retention Systems

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

Applications

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

Purpose

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

Flow Control Systems

Flow Control

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

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

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

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

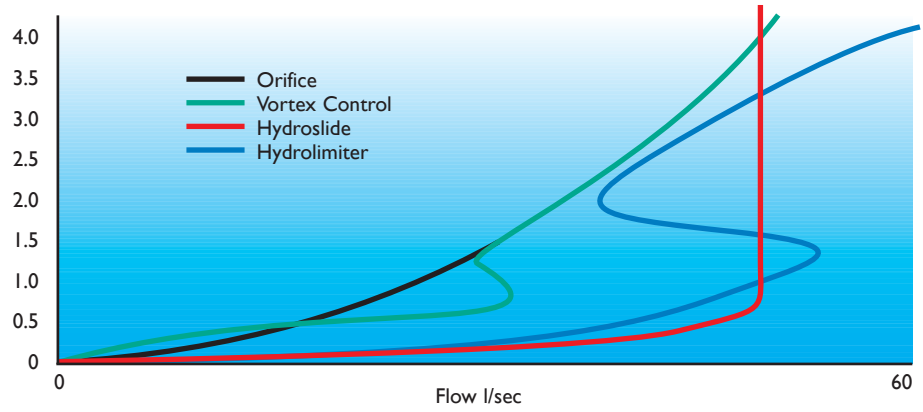
Typical SurfSep installation

Flow Control Technical Design

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

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

Representation of flow through an orifice



Operation & Performance

Performance Criteria

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

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

Typical 1.2 mm aperture Performance

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

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

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

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

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

Maintenance

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

Since this is seldom the case we recommend;

New Installations

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

Ongoing Operation

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

Cleaning Methods

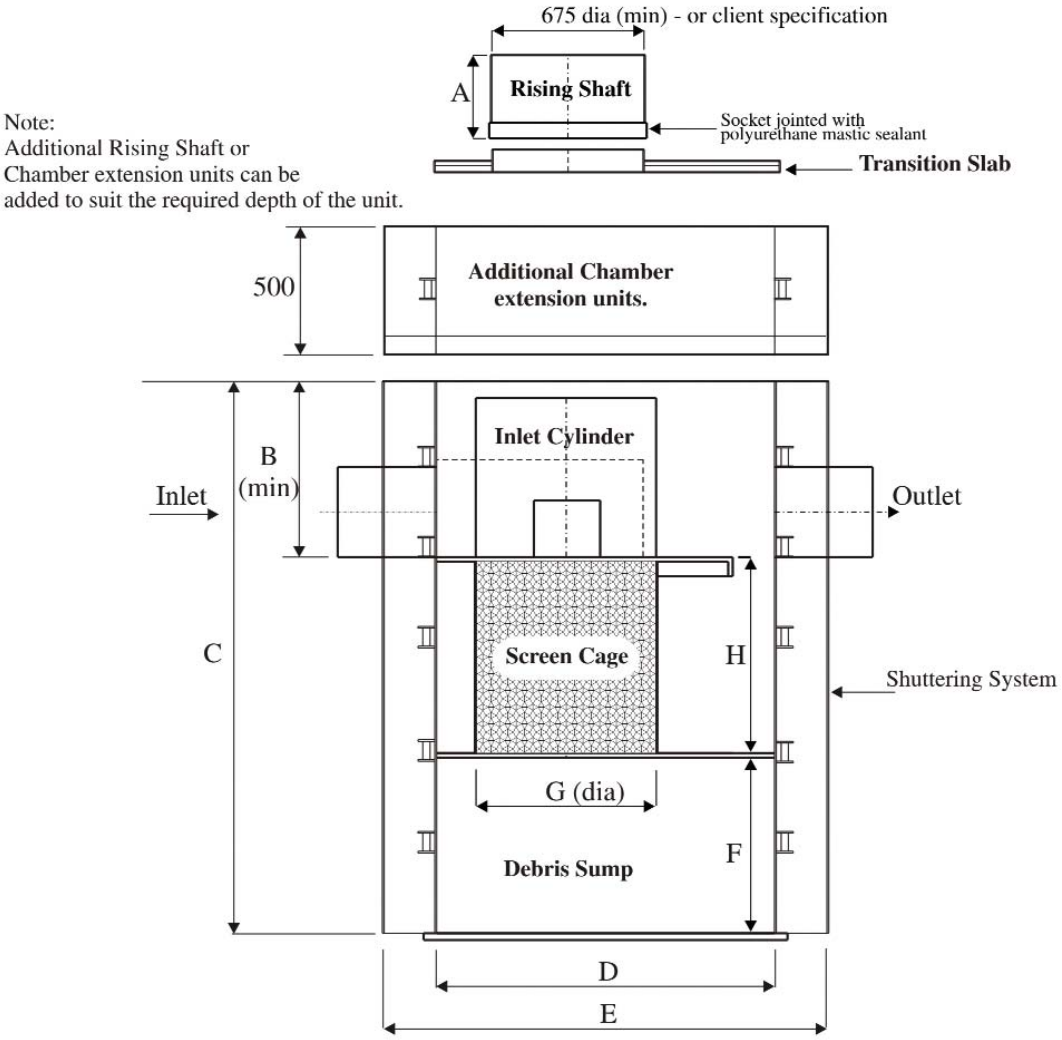
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

Maintenance Cycle

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

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

SurfSep Dimensions



***SurfSep* Dimensions (mm)**

	SWI0404	SW0604	SW0606	SW0804	SW0806	SW0808	SWI010	SWI012	SWI015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	1200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table - *SurfSep*

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

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

In-Line *SurfSep* Units (SWI)

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

Off-Line *SurfSep* Units (SWO)

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

Model Designation

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

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

Surface Water Treatment

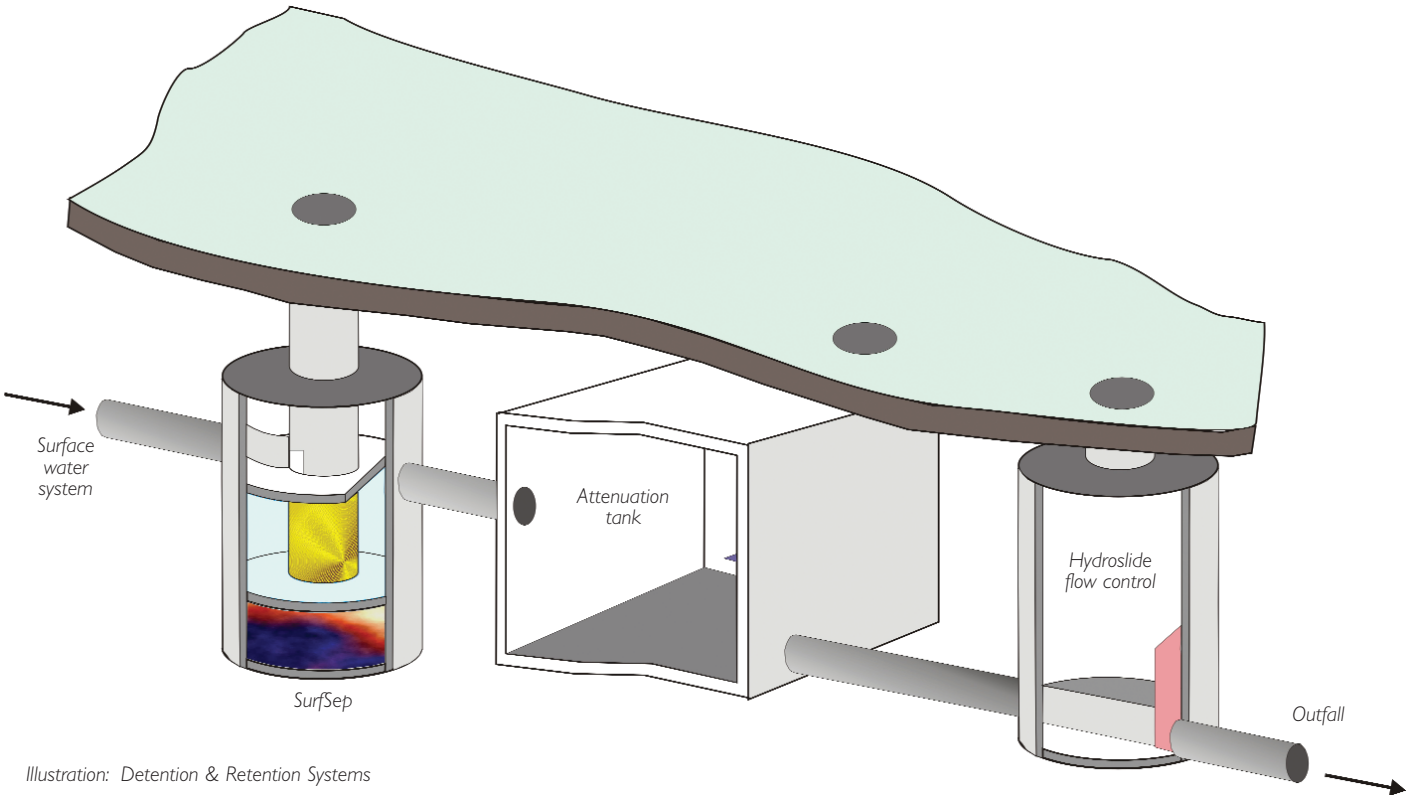


Illustration: Detention & Retention Systems

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

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

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

Approved Suppliers

If you would like more information please contact:

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

Alternatively please contact our approved supplier detailed left.

 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

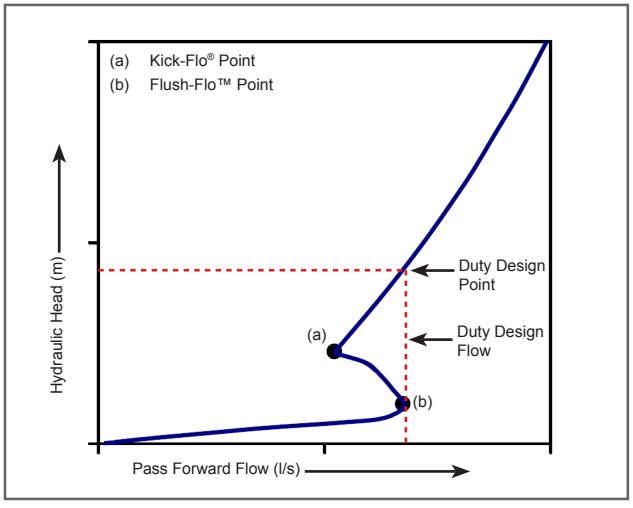
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

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

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



Typical Hydro-Brake® Head Versus Flow Characteristics

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

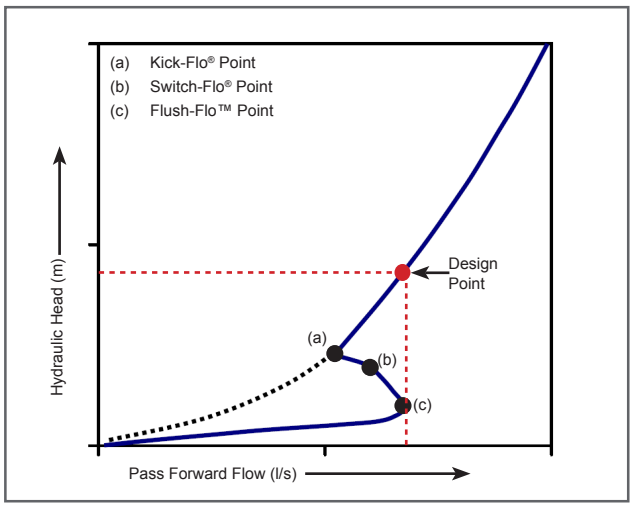
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in Win*Des*® W.12.6!

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



Typical STH Head Versus Flow Characteristics

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

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

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

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

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

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HRD Technologies Ltd is a subsidiary of Hydro International plc

Appendix A – Storm Water Network Design

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	20	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	18.200	Minimum Backdrop Height (m)	0.200
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW1	0.240	5.00	92.400	1200	1.300
SW2	0.157	5.00	92.280	1200	1.600
SW3	0.216	5.00	92.250	1200	1.790
SW4	0.039	5.00	92.720	1200	1.610
SW5			92.900	1200	1.900
SW6	0.109	5.00	92.950	1200	2.050
SW7	0.061	5.00	92.750	1200	1.800
SW8	0.180	5.00	92.900	1200	2.280
SW9			92.480	1200	2.140
SW10	0.138	5.00	92.560	1200	2.360
SW11			92.570	1200	2.664
SW12		5.00	92.250	1200	2.345
SW13			92.250	1200	2.350
SW14		5.00	92.430	1200	2.530
SW15			92.400	1200	2.580

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW1	SW2	90.000	0.600	91.100	90.755	0.345	260.9	300	6.55	48.8
1.001	SW2	SW3	48.273	0.600	90.680	90.535	0.145	332.9	375	7.36	46.5
1.002	SW3	SW9	48.273	0.600	90.460	90.340	0.120	402.3	450	8.16	44.5
2.000	SW4	SW5	14.397	0.600	91.110	91.000	0.110	130.9	225	5.21	50.0
2.001	SW5	SW6	3.831	0.600	91.000	90.975	0.025	153.3	225	5.27	50.0
2.002	SW6	SW8	48.104	0.600	90.900	90.695	0.205	234.7	300	6.06	50.0
3.000	SW7	SW8	23.966	0.600	90.950	90.770	0.180	133.1	225	5.35	50.0
2.003	SW8	SW9	64.151	0.600	90.620	90.415	0.205	312.9	375	7.11	47.2

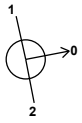
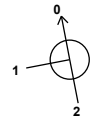
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
1.000	0.969	68.5	38.1	1.000	1.225	0.240	0.0	160
1.001	0.987	109.0	60.0	1.225	1.340	0.397	0.0	199
1.002	1.007	160.2	88.7	1.340	1.690	0.613	0.0	240
2.000	1.141	45.4	6.3	1.385	1.675	0.039	0.0	57
2.001	1.054	41.9	6.3	1.675	1.750	0.039	0.0	59
2.002	1.022	72.2	24.1	1.750	1.905	0.148	0.0	119
3.000	1.131	45.0	9.9	1.575	1.905	0.061	0.0	72
2.003	1.019	112.5	59.7	1.905	1.690	0.389	0.0	194

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	SW9	SW10	15.089	0.600	90.340	90.300	0.040	377.2	450	8.40	43.9
1.004	SW10	SW11	2.227	0.600	90.200	90.180	0.020	111.3	450	8.42	43.8
5.000	SW12	SW13	4.296	0.600	89.905	89.900	0.005	859.2	450	5.10	50.0
4.000	SW14	SW15	14.373	0.600	89.900	89.820	0.080	179.7	225	5.25	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
1.003	1.041	165.5	143.1	1.690	1.810	1.002	0.0	325
1.004	1.926	306.3	162.6	1.910	1.940	1.140	0.0	233
5.000	0.685	109.0	0.0	1.895	1.900	0.000	0.0	0
4.000	0.972	38.7	0.0	2.305	2.355	0.000	0.0	0

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW1	709186.615	728384.544	92.400	1.300	1200				
						0	1.000	91.100	300
SW2	709274.837	728402.345	92.280	1.600	1200		1	1.000	90.755	300
							0	1.001	90.680	375
SW3	709265.652	728449.736	92.250	1.790	1200		1	1.001	90.535	375
							0	1.002	90.460	450
SW4	709192.914	728422.728	92.720	1.610	1200				
						0	2.000	91.110	225
SW5	709201.756	728434.090	92.900	1.900	1200		1	2.000	91.000	225
							0	2.001	91.000	225
SW6	709202.644	728437.817	92.950	2.050	1200		1	2.001	90.975	225
							0	2.002	90.900	300
SW7	709188.279	728508.435	92.750	1.800	1200				
						0	3.000	90.950	225
SW8	709193.468	728485.038	92.900	2.280	1200		1	3.000	90.770	225
							2	2.002	90.695	300
							0	2.003	90.620	375
SW9	709256.469	728497.128	92.480	2.140	1200		1	2.003	90.415	375
							2	1.002	90.340	450
							0	1.003	90.340	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW10	709253.626	728511.947	92.560	2.360	1200	1	1.003	90.300	450
									
						0	1.004	90.200	450
SW11	709255.813	728512.365	92.570	2.664	1200	1	1.004	90.180	450
									
SW12	709277.240	728401.721	92.250	2.345	1200				
						0	5.000	89.905	450
SW13	709273.392	728399.811	92.250	2.350	1200	1	5.000	89.900	450
									
SW14	709184.756	728381.972	92.430	2.530	1200				
						0	4.000	89.900	225
SW15	709170.692	728379.009	92.400	2.580	1200	1	4.000	89.820	225
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	18.200	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	30.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node SW14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	90.010	Product Number	CTL-SHE-0073-3000-1670-3000
Design Depth (m)	1.670	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

Node SW12 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	10.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	89.905	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets

SW11

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	298.0	0.0	1.780	298.0	0.0

Node SW14 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	10.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	89.900	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets

SW13

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	217.4	0.0	1.780	217.4	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	259.519	73.435	30 year +20% CC 2880 minute summer	8.992	2.410
30 year +20% CC 15 minute winter	182.118	73.435	30 year +20% CC 2880 minute winter	6.043	2.410
30 year +20% CC 30 minute summer	178.067	50.387	30 year +20% CC 4320 minute summer	6.961	1.820
30 year +20% CC 30 minute winter	124.959	50.387	30 year +20% CC 4320 minute winter	4.584	1.820
30 year +20% CC 60 minute summer	124.409	32.878	30 year +20% CC 5760 minute summer	5.824	1.491
30 year +20% CC 60 minute winter	82.654	32.878	30 year +20% CC 5760 minute winter	3.769	1.491
30 year +20% CC 120 minute summer	79.323	20.963	30 year +20% CC 7200 minute summer	5.006	1.277
30 year +20% CC 120 minute winter	52.700	20.963	30 year +20% CC 7200 minute winter	3.231	1.277
30 year +20% CC 180 minute summer	62.197	16.006	100 year +20% CC 15 minute summer	337.357	95.460
30 year +20% CC 180 minute winter	40.430	16.006	100 year +20% CC 15 minute winter	236.742	95.460
30 year +20% CC 240 minute summer	49.913	13.191	100 year +20% CC 30 minute summer	232.344	65.745
30 year +20% CC 240 minute winter	33.161	13.191	100 year +20% CC 30 minute winter	163.048	65.745
30 year +20% CC 360 minute summer	38.951	10.023	100 year +20% CC 60 minute summer	161.195	42.599
30 year +20% CC 360 minute winter	25.319	10.023	100 year +20% CC 60 minute winter	107.094	42.599
30 year +20% CC 480 minute summer	31.183	8.241	100 year +20% CC 120 minute summer	101.792	26.901
30 year +20% CC 480 minute winter	20.717	8.241	100 year +20% CC 120 minute winter	67.628	26.901
30 year +20% CC 600 minute summer	25.871	7.076	100 year +20% CC 180 minute summer	79.294	20.405
30 year +20% CC 600 minute winter	17.677	7.076	100 year +20% CC 180 minute winter	51.543	20.405
30 year +20% CC 720 minute summer	23.309	6.247	100 year +20% CC 240 minute summer	63.317	16.733
30 year +20% CC 720 minute winter	15.665	6.247	100 year +20% CC 240 minute winter	42.067	16.733
30 year +20% CC 960 minute summer	19.485	5.131	100 year +20% CC 360 minute summer	49.049	12.622
30 year +20% CC 960 minute winter	12.907	5.131	100 year +20% CC 360 minute winter	31.883	12.622
30 year +20% CC 1440 minute summer	14.499	3.886	100 year +20% CC 480 minute summer	39.055	10.321
30 year +20% CC 1440 minute winter	9.745	3.886	100 year +20% CC 480 minute winter	25.947	10.321
30 year +20% CC 2160 minute summer	10.637	2.940	100 year +20% CC 600 minute summer	32.265	8.825
30 year +20% CC 2160 minute winter	7.329	2.940	100 year +20% CC 600 minute winter	22.046	8.825

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 720 minute summer	28.969	7.764	100 year +20% CC 2880 minute summer	10.870	2.913
100 year +20% CC 720 minute winter	19.469	7.764	100 year +20% CC 2880 minute winter	7.305	2.913
100 year +20% CC 960 minute summer	24.084	6.342	100 year +20% CC 4320 minute summer	8.338	2.180
100 year +20% CC 960 minute winter	15.954	6.342	100 year +20% CC 4320 minute winter	5.491	2.180
100 year +20% CC 1440 minute summer	17.784	4.766	100 year +20% CC 5760 minute summer	6.929	1.774
100 year +20% CC 1440 minute winter	11.952	4.766	100 year +20% CC 5760 minute winter	4.485	1.774
100 year +20% CC 2160 minute summer	12.939	3.576	100 year +20% CC 7200 minute summer	5.925	1.511
100 year +20% CC 2160 minute winter	8.915	3.576	100 year +20% CC 7200 minute winter	3.824	1.511

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	12	91.584	0.484	80.2	3.2249	0.0000	SURCHARGED
4320 minute winter	SW2	3360	91.330	0.650	4.3	2.6497	0.0000	SURCHARGED
4320 minute winter	SW3	3360	91.330	0.870	6.6	4.1344	0.0000	SURCHARGED
4320 minute winter	SW4	3360	91.330	0.220	0.4	0.4092	0.0000	OK
4320 minute winter	SW5	3360	91.330	0.330	0.4	0.3735	0.0000	SURCHARGED
4320 minute winter	SW6	3360	91.330	0.430	1.6	1.1728	0.0000	SURCHARGED
4320 minute winter	SW7	3360	91.330	0.380	0.7	0.8167	0.0000	SURCHARGED
4320 minute winter	SW8	3360	91.330	0.710	4.2	2.4850	0.0000	SURCHARGED
4320 minute winter	SW9	3360	91.330	0.990	10.1	1.1199	0.0000	SURCHARGED
4320 minute winter	SW10	3360	91.330	1.130	11.2	3.2606	0.0000	SURCHARGED
4320 minute winter	SW11	3360	91.330	1.424	11.1	1.6108	0.0000	OK
4320 minute winter	SW12	3360	91.330	1.425	8.5	1.6119	0.0000	SURCHARGED
4320 minute winter	SW13	3360	91.330	1.430	5.9	1.6175	0.0000	OK
4320 minute winter	SW14	3360	91.330	1.430	4.0	1.6175	0.0000	SURCHARGED
15 minute summer	SW15	1	89.820	0.000	2.3	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	73.9	1.098	1.080	6.3377	
15 minute winter	SW2	1.001	SW3	108.7	1.030	0.997	5.3244	
15 minute winter	SW3	1.002	SW9	169.6	1.070	1.058	7.6485	
15 minute winter	SW4	2.000	SW5	12.9	0.813	0.283	0.3113	
15 minute winter	SW5	2.001	SW6	12.6	0.773	0.301	0.1301	
15 minute winter	SW6	2.002	SW8	47.9	0.913	0.663	3.2828	
15 minute winter	SW7	3.000	SW8	20.2	0.964	0.448	0.8752	
15 minute summer	SW8	2.003	SW9	105.2	1.039	0.935	7.0757	
15 minute winter	SW9	1.003	SW10	272.3	1.719	1.646	2.3616	
15 minute winter	SW10	1.004	SW11	314.6	1.994	1.027	0.3385	
30 minute winter	SW11	Flow through pond	SW12	254.9	0.075	0.004	134.2845	
30 minute summer	SW12	5.000	SW13	213.9	2.423	1.962	0.6458	
30 minute summer	SW13	Flow through pond	SW14	138.8	0.055	0.003	88.4768	
4320 minute winter	SW14	Hydro-Brake®	SW15	2.7				538.7

Max water level in the attenuation and drainage network for storms up to 1:30y return. Critical event duration 3360min. Maximum achieved water level during this event does not exceed the high water level in the proposed attenuation tank (91.68m) therefore proposed attenuation has sufficient capacity to accommodate storms up to 1in30 years return +20%Climate Change. See drawing ref. D1679-D1-PL2 for attenuation base and high water level.

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	12	92.202	1.102	104.2	7.3488	0.0000	FLOOD RISK
4320 minute winter	SW2	3420	91.676	0.996	5.1	4.0585	0.0000	SURCHARGED
4320 minute winter	SW3	3420	91.676	1.216	7.4	5.7770	0.0000	SURCHARGED
4320 minute winter	SW4	3420	91.676	0.566	0.5	1.0516	0.0000	SURCHARGED
4320 minute winter	SW5	3420	91.676	0.676	0.5	0.7645	0.0000	SURCHARGED
4320 minute winter	SW6	3420	91.676	0.776	1.9	2.1153	0.0000	SURCHARGED
4320 minute winter	SW7	3420	91.676	0.726	0.8	1.5594	0.0000	SURCHARGED
4320 minute winter	SW8	3420	91.676	1.056	5.0	3.6948	0.0000	SURCHARGED
4320 minute winter	SW9	3420	91.676	1.336	11.8	1.5109	0.0000	SURCHARGED
4320 minute winter	SW10	3420	91.676	1.476	13.5	4.2580	0.0000	SURCHARGED
4320 minute winter	SW11	3420	91.676	1.770	13.4	2.0018	0.0000	OK
4320 minute winter	SW12	3420	91.676	1.771	10.2	2.0029	0.0000	SURCHARGED
4320 minute winter	SW13	3420	91.676	1.776	7.0	2.0085	0.0000	OK
4320 minute winter	SW14	3420	91.676	1.776	4.7	2.0085	0.0000	SURCHARGED
15 minute summer	SW15	1	89.820	0.000	2.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	83.1	1.180	1.213	6.3377	
15 minute winter	SW2	1.001	SW3	137.3	1.245	1.260	5.3244	
15 minute winter	SW3	1.002	SW9	214.2	1.352	1.337	7.6485	
15 minute summer	SW4	2.000	SW5	16.7	0.827	0.368	0.5726	
15 minute summer	SW5	2.001	SW6	21.0	0.723	0.501	0.1524	
15 minute winter	SW6	2.002	SW8	54.6	0.918	0.755	3.3875	
15 minute summer	SW7	3.000	SW8	23.5	0.940	0.522	0.9532	
15 minute winter	SW8	2.003	SW9	138.7	1.258	1.233	7.0757	
15 minute winter	SW9	1.003	SW10	353.4	2.231	2.136	2.3908	
15 minute winter	SW10	1.004	SW11	401.0	2.531	1.309	0.3476	
30 minute winter	SW11	Flow through pond	SW12	336.7	0.075	0.006	174.8514	
15 minute winter	SW12	5.000	SW13	272.7	2.819	2.502	0.6703	
15 minute winter	SW13	Flow through pond	SW14	139.4	0.090	0.003	93.9890	
4320 minute winter	SW14	Hydro-Brake®	SW15	3.0				593.3

Max water level in the attenuation and drainage network for storms up to 1:100y return. Critical event duration 3420min. Maximum achieved water level during this event does not exceed the high water level in the proposed attenuation tank (91.68m) therefore proposed attenuation has sufficient capacity to accommodate storms up to 1in100 years return +20% Climate Change. See drawing ref. D1679-D1-PL2 for attenuation base and high water level.

Appendix B - Foul Sewer Network Design

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	2800	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Manhole Type	Depth (m)
F1	320.0	92.310	Storm	1.310
F2	150.0	92.450	Storm	2.210
F3	90.0	92.600	Storm	1.500
F4		92.650	Storm	1.700
F5	90.0	92.450	Storm	1.450
F6	375.0	92.400	Storm	1.800
F7	135.0	92.770	Storm	2.270
F8	50.0	92.850	Storm	2.780
F9		92.650	Storm	2.700
F10		92.550	Storm	2.690
F11		92.550	Storm	2.720
F12		92.550	Storm	2.750
F13		92.500	Storm	2.730
F14		92.300	Storm	2.870
F15		92.380	Storm	3.230

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	F1	F2	76.254	1.500	91.000	90.240	0.760	100.3	225
1.001	F2	F9	43.500	1.500	90.240	89.950	0.290	150.0	225
2.000	F3	F4	8.836	1.500	91.100	90.950	0.150	58.9	225
2.001	F4	F6	20.736	1.500	90.950	90.600	0.350	59.2	225
3.000	F5	F6	21.784	1.500	91.000	90.600	0.400	54.5	225
2.002	F6	F8	60.945	1.500	90.600	90.070	0.530	115.0	225
4.000	F7	F8	24.040	1.500	90.500	90.070	0.430	55.9	225
2.003	F8	F9	18.382	1.500	90.070	89.950	0.120	153.2	225
1.002	F9	F10	18.638	1.500	89.950	89.860	0.090	207.1	225
1.003	F10	F11	5.316	1.500	89.860	89.830	0.030	177.2	225

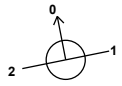
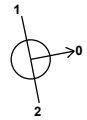
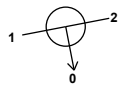
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.146	45.6	8.9	1.085	1.985	0.000	0	320.0	0.0	67	0.887
1.001	0.936	37.2	10.8	1.985	2.475	0.000	0	470.0	0.0	83	0.811
2.000	1.497	59.5	4.7	1.275	1.475	0.000	0	90.0	0.0	43	0.888
2.001	1.493	59.3	4.7	1.475	1.575	0.000	0	90.0	0.0	44	0.896
3.000	1.557	61.9	4.7	1.225	1.575	0.000	0	90.0	0.0	43	0.923
2.002	1.070	42.5	11.8	1.575	2.555	0.000	0	555.0	0.0	81	0.917
4.000	1.537	61.1	5.8	2.045	2.555	0.000	0	135.0	0.0	47	0.968
2.003	0.926	36.8	13.6	2.555	2.475	0.000	0	740.0	0.0	94	0.856
1.002	0.796	31.6	17.4	2.475	2.465	0.000	0	1210.0	0.0	119	0.815
1.003	0.861	34.2	17.4	2.465	2.495	0.000	0	1210.0	0.0	114	0.865

Links

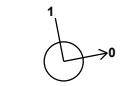
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.004	F11	F12	4.102	1.500	89.830	89.800	0.030	136.7	225
1.005	F12	F13	5.714	1.500	89.800	89.770	0.030	190.5	225
1.006	F13	F14	66.540	1.500	89.770	89.430	0.340	195.7	225
1.007	F14	F15	54.853	1.500	89.430	89.150	0.280	195.9	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	0.981	39.0	17.4	2.495	2.525	0.000	0	1210.0	0.0	105	0.952
1.005	0.830	33.0	17.4	2.525	2.505	0.000	0	1210.0	0.0	116	0.842
1.006	0.819	32.6	17.4	2.505	2.645	0.000	0	1210.0	0.0	117	0.833
1.007	0.818	32.5	17.4	2.645	3.005	0.000	0	1210.0	0.0	117	0.833

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1	709270.230	728420.833	92.310	1.310	1200				
						0	1.000	91.000	225
F2	709255.725	728495.694	92.450	2.210	1200		1	1.000	90.240	225
									
						0	1.001	90.240	225
F3	709180.023	728413.955	92.600	1.500	1200				
						0	2.000	91.100	225
F4	709186.348	728420.125	92.650	1.700	1200		1	2.000	90.950	225
									
						0	2.001	90.950	225
F5	709228.028	728428.534	92.450	1.450	1200				
						0	3.000	91.000	225
F6	709206.674	728424.226	92.400	1.800	1200		1	3.000	90.600	225
							2	2.001	90.600	225
						0	2.002	90.600	225
F7	709190.143	728507.586	92.770	2.270	1200				
						0	4.000	90.500	225
F8	709195.049	728484.052	92.850	2.780	1200		1	4.000	90.070	225
							2	2.002	90.070	225
						0	2.003	90.070	225
F9	709213.102	728487.516	92.650	2.700	1200		1	2.003	89.950	225
							2	1.001	89.950	225
						0	1.002	89.950	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F10	709216.644	728469.218	92.550	2.690	1200		1	1.002	89.860	225
							0	1.003	89.860	225
F11	709217.654	728463.999	92.550	2.720	1200		1	1.003	89.830	225
							0	1.004	89.830	225
F12	709218.434	728459.972	92.550	2.750	1200		1	1.004	89.800	225
							0	1.005	89.800	225
F13	709224.044	728461.058	92.500	2.730	1200		1	1.005	89.770	225
							0	1.006	89.770	225
F14	709236.690	728395.731	92.300	2.870	1200		1	1.006	89.430	225
							0	1.007	89.430	225
F15	709182.921	728384.882	92.380	3.230	1200		1	1.007	89.150	225

Appendix C - Irish Water Confirmation of Feasibility and Statement of Design Acceptance

Bartosz Kedzierski

Unit G3
Calmount Business Park
Ballymount
Dublin 12
Co. Dublin
D12 Y05

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

13 September 2021

Re: CDS20005635 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 252 units at Broomhill Road, Tallaght, Dublin 24, Dublin

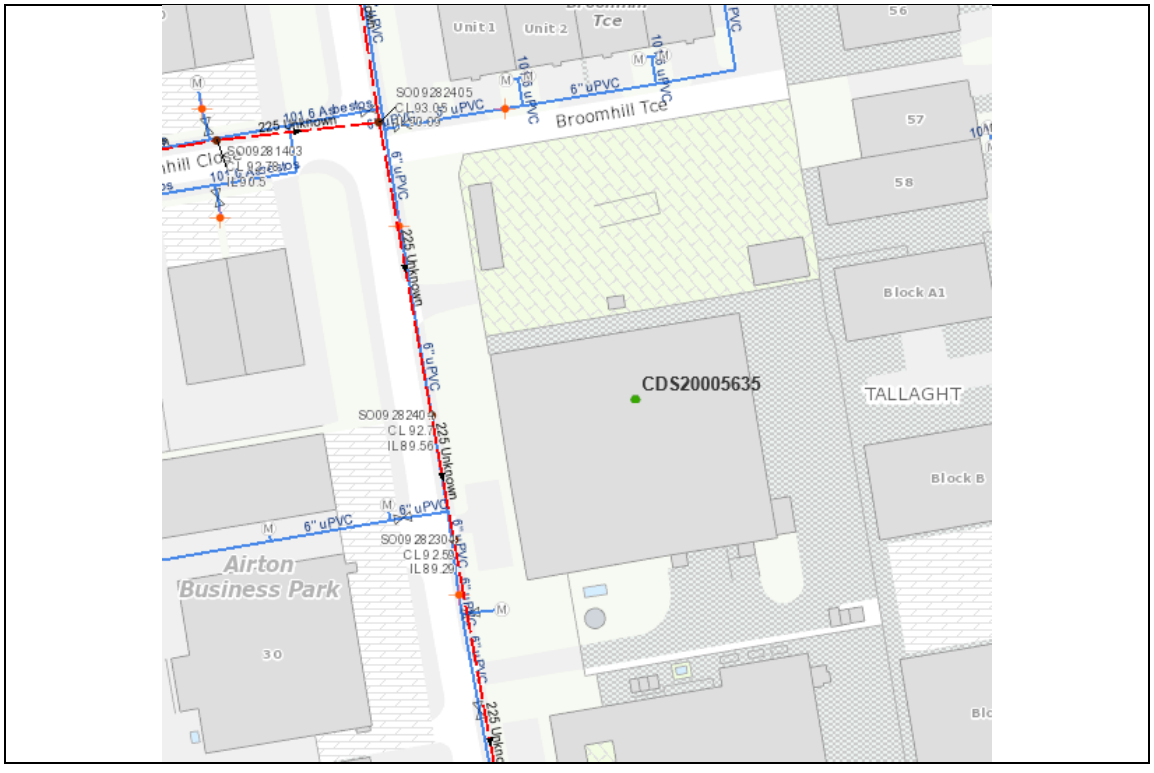
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Broomhill Road, Tallaght, Dublin 24, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	Upgrade of existing 6'' uPVC to 200mm ID pipe for approximately 275m (dashed line in figure below) is required for the connection. 

	Additionally, at connection application stage, local pressure tests must be performed to identify any other local water network upgrades which may be required for the connection. The upgrades will be funded by the Customer.
Wastewater Connection	Irish Water can facilitate the connection subject to the development adhering to strict flow management. This is to ensure no further detriment in the downstream network resulting from the new connections to the existing sewer. The flow control and storage measures will be installed, owned, operated and managed by the developer locally on the private side, and will be required until Irish Water have increased capacity in the downstream network. Providing this arrangement can be facilitated and managed on the private network, your connection can be facilitated subject to a Connection Agreement with Irish Water. The period of time for operating and maintaining flow control measures are subject to the delivery of the public network upgrade and will be a condition of any potential connection. The capital upgrade project is currently at preliminary design stage. In addition to the above removing any existing misconnections or installing dedicated separate storm water systems will be required to preserve the existing capacity for foul only flows. Local Network upgrades or extensions required to connect to strategic infrastructure and point of connection will be assessed at connection application stage.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:

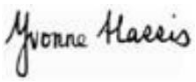


General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Bartosz Kedzierski
Unit F3
Calmount Business Park
Ballymount
Dublin 12, Co. Dublin D12 Y05

6 May 2022

Re: Design Submission for Broomhill Road, Tallaght, Dublin 24, Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS20005635

Dear Bartosz Kedzierski,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Antonio Garzón
Phone: 0838983711
Email: antonio.garzon@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- D1679 D1 Drainage Layout PL2
- D1679 D2 Watermain Layout PL2
- D1679 D3 Foul Long Sections PL2

Standard Details/Code of Practice Exemption:

1. *Pump station and rising main arrangements*

Additional Comments
The design submission will be subject to further technical review at connection application stage. This Statement of Design Acceptance does not extend to proposed pump station and rising main arrangements. The pump station and rising main will be vested at connection application stage

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

A1

SURFSEP SILT TRAP SWI0606/02
OR SIMILAR APPROVED

NEW MH SW11
CL=92.570
IL=90.180

KLARGESTER CLASS 1 BYPASS
PETROL INTERCEPTOR NSBE020

NEW MH F2
CL=92.450
IL=90.240

PROPOSED UNDERGROUND STORMTECH ATTENUATION TANK 'A'
VOLUME 530m³
OVERALL ATTENUATION VOLUME IN TANKS 'A' AND 'B' = 530m³ + 387m³ = 917m³
BASE OF TANK @ +89.90
HIGH WATER LEVEL @ +91.68
MIN FLOOR LEVEL IN CORRESPONDING CATCHMENT SET @+92.65

NEW MH SW2
CL=92.280
IL=90.680

NEW MH SW12
CL=92.250
IL=89.920

NEW MH SW13
CL=92.250
IL=89.910

NEW MH SW10
CL=92.560
IL=90.200

NEW MH SW9
CL=92.480
IL=90.340

NEW MH F1
CL=92.310
IL=91.000

NEW MH SW3
CL=92.250
IL=90.460

BLOCK A
FFL 92.80

BLOCK E
FFL 92.65

225Ø GRAVITY CONNECTION TO BE MADE WHEN ADDITIONAL PEAK HOURS CAPACITY IN THE RECIEVING FOUL NETWORK BECOMES AVAILABLE.

NEW MH F11
CL=92.550
IL=89.825

NEW MH F13
CL=92.500
IL=89.770

NEW MH F14
CL=92.300
IL=89.430

NEW MH F10
CL=92.550
IL=89.855

NEW MH F9
CL=92.650
IL=89.950

NEW MH F12
CL=92.550
IL=89.800

NEW MH F5
CL=92.450
IL=91.000

RISING MAIN DISCHARGE MANHOLE
CL=92.550
IL=89.900
TO BE DECOMMISSIONED WHEN ADDITIONAL PEAK HOUR CAPACITY IN THE RECEIVING FOUL NETWORK BECOMES AVAILABLE

NEW MH F7
CL=92.770
IL=90.500

NEW MH SW7
CL=92.750
IL=90.950

NEW MH SW8
CL=92.900
IL=90.620

NEW MH F8
CL=92.850
IL=90.070

NEW MH SW6
CL=92.950
IL=90.900

NEW MH SW5
CL=92.900
IL=91.000

NEW MH F6
CL=92.400
IL=90.600

BLOCK D
FFL 92.65

BLOCK B+C
FFL 93.15

UNDERGROUND FOUL PUMP STATION WITH 24h STORAGE TANK TO INTERCEPT FOUL SEWAGE AND TO DISCHARGE TO GRAVITY FOUL NETWORK DURING OFF PEAK HOURS. PROPOSED PUMPING STATION TO BE DECOMMISSIONED WHEN UPGRADES TO THE RECEIVING NETWORK ARE FINISHED AND THE ADDITIONAL CAPACITY DURING PEAK HOURS BECOMES AVAILABLE.

NEW MH F4
CL=92.550
IL=90.950

NEW MH F3
CL=92.500
IL=91.100

NEW MH SW4
CL=92.600
IL=91.110

PROPOSED UNDERGROUND STORMTECH ATTENUATION TANK 'B'
VOLUME 387m³
OVERALL ATTENUATION VOLUME IN TANKS 'A' AND 'B' = 530m³ + 387m³ = 917m³
BASE OF TANK @ +89.90
HIGH WATER LEVEL @ +91.68
MIN FLOOR LEVEL IN CORRESPONDING CATCHMENT SET @+92.65

NEW HYDROBRAKE MH SW14
CL=92.400
HYDROBRAKE IL=90.01
FLOW CONTROL DEVICE TO BE PLACED ON OUTLET OF MANHOLE TO LIMIT FLOW TO Q=3.0 l/sec

NEW MH SW1
CL=92.400
IL=91.100

NEW MH F15
CL=92.40
IL=89.150

CONNECT TO EXISTING SW MANHOLE

BROOMHILL TERRACE

LEGEND:

- EXISTING SURFACE WATER DRAIINAGE
- NEW SW DRAINAGE
- EXISTING FOUL SEWER
- NEW FOUL SEWER
- DENOTES PERMEABLE SURFACING TO CAR PARKING SPACES
- DENOTES IRRIGATION TREE PIT
- DENOTES ROOFS OF PROPOSED APARTMENT BLOCKS
- DENOTES INACCESSIBLE EXTENSIVE ROOF COVER TO PROPOSED APARTMENT BLOCKS
- DENOTES COMMUNAL OPEN SPACE ON ROOF TERRACE
- DENOTES BIO-RETENTION AREA
- TOPOGRAPHICAL SURVEY INFORMATION SHOWN DENOTES GREEN FIELD LEVELS AND FEATURES FOR REFERENCE ONLY

FOUL SEWER NETWORK AND ALL ASSOCIATED WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE AND IRISH WATER WASTEWATER INFRASTRUCTURE STANDARD DETAILS:

- IW-CDS-5030-1
- IW-CDS-5030-3

WASTEWATER PIPE MATERIALS:

ALL SEWER PIPE MATERIALS TO BE IN COMPLIANCE WITH SECTION 3.13 OF THE IRISH WATER "CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE" REF. IW-CDS-5030-03

ALL RISING MAIN PIPE MATERIALS TO BE IN COMPLIANCE WITH SECTION 3.14 OF THE IRISH WATER "CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE" REF. IW-CDS-5030-03

MANHOLE COVERS:

200mm ALL AROUND x 100mm DEEP, C20/25 CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LINK AROUND COVERS IN GREEN AREAS AS PER IW STANDARD DETAILS

Mark	Date	By	Chk.	App.	Revision
PL2	07-04-2022	PB	BK	DOS	SITE PLAN UPDATED
PL1	08-01-2021	BK	DOS	__	ISSUED FOR PLANNING

Drawing Status
PLANNING

Job Title
DEVELOPMENT AT
BROOMHILL ROAD

Drawing Title
DRAINAGE LAYOUT

Architect/Client
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Drn	Checked	Approved
PB	BK	DOS

Scales 1:250 | Date 07/04/2022

Job No.	Drawing No.	Rev.
D1679	D1	PL2

A1

BLOCK A
FFL 92.80

BLOCK E
FFL 92.65

BLOCK D
FFL 92.65

BLOCK B+C
FFL 93.15

BROOMHILL TERRACE

BROOMHILL ROAD

HYDRANT

PROVIDE AIR VALVE IN ACCORDANCE WITH SECTION 3.16.6. LOCATION OF AIR VALVE TO BE FINALISED THROUGH AGREEMENT WITH IRISH WATER

SCOUR VALVE (OFFLINE) WITH THE APPROPRIATE SCOUR CHAMBER WITH NON RETURN VALVE TO BE PROVIDED IN THE NETWORK LOW POINT IN ACCORDANCE WITH SECTIONS 3.16.4 AND 3.21 OF IRISH WATER CODE OF PRACTICE FOR WATER INFRASTRUCTURE.

SEPARATE INTERNAL WATER DISTRIBUTION SYSTEMS FOR FIRE FIGHTING AND WATER SUPPLY WITH THEIR ANCILLARY STORAGE TANKS AND PUMPING SYSTEMS TO M&E ENGINEER'S DESIGN. DETAILED SPECIFICATION AND CONNECTION SIZES TO BE SUBMITTED AT DETAIL DESIGN/CONNECTION APPLICATION STAGE. AN ACCEPTABLE ISOLATION DEVICES (TOGETHER WITH AN ACCEPTABLE CONNECTION ARRANGEMENT) IN ACCORDANCE WITH SECTION 3.13 OF IRISH WATER CODE OF PRACTICE FOR WATER INFRASTRUCTURE WILL BE PROVIDED ON ALL SERVICE CONNECTIONS TO PREVENT BACK FLOW FROM INTERNAL WATER DISTRIBUTION SYSTEMS TO IRISH WATER'S NETWORK. DEDICATED BULK FLOW METER AND ASSOCIATED TELEMETRY SYSTEM ON THE FIRE MAIN CONNECTION TO BE PROVIDED AT THE CUSTOMER'S COST. THE CONNECTION TO BE PROVIDED WITH A CHECK VALVE TO PREVENT BACKFLOW INTO THE WATER NETWORK SYSTEM.

BULK METER AND ASSOCIATED TELEMETRY SYSTEM WILL BE PROVIDED TO MEASURE THE DEMAND OF THE DEVELOPMENT AS PER SECTION 2.6.6 OF IW CODE OF PRACTICE FOR WATER INFRASTRUCTURE. BULK WATER METER TO BE IN ACCORDANCE WITH SECTION 3.15.4 OF THE IW CODE OF PRACTICE FOR WATER INFRASTRUCTURE. AN OFF-LINE HYDRANT WILL BE LOCATED ON THE PIPEWORK DOWNSTREAM OF THE METER CHAMBER ALONG WITH A SLUICE VALVE.

NEW 100Ø WATERMAIN CONNECTION TO EXISTING LOCAL AUTHORITY 6" WATERMAIN IN BROOMHILL ROAD FOOTPATH

WATERMAIN NETWORK AND ALL ASSOCIATED WORKS TO BE CONSTRUCTED IN ACCORDANCE IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WATER INFRASTRUCTURE AND IRISH WATER WATER INFRASTRUCTURE STANDARD DETAILS:

- IW-CDS-5020-1
- IW-CDS-5020-3

WATERMAIN PIPE MATERIALS:

ALL WATERMAIN PIPE MATERIALS TO BE IN COMPLIANCE WITH SECTION 3.9 OF THE IRISH WATER "CODE OF PRACTICE FOR WATER INFRASTRUCTURE" REF. IW-CDS-5020-03

WATERMAIN PIPES TO BE LAID AT MIN 1M FROM THE TREE TRUNK BASE OR AT DISTANCE OF 4X THE GIRTH OF THE TREE MEASURED FROM THE CENTER OF TREE (WHICHEVER IS GREATER) IN ACCORDANCE WITH IW STANDARD DETAIL STD-W-12A. TREE ROOT BARRIERS TO BE PROVIDED TO ALL TREES ADJACENT TO WATERMAIN PIPES

LEGEND:

- WM — EXISTING WATER MAIN
- HYDRANT — WM — NEW WATER MAIN
- DENOTES 124 No. OF DWELLINGS TO BE CONSTRUCTED UNDER PLANNING PERMISSION REG REF. 19/886 AND 19/886 AND TO BE CONNECTED TO EXISTING WATERMAIN NETWORK
- DENOTES EXTENSIVE ROOF COVER TO PROPOSED APARTMENT BLOCKS
- DENOTES COMMUNAL OPEN SPACE ON ROOF TERRACE
- TOPOGRAPHICAL SURVEY INFORMATION SHOWN DENOTES GREEN FIELD LEVELS AND FEATURES FOR REFERENCE ONLY

Mark	Date	By	Chk.	App.	Revision
PL2	07-04-2022	PB	BK	DOS	SITE PLAN UPDATED
PL1	06-01-2021	BK	DOS	_	ISSUED FOR PLANNING

Drawing Status: PLANNING

Job Title: DEVELOPMENT AT BROOMHILL ROAD

Drawing Title: WATERMAIN LAYOUT

Architect/Client: GARYARON HOMES

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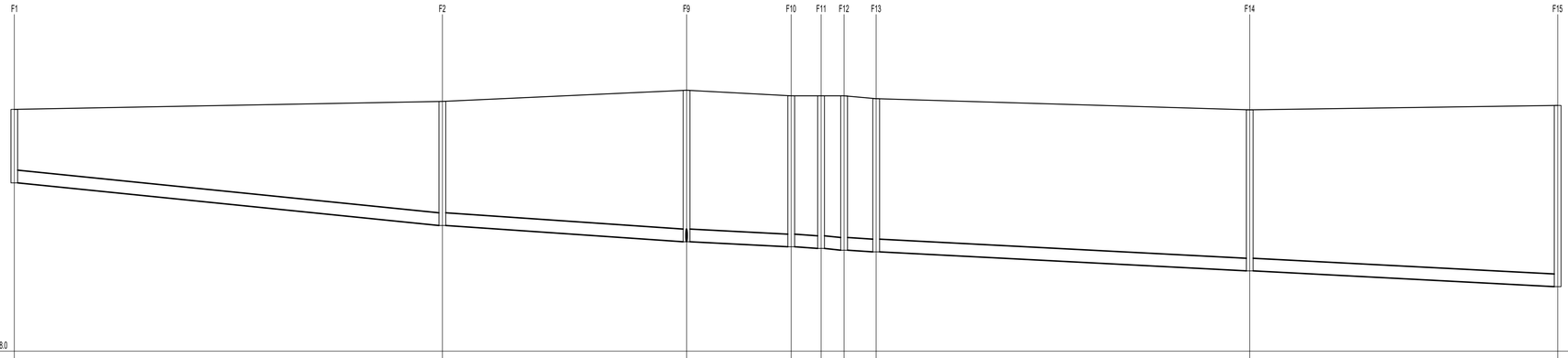
Drn	Checked	Approved
PB	BK	DOS

Scales 1:250 | Date 07/04/2022

Job No.	Drawing No.	Rev.
D1679	D2	PL2

A1



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Slope		1:100.3	1:150.0	1:196.2	1:177.2	1:164.1	1:190.5	1:195.7	1:195.9
Cover Level		92.510	92.450	92.650	92.550	92.550	92.450	92.500	92.300	92.380
Invert Level		91.000	90.240 / 90.240	89.950 / 89.950	89.855 / 89.855	89.825 / 89.825	89.800 / 89.800	89.770 / 89.770	89.430 / 89.430	89.150
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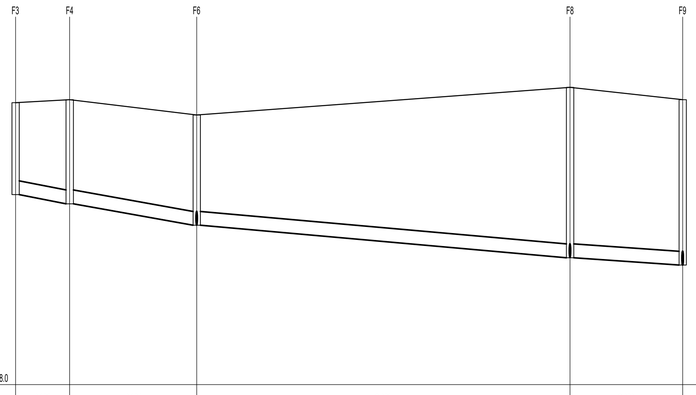
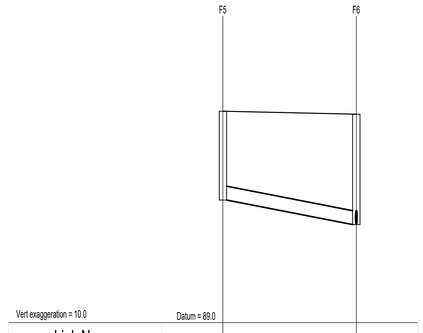


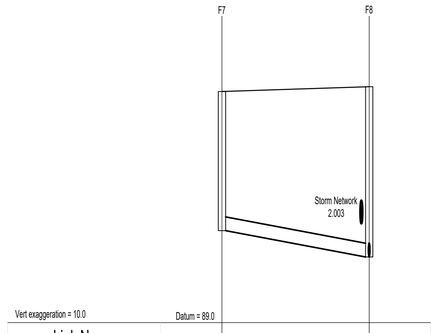
Vert exaggeration = 10.0 | Datum = 88.0

Link Name		2.000	2.001	2.002	2.003
Section Type		225mm	225mm	225mm	225mm
Slope		1:58.9	1:59.2	1:115.0	1:153.2
Cover Level		92.600	92.650	92.400	92.650	92.650
Invert Level		91.100	90.950 / 90.950	90.600 / 90.600	90.070 / 90.070	89.950
Length		8.836	20.736	60.945	18.382	



Vert exaggeration = 10.0 | Datum = 89.0

Link Name		3.000	
Section Type		225mm	
Slope		1:54.5	
Cover Level		92.450	92.400
Invert Level		91.000	90.600
Length		21.784	



Vert exaggeration = 10.0 | Datum = 89.0

Link Name		4.000	
Section Type		225mm	
Slope		1:55.9	
Cover Level		92.770	92.650
Invert Level		90.500	90.070
Length		24.040	

Mark	Date	By	Chk.	App.	Revision
PL2	06-04-2022	BK	DOS	—	ISSUED FOR PLANNING

Drawing Status
PLANNING

Job Title
DEVELOPMENT AT
BROOMHILL ROAD

Drawing Title
WATERMAIN LAYOUT

Architect/Client
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Ballymount,
Dublin 12.

Drn	Checked	Approved
BK	PK	—
Scales 1:500		Date 07/04/2022

Job No.	Drawing No.	Rev.
D1679	D3	PL2