SURFACE WATER DRIANAGE CALCULATIONS

UPON

LAND OFF

GOSBERTON ROAD, SURFLEET

LINCOLNSHIRE

PROJECT No: SW 21-178

DOCUMENT REF: SW 21-178-CAL-01



SCOTT PARK DEVELOPMENTS LTD

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INTRODUCTION

The following set of calculations cover the design of the surface water drainage system for the proposed 8 plot development on the previous Surfleet Café site, off Gosberton Road, Surfleet.

The system follows the principles of the SUDs hierarchy.

Infiltration has been considered, and as demonstrated within the Ground investigation is not viable for this site.

The majority of the surface water will collect via the permeable surfaces provided to the driveways and private road. This will provide a suitable treatment train.

The drainage system outfalls to the riparian drain located along the Northern boundary of the site, which runs Westwards and outfalls to the Welland and Deeping IDB system.

The proposed outfall is via a flow restriction device limiting flow to a practical minimum, with attenuation volume being provided within the permavoid crates in the prvite road build up.

Contained in the following document are hydraulic modelling calculations, the Hydrobrake details, and the greenfield run-off estimate.

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Garry Dunnett
Site name:	Gosberton Road
Site location:	Surfleet

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

Site Details

Latitude:	52.83754° N
Longitude:	0.1452° W
Reference:	1771876587
Date:	Aug 27 2021 10:28

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.427

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	560	560
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

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

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

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.6	0.6
1 in 1 year (l/s):	0.52	0.52
1 in 30 years (l/s):	1.47	1.47
1 in 100 year (l/s):	2.13	2.13
1 in 200 years (l/s):	2.52	2.52

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PP1	0.121	5.00	3.735	1200	525017.473	328279.378	0.968
SW1	0.000		3.735	1350	525057.367	328291.141	1.010
S1	0.032	5.00	3.805	1800	525060.423	328292.643	1.490
S2	0.038	5.00	3.535	1800	525065.542	328305.613	1.225
S3	0.000		3.495	1800	525057.105	328303.003	1.215
S4	0.008	5.00	3.280	1800	525054.894	328310.137	1.025
Outfall	0.000		3.274	1200	525053.695	328314.005	1.034

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	PP1	SW1	41.591	0.600	2.767	2.725	0.042	1000.0	375	5.00	50.0
1.001	SW1	S1	3.406	0.600	2.725	2.315	0.410	8.3	375	5.01	50.0
1.002	S1	S3	10.878	0.600	2.315	2.280	0.035	310.8	375	5.19	50.0
2.000	S2	S3	8.832	0.600	2.310	2.280	0.030	294.4	375	5.14	50.0
1.003	S3	S4	7.469	0.600	2.280	2.255	0.025	298.8	375	5.31	50.0
1.004	S4	Outfall	4.049	0.600	2.255	2.240	0.015	269.9	375	5.37	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)	Pro Velocity (m/s)
1.000	0.565	62.4	16.4	0.593	0.635	0.121	0.0	131	0.478
1.001	6.320	698.0	16.4	0.635	1.115	0.121	0.0	39	2.687
1.002	1.022	112.9	20.7	1.115	0.840	0.153	0.0	108	0.784
2.000	1.051	116.0	5.1	0.850	0.840	0.038	0.0	53	0.534
1.003	1.043	115.2	25.9	0.840	0.650	0.191	0.0	120	0.847
1.004	1.098	121.2	27.0	0.650	0.659	0.199	0.0	120	0.889

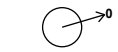
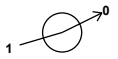
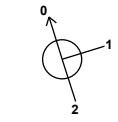
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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	41.591	1000.0	375	Circular	3.735	2.767	0.593	3.735	2.725	0.635
1.001	3.406	8.3	375	Circular	3.735	2.725	0.635	3.805	2.315	1.115
1.002	10.878	310.8	375	Circular	3.805	2.315	1.115	3.495	2.280	0.840
2.000	8.832	294.4	375	Circular	3.535	2.310	0.850	3.495	2.280	0.840
1.003	7.469	298.8	375	Circular	3.495	2.280	0.840	3.280	2.255	0.650
1.004	4.049	269.9	375	Circular	3.280	2.255	0.650	3.274	2.240	0.659

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	PP1	1200	Manhole	Adoptable	SW1	1350	Manhole	Adoptable
1.001	SW1	1350	Manhole	Adoptable	S1	1800	Manhole	Adoptable
1.002	S1	1800	Manhole	Adoptable	S3	1800	Manhole	Adoptable
2.000	S2	1800	Manhole	Adoptable	S3	1800	Manhole	Adoptable
1.003	S3	1800	Manhole	Adoptable	S4	1800	Manhole	Adoptable
1.004	S4	1800	Manhole	Adoptable	Outfall	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
PP1	525017.473	328279.378	3.735	0.968	1200	 0	1.000	2.767	375
SW1	525057.367	328291.141	3.735	1.010	1350	1  0	1.000 1.001	2.725 2.725	375 375
S1	525060.423	328292.643	3.805	1.490	1800	1  0	1.001 1.002	2.315 2.315	375 375
S2	525065.542	328305.613	3.535	1.225	1800	 0	2.000	2.310	375
S3	525057.105	328303.003	3.495	1.215	1800	1 2  0	2.000 1.002 1.003	2.280 2.280 2.280	375 375 375
S4	525054.894	328310.137	3.280	1.025	1800	1  0	1.003 1.004	2.255 2.255	375 375
Outfall	525053.695	328314.005	3.274	1.034	1200	1 	1.004	2.240	375

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Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node 1.004 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	0.000	Product Number	CTL-SHE-0067-2000-1025-2000
Design Depth (m)	1.025	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 1.000 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	209.5	0.0	0.150	209.5	0.0

Node 1.000 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.000	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	4.100	Inf Depth (m)	
Porosity	0.30	Length (m)	57.950		

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Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PP1	10	2.888	0.121	17.3	0.4376	0.0000	OK
15 minute winter	SW1	11	2.765	0.040	16.8	0.0572	0.0000	OK
15 minute winter	S1	11	2.440	0.125	21.2	0.3726	0.0000	OK
15 minute winter	S2	11	2.417	0.107	5.4	0.3402	0.0000	OK
15 minute winter	S3	11	2.417	0.137	26.0	0.3476	0.0000	OK
15 minute winter	S4	11	2.387	0.132	26.7	0.3554	0.0000	OK
15 minute winter	Outfall	12	2.356	0.116	26.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PP1	1.000	SW1	16.8	0.981	0.270	0.7627	
15 minute winter	SW1	1.001	S1	16.9	0.953	0.024	0.0655	
15 minute winter	S1	1.002	S3	21.2	0.630	0.188	0.3724	
15 minute winter	S2	2.000	S3	4.8	0.373	0.042	0.2751	
15 minute winter	S3	1.003	S4	25.6	0.725	0.222	0.2641	
15 minute winter	S4	1.004	Outfall	26.4	0.834	0.218	0.1286	13.1

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Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PP1	10	2.965	0.198	48.8	0.7197	0.0000	OK
15 minute winter	SW1	10	2.798	0.073	47.8	0.1046	0.0000	OK
15 minute winter	S1	11	2.565	0.250	60.2	0.7439	0.0000	OK
15 minute winter	S2	11	2.540	0.230	15.3	0.7294	0.0000	OK
15 minute winter	S3	11	2.539	0.259	74.6	0.6595	0.0000	OK
15 minute winter	S4	11	2.494	0.239	77.6	0.6467	0.0000	OK
15 minute winter	Outfall	11	2.444	0.204	77.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PP1	1.000	SW1	47.8	1.357	0.767	1.5422	
15 minute winter	SW1	1.001	S1	47.9	1.094	0.069	0.1571	
15 minute winter	S1	1.002	S3	60.2	0.767	0.534	0.8666	
15 minute winter	S2	2.000	S3	14.4	0.460	0.124	0.6724	
15 minute winter	S3	1.003	S4	74.6	0.960	0.648	0.5807	
15 minute winter	S4	1.004	Outfall	77.5	1.144	0.639	0.2740	36.9

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PP1	10	3.048	0.281	92.0	1.0197	0.0000	OK
15 minute summer	SW1	9	2.816	0.091	86.3	0.1303	0.0000	OK
15 minute winter	S1	11	2.757	0.442	114.3	1.3153	0.0000	SURCHARGED
15 minute winter	S2	11	2.699	0.389	28.9	1.2323	0.0000	SURCHARGED
15 minute winter	S3	11	2.696	0.416	140.8	1.0588	0.0000	SURCHARGED
15 minute winter	S4	11	2.617	0.362	146.9	0.9766	0.0000	OK
15 minute winter	Outfall	11	2.523	0.283	147.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PP1	1.000	SW1	90.4	1.674	1.449	2.2624	
15 minute summer	SW1	1.001	S1	85.9	1.217	0.123	0.2212	
15 minute winter	S1	1.002	S3	112.9	1.024	1.000	1.1998	
15 minute winter	S2	2.000	S3	27.8	0.464	0.240	0.9741	
15 minute winter	S3	1.003	S4	141.2	1.281	1.226	0.8190	
15 minute winter	S4	1.004	Outfall	147.3	1.461	1.215	0.4015	69.6

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Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.025	2.000
Flush-Flo™	0.292	1.921
Kick-Flo®	0.594	1.560
Mean Flow		1.713

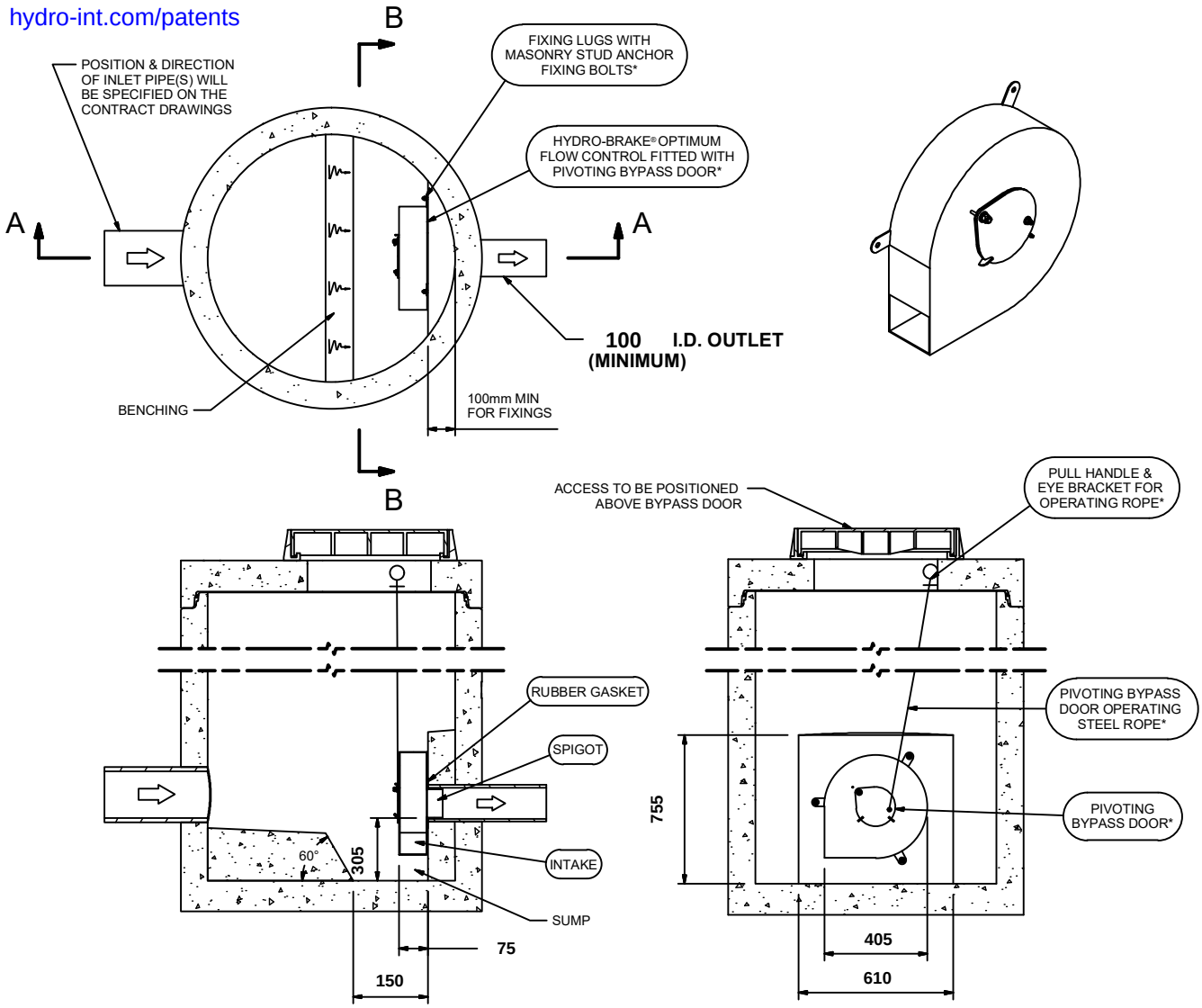
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

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SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0067-2000-1025-2000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	8/27/2021 2:05 PM
SITE	Surfleet
DESIGNER	Garry Dunnett
REF	AEQ-215

SHE-0067-2000-1025-2000
Hydro-Brake® Optimum

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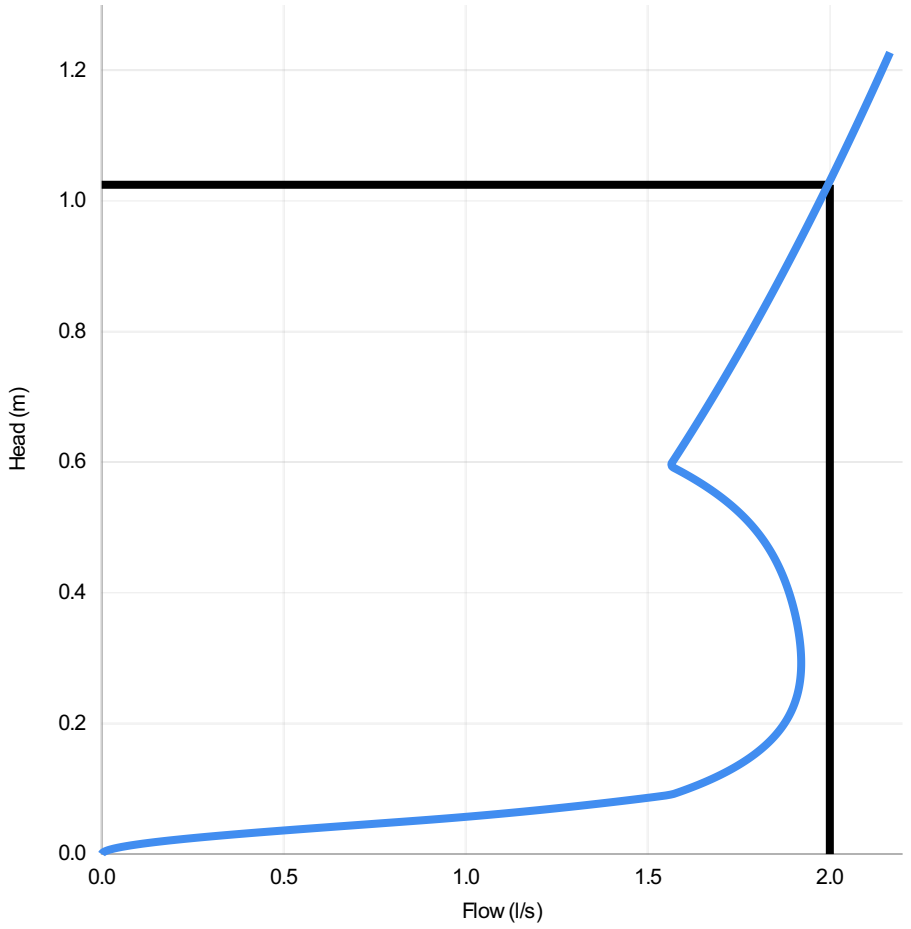
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BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

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Head (m)	Flow (l/s)
0.000	0.000
0.035	0.480
0.071	1.258
0.106	1.638
0.141	1.764
0.177	1.842
0.212	1.888
0.247	1.912
0.283	1.921
0.318	1.919
0.353	1.910
0.389	1.894
0.424	1.873
0.459	1.842
0.495	1.798
0.530	1.737
0.566	1.653
0.601	1.568
0.636	1.609
0.672	1.648
0.707	1.687
0.742	1.724
0.778	1.761
0.813	1.796
0.848	1.831
0.884	1.865
0.919	1.899
0.954	1.931
0.990	1.963
1.025	1.995

DESIGN ADVICE

The head/flow characteristics of this SHE-0067-2000-1025-2000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	27/08/2021 14:05
Site	Surfleet
DESIGNER	Garry Dunnett
Ref	AEQ-215

SHE-0067-2000-1025-2000

Hydro-Brake Optimum®

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