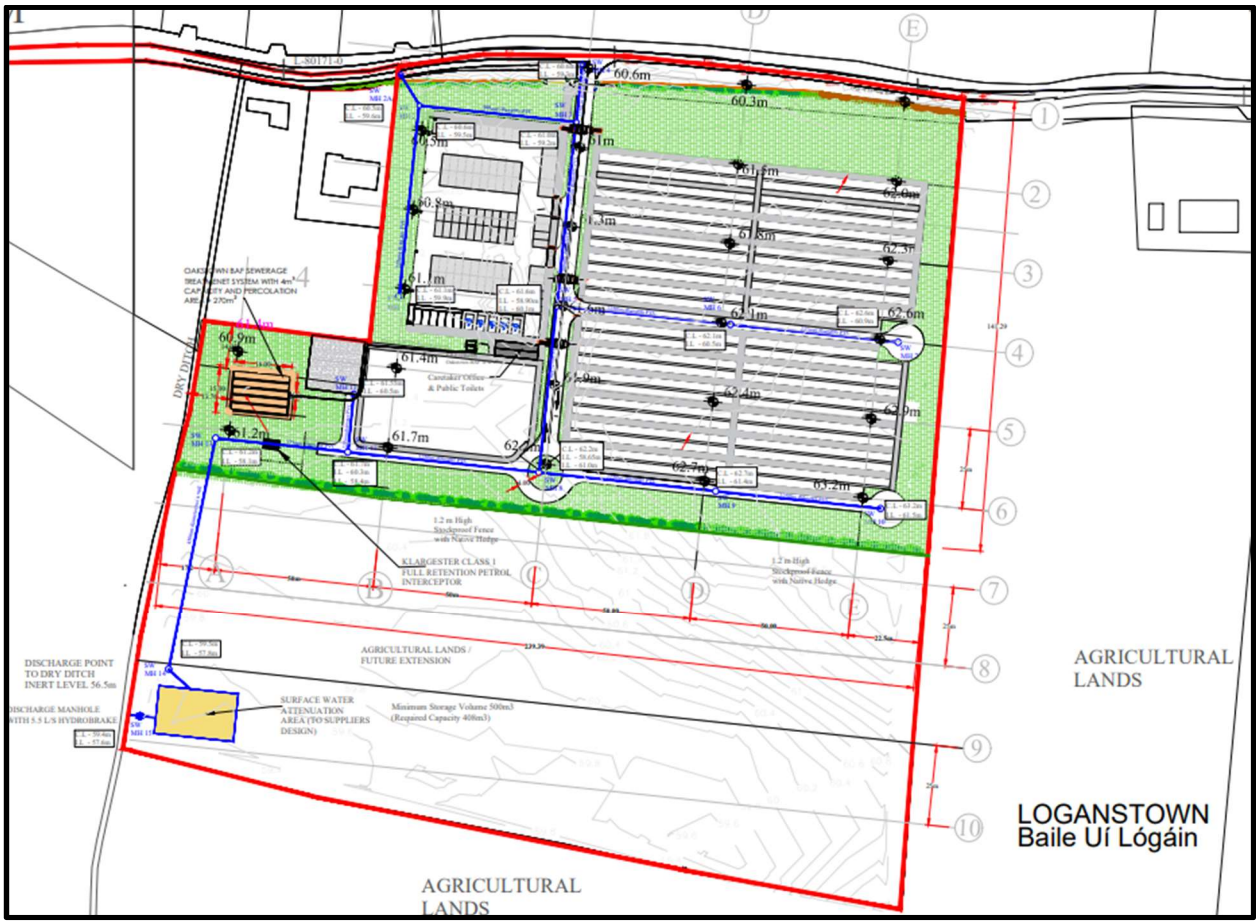
comhairle chontae na mí
meath county council

PROPOSED BURIAL GROUND DEVELOPTMENT AT LOGANSTOWN, TRIM, CO. MEATH

SURFACE WATER, ATTENUTATION CALCULATIONS & DETAILS



DETERMINATION OF GREENFIELD RUN-OFF RATE

For a development less than 25 hectares in area, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No. 124

ATTENUATION DESIGN In accordance with CIRIA publication C753 - The SUDS Manual

$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

where QBAR (m^3/s) is the mean annual peak flow.

AREA = Area of Catchment = 29,010 m^2 = 29,010 x 10^{-6} km^2

SAAR = Annual Average Rainfall = 785mm for Trim = 864mm allowing +10% climate change

SOIL = Soil Index with values in the range 0.15 (very low runoff) - 0.5 (very high runoff).

A site investigation was carried to determine the soil type, and a value of 0.4 has been taken for this moderately permeable subsoil, ref. Transport Infrastructure Ireland:

Drainage of runoff from Natural Catchments (including Amendments No.1 dated June 2015)

Using the values above in the QBAR formula, **QBAR rural = 0.0037 m3/s (or 3.7 lt/sec)**

The overall permissible outflow from the developed site will be set at 3.7 litres/second.

REQUIRED STORAGE VOLUME CALCULATION

General Data	
Site location:	Ireland
60 min rainfall depth of 5 year return period 'R' [mm] =	15.00
M5-60 to M5-2d rainfall ratio 'r'	0.40
proposed discharge rate 'v1' [litre/s]	5.50
proposed discharge rate 'v2' [litre/s]	5.50
allowance for climate change	20%

Summary of Calculations		
required storage volume for discharge rate 'v1' =	**298.79**	**m^3**
required storage volume for discharge rate 'v2' =	**408.04**	**m^3**

Area Data	Area (m2)	Impermeability [%]	Effective Area [m^2]
Impermeable area 'A_1' [m^2] =	10210	100	10,210
landscaping and/or green area 'A_2' [m^2] =	18800	0	0
other partially permeable area 'A_3' [m^2] = 0	0	0	0
AREA DRAINED TO ATTENUATION TANK = m^2			10,210

Required Storage Volume Per Rainfall Duration for Discharge Rate v1													
Rainfall Duration (Min)	Rainfall Factor Z1	M5-D Rainfalls [mm]	M10-D			M20-D			M30-D			Outflow from attenuation tank [m³]	Required Storage [m³]
			Z2	Rainfall [mm]	inflow [m³]	Z2	Rainfall [mm]	inflow [m³]	Z2	Rainfalls [mm]	inflow [m³]		
5	0.37	6.1	1.17	7.1	72.49	1.36	8.7	88.83	1.45	9.7	99.04	1.65	97.39
10	0.52	8.4	1.18	9.9	101.08	1.38	12.1	123.54	1.47	13.5	137.84	3.3	134.54
15	0.63	9.9	1.19	11.7	119.46	1.39	14.2	144.98	1.49	15.99	163.26	4.95	158.31
30	0.8	12.7	1.2	14.6	149.07	1.39	17.6	179.70	1.49	19.5	199.10	9.9	189.20
60	1	16.2	1.2	18.3	186.84	1.39	21.7	221.56	1.49	24	245.04	19.8	225.24
120	1.21	20.8	1.19	22.9	233.81	1.38	26.9	274.65	1.47	29.5	301.20	39.6	261.60
240	1.45	26.5	1.18	28.7	293.03	1.37	33.3	339.99	1.46	36.2	369.60	79.2	290.40
360	1.6	30.6	1.18	32.7	333.87	1.36	37.7	384.92	1.44	40.9	417.59	118.8	**298.79**
600	1.79	36.4	1.17	38.5	393.09	1.35	44	449.24	1.42	47.5	484.98	198	286.98
1440	2.24	39.2	1.17	51.3	523.77	1.34	57.7	589.12	1.42	61.7	629.96	475.2	154.76

Z2 is a growth factor from M5 rainfalls

Required Storage Volume Per Rainfall Duration for Discharge Rate v2													
Rainfall Duration (Min)	Rainfall Factor Z1	M5-D Rainfalls [mm]	M10-D			M30-D			M100-D			Outflow from attenuation tank [m³]	Required Storage [m³]
			Z2	Rainfall [mm]	inflow [m³]	Z2	Rainfall [mm]	inflow [m³]	Z2	Rainfall [mm]	inflow [m³]		
5	0.37	6.1	1.17	7.1	72.49	1.45	9.7	99.037	1.88	13.4	136.814	1.65	135.16
10	0.52	8.4	1.18	9.9	101.08	1.47	13.5	137.835	1.93	18.6	189.906	3.3	186.61
15	0.63	9.9	1.19	11.7	119.46	1.49	159	1623.39	1.97	21.9	223.599	4.95	218.65
30	0.8	12.7	1.2	14.6	149.07	1.49	19.5	199.095	1.98	26.4	269.544	9.9	259.64
60	1	16.2	1.2	18.3	186.84	1.49	24	245.04	1.97	31.8	324.678	19.8	304.88
120	1.21	20.8	1.19	22.9	233.81	1.47	29.5	301.195	1.92	38.4	392.064	39.6	352.46
240	1.45	26.5	1.18	28.7	293.03	1.46	36.2	369.602	1.88	46.2	471.702	79.2	392.50
360	1.6	30.6	1.18	32.7	333.87	1.44	40.9	417.589	1.85	51.6	526.836	118.8	**408.04**
600	1.79	36.4	1.17	38.5	393.09	1.42	47.5	484.975	1.8	59.1	603.411	198	405.41
1440	2.24	39.2	1.17	51.3	523.77	1.42	61.7	629.957	1.78	74.9	764.729	475.2	289.53

Z2 is a growth factor from M5 rainfalls

DATA	STORM WATER FLOW			Cr = 1.3					SEWER DESIGN			
SEWER REFERENCE	Modified Rational Method			Cv = 0.7					Ka = 0.6			
From Man hole	To Man hole	Roads	footpath	Roof	Impervious Area	Cumulative Impervious Area	Rainfall (mm/hr):I	Storm Water Flow	Size of Drain (mm)	Gradient (1 in x)	Length (m)	Capacity (l/sec)
		Area 1	Area 2	Area 3				Q=Ap*I*Cr*Cv*2.78 (Lt/sec)				
1	2	3	4	5	6	7	8	9	10	11	12	13
S1	S2	0.306	0	0	0.306	0.306	50	38.71	300	200.00	58.3	75
S2	S3	0	0	0	0	0.306	50	38.71	300	200.00	41.6	75
S4	S3	0.0224	0	0	0.0224	0.0224	50	2.83	225	200.00	16.7	36
S3	S5	0.0374	0	0	0.0374	0.3284	50	41.54	300	200.00	56.2	75
S7	S6	0.0251	0.02	0	0.0451	0.0451	50	5.70	225	200.00	51	36
S6	S5	0.0179	0.02	0	0.0379	0.083	50	10.50	225	200.00	52.9	36
S5	S8	0.0315	0	0.063	0.0945	0.5059	50	63.99	300	200.00	51.5	75
S10	S9	0.0282	0.01	0	0.0382	0.0382	50	4.83	225	200.00	51	36
S9	S8	0.0295	0.01	0	0.0395	0.0777	50	9.83	225	200.00	54.8	36
S8	S12	0.026	0.012	0	0.038	0.6216	50	78.63	375	200.00	60.4	180
S11	S12	0.00705	0.0035	0	0.01055	0.0105	50	1.33	225	200.00	18.2	36
S12	S13	0.00336	0	0	0.00336	0.63546	50	80.38	375	200.00	41.7	180
S13	S14	0	0	0	0	0	50	80.38	450	200.00	74.2	220
S14	S15out							5.50				

5.5	l/s achieved by means of hydro break

RUN OFF ESTIMATED METHODS		
EQUATION – QBAR = 0.00108 * (AREA)^0.89*(SAAR)^1.17*(SOIL)^2.17		
AREA	29010	m^2
SAAR	1086	mm
SOIL	0.4	index
QBAR	1.36	m^3/sec
Site Outflow	22.7	l/s
Outflow	7.82	l/s/ha

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 194236, Northing: 300019,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.5,	4.0,	4.8,	5.3,	5.8,	7.1,	8.7,	9.7,	11.1,	12.4,	13.4,	14.9,	16.1,	17.0,	N/A ,
10 mins	3.4,	4.8,	5.6,	6.7,	7.4,	8.0,	9.9,	12.1,	13.5,	15.5,	17.3,	18.6,	20.7,	22.4,	23.7,	N/A ,
15 mins	4.0,	5.7,	6.5,	7.9,	8.7,	9.4,	11.7,	14.2,	15.9,	18.2,	20.3,	21.9,	24.4,	26.3,	27.9,	N/A ,
30 mins	5.4,	7.4,	8.5,	10.1,	11.1,	12.0,	14.6,	17.6,	19.5,	22.2,	24.6,	26.4,	29.2,	31.4,	33.2,	N/A ,
1 hours	7.2,	9.7,	11.0,	12.9,	14.2,	15.2,	18.3,	21.7,	24.0,	27.1,	29.8,	31.8,	35.0,	37.4,	39.4,	N/A ,
2 hours	9.6,	12.7,	14.3,	16.6,	18.1,	19.2,	22.9,	26.9,	29.5,	33.0,	36.0,	38.4,	41.9,	44.6,	46.8,	N/A ,
3 hours	11.4,	14.9,	16.6,	19.2,	20.8,	22.1,	26.1,	30.5,	33.2,	37.0,	40.3,	42.8,	46.6,	49.4,	51.7,	N/A ,
4 hours	12.9,	16.6,	18.5,	21.3,	23.1,	24.4,	28.7,	33.3,	36.2,	40.2,	43.6,	46.2,	50.2,	53.1,	55.6,	N/A ,
6 hours	15.2,	19.4,	21.6,	24.6,	26.6,	28.1,	32.7,	37.7,	40.9,	45.1,	48.8,	51.6,	55.7,	58.9,	61.4,	N/A ,
9 hours	18.0,	22.8,	25.1,	28.5,	30.6,	32.2,	37.3,	42.7,	46.1,	50.7,	54.6,	57.5,	61.9,	65.3,	68.0,	N/A ,
12 hours	20.3,	25.4,	28.0,	31.5,	33.9,	35.6,	41.0,	46.7,	50.2,	55.0,	59.1,	62.2,	66.7,	70.2,	73.0,	N/A ,
18 hours	24.1,	29.8,	32.6,	36.5,	39.0,	40.9,	46.7,	52.9,	56.7,	61.8,	66.1,	69.3,	74.2,	77.8,	80.7,	N/A ,
24 hours	27.2,	33.3,	36.3,	40.5,	43.1,	45.1,	51.3,	57.7,	61.7,	67.1,	71.6,	74.9,	79.9,	83.7,	86.7,	96.7,
2 days	34.3,	41.2,	44.5,	49.0,	51.9,	54.1,	60.6,	67.4,	71.5,	77.0,	81.7,	85.1,	90.2,	93.9,	96.9,	106.9,
3 days	40.4,	47.9,	51.4,	56.3,	59.4,	61.7,	68.7,	75.8,	80.1,	85.8,	90.6,	94.1,	99.4,	103.2,	106.3,	116.5,
4 days	45.9,	53.9,	57.7,	62.9,	66.2,	68.6,	75.9,	83.3,	87.8,	93.8,	98.7,	102.4,	107.7,	111.7,	114.8,	125.2,
6 days	56.0,	64.9,	69.1,	74.8,	78.4,	81.0,	88.9,	96.9,	101.7,	108.1,	113.3,	117.2,	122.8,	126.9,	130.3,	141.1,
8 days	65.1,	74.9,	79.4,	85.6,	89.4,	92.2,	100.7,	109.2,	114.3,	120.9,	126.4,	130.5,	136.4,	140.7,	144.1,	155.4,
10 days	73.8,	84.2,	89.1,	95.6,	99.7,	102.7,	111.6,	120.5,	125.9,	132.9,	138.6,	142.8,	148.9,	153.4,	157.0,	168.6,
12 days	82.1,	93.2,	98.3,	105.2,	109.5,	112.6,	122.0,	131.3,	136.9,	144.1,	150.1,	154.4,	160.8,	165.4,	169.1,	181.1,
16 days	97.9,	110.1,	115.7,	123.3,	127.9,	131.4,	141.5,	151.5,	157.4,	165.2,	171.5,	176.2,	182.9,	187.8,	191.7,	204.2,
20 days	112.9,	126.2,	132.2,	140.4,	145.4,	149.0,	159.8,	170.4,	176.7,	184.9,	191.6,	196.4,	203.5,	208.6,	212.7,	225.8,
25 days	131.1,	145.5,	152.0,	160.8,	166.1,	170.0,	181.5,	192.8,	199.5,	208.2,	215.2,	220.3,	227.7,	233.1,	237.4,	251.1,

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

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	4.000	5.500
Flush-Flo™	0.354	3.117
Kick-Flo®	0.727	2.497
Mean Flow		3.933

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 08/4598

WRc Approved PT/329/0412

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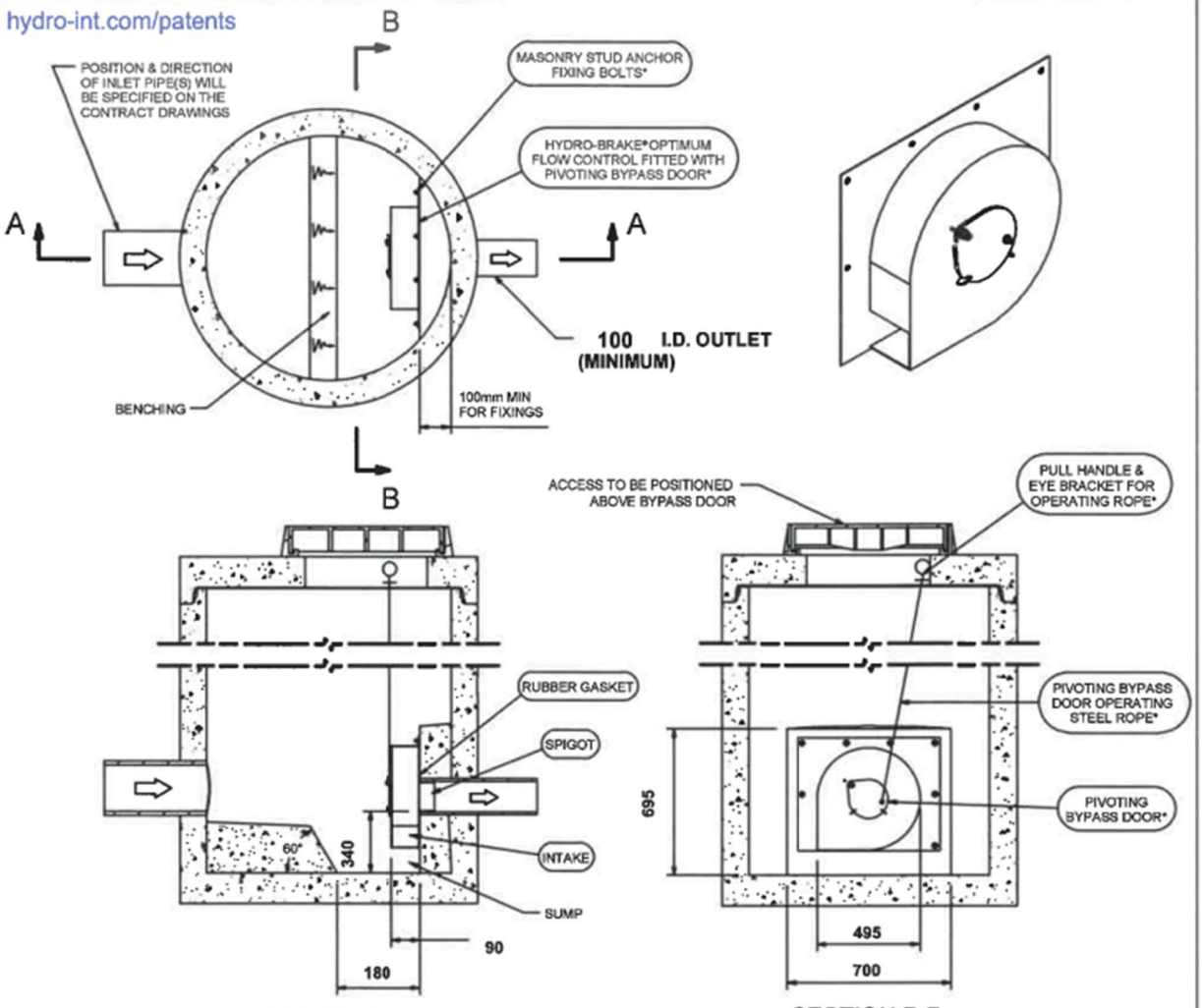

SECTION A-A

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-0081-5500-4000-5500 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	
SITE	
DESIGNER	
REF	

SHE-0081-5500-4000-5500
Hydro-Brake® Optimum

marc@alantraynor.com

Technical Specification

Control Point	Head (m)	Flow (l/s)
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Flush-Flo	0.354	3.117
Kick-Flo®	0.727	2.497
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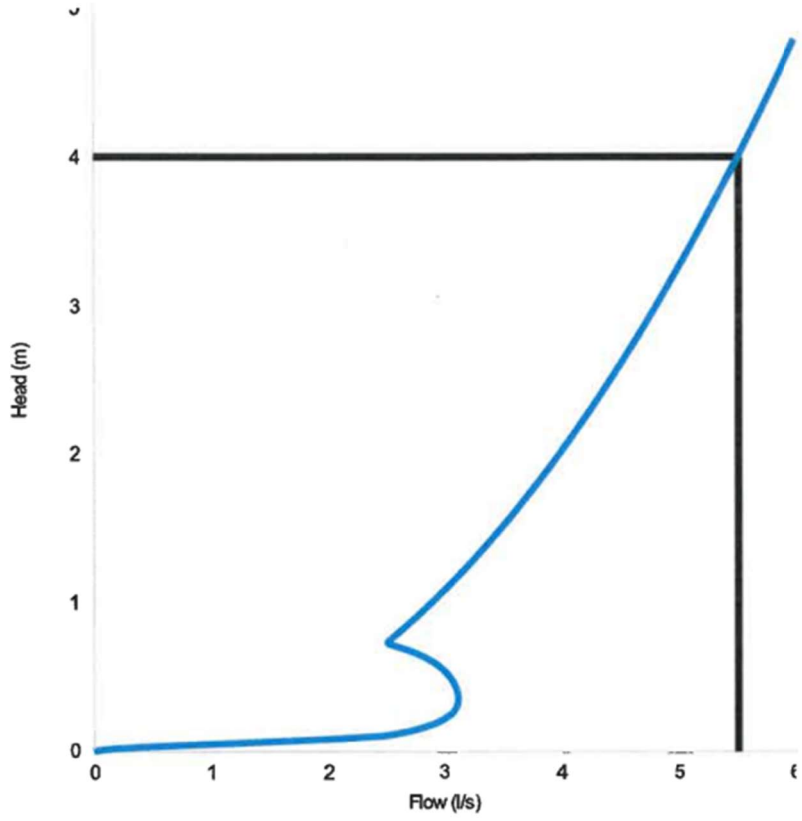
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.138	2.706
0.276	3.083
0.414	3.104
0.552	2.989
0.690	2.661
0.828	2.649
0.966	2.842
1.103	3.021
1.241	3.189
1.379	3.347
1.517	3.498
1.655	3.641
1.793	3.779
1.931	3.911
2.069	4.038
2.207	4.161
2.345	4.280
2.483	4.395
2.621	4.507
2.759	4.617
2.897	4.723
3.034	4.827
3.172	4.928
3.310	5.027
3.448	5.124
3.586	5.219
3.724	5.313
3.862	5.404
4.000	5.494

DESIGN ADVICE

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Hydro International

DATE	
Site	
DESIGNER	
Ref	

SHE-0081-5500-4000-5500

Hydro-Brake Optimum®