

Drainage Maintenance Schedule



The Civil Engineering Practice
11 Tungsten Building
George Street
Fishersgate
Sussex
BN41 1RA

Project	Wicks Farm - East, Ford Lane, Ford, West Sussex
Project Number	23482

By Stuart Magowan

Date 12 May 2022

1 Schedule of Maintenance

- 1.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.
- 1.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.
- 1.3 Upon completion, responsibility for regular and corrective maintenance of all elements of the drainage system will be passed on to a Site Operator and managed by them.
- 1.4 An initial pre-handover inspection of the scheme will be undertaken to ensure that it has been constructed as designed.
- 1.5 The following maintenance schedules detail the typical tasks to be undertaken at different intervals and is based on the maintenance requirements outline in Chapter 32 of CIRIA document C753 'The SuDS Manual'.

Maintenance Schedule	Required Action	Frequency
Regular / Occasional Maintenance	Inspections and reporting on the whole drainage system	2 monthly or after significant storm events*
	Litter and debris removal – trash screen, catch pits, filter drain, Hydrobrake control devices, swales, permitter ditches, pond and reservoir	Monthly or as required
	Grass Cutting – edges filter trench, pond and reservoir	Monthly or as required
	Weed and invasive plant control – filter trench, pond and reservoir	As required
	Shrub Control – filter trench, pond, permitter ditches and reservoir	As required
	Aquatic and shoreline vegetation management	As required
	Surface and foul water pipework, channel drains, headwalls and fin drains – jetting / rodding	Every 2 years or as required
	Remove sediment and debris from silt trap chambers, channel drains, inlet chambers and Hydrobrake chambers	6 monthly
	Remove sediment and debris from swales, pond and permitter ditches, reservoir and downstream defender.	Once a year



	Inspection of Downstream Defender	Once a year, or as manufacturers recommendation
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* During the first year of operation inspections will usually be carried out monthly and/or after significant storm events to ensure that the system is functioning as designed and that no damage is apparent.

Maintenance Schedule	Required Action	Frequency
Corrective Maintenance	Remove debris and/or blockages from the drainage systems including, trash screen, silt traps, channel drains, fin drains, Hydrobrake control devices	As required
	Repairs to access chambers, pipework, silt traps, manhole covers, fin drains, channel drains, headwalls, trash screens and grilles	As required
	Inspect inlet, outlet from downpipe and gullies for blockages, standing water and clear	As required
	Repairs to reservoir liner to ensure full capacity maintained	As required
	Replace Hydrobrake control devices	As required/every 25 years
	Replace downstream defender	As required/every 25 years

Indicative Schedule of Maintenance for the Proposed Drainage System

- 1.6 Provisions will be made to replace any infrastructure that has reached the end of its serviceable design life and will be replaced on a like for like basis as far as reasonably practicable.

2 Financing

- 2.1 The regular and corrective maintenance of all elements of the drainage system will be managed and funded by the Site Operator:-

Inspection / Action Required	Gullies, Channels, Fin Drains and Gutters	Catchpits / Inspection Chambers	Surface and Foul Water Pipework	Headwalls and Trash Screen	Pond / Filter Trench / Reservoir	Hydrobrake Control Devices	Downstream Defender
After leaf fall in Autumn	✓	✓					
Monthly	✓				✓		
2 Monthly	✓	✓	✓	✓	✓	✓	
6 Months	✓	✓		✓			
1 Year					✓		✓
2 Years			✓				
25 Years						✓	✓

Drainage System Maintenance Summary

Level of storage pond designed to allow the potential to link to existing western storage pond subject to future planning permission

Storage Pond Details

Top bank level = 4.960m AOD

1:100 year + 40% storage between 3.85m AOD and 4.143m AOD

Volume = 3546m³

293mm depth of flood storage

817mm freeboard

Maximum Irrigation water level

3.85m AOD

Pond base level

2.36m AOD

Volume = 17222m³

STORM WATER MANHOLE SCHEDULE

MH_REF	COVER LEVEL	INVERT	DEPTH	COVER TYPE	CHAMBER TYPE	EASTING	NORTHING
HB01	4.650	3.350	1.300	D400	TYPE C 1350 DIA (Hydrobrake manhole)	499256.262	104169.123
HB02	4.940	3.640	1.300	D400	TYPE C 1350 DIA (Hydrobrake manhole)	499358.696	104279.779
S01	4.650	3.525	1.125	D400	TYPE D 600 DIA FIG B18	499208.220	104123.613
S02	4.650	3.525	1.125	D400	TYPE D 600 DIA FIG B18	499253.296	104169.123
S03	4.650	3.130	1.520	D400	TYPE D 450 DIA FIG B18	499292.962	104169.123
S04	4.650	2.910	1.740	D400	TYPE D 450 DIA FIG B18	499329.662	104169.123
S05	4.650	2.692	1.958	D400	TYPE D 450 DIA FIG B18	499366.031	104169.123
S06	4.158	2.671	1.487	D400	TYPE D 450 DIA FIG B18	499369.517	104169.123
S07	3.599	2.142	1.457	D400	TYPE C 1350 DIA FIG B15	499457.892	104169.123
S10	4.960	3.557	1.403	D400	TYPE D 450 DIA FIG B18	499358.696	104265.932
S11	4.450	3.461	0.989	D400	TYPE D 450 DIA FIG B18	499366.031	104251.633
S12	4.550	3.215	1.335	D400	TYPE D 450 DIA FIG B18	499366.031	104210.498
DD01	4.650	3.340	1.310	D400	1200Ø PQL Conc Downstream Defender	499258.166	104169.123

GENERAL NOTES:

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2. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and specification.

3. The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.

4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

DRAINAGE NOTES:

1. All adoptable pipes, bends and junctions shall be vitrified clay in accordance with the current version of BS EN 295-1, with flexible joints and kitemark certified.

2. All Adoptable sewers shall be in strict accordance with the SSG Appendix C - Design and Construction Guidance. Unless otherwise stated adoptable sewers shall be 150mm diameter and shall be laid in a class S bedding. Where the depth to soffit is less than 1.2m under a public highway or 0.5m elsewhere the pipe shall be laid with a class 2 bedding.

3. All private building drainage shall be constructed in strict in accordance with the current version of BS EN 752:2017. Unless otherwise specified building drainage shall be 100mm diameter and shall be laid at a minimum gradient of 1 in 40 for foul drains and 1 in 80 for surface water drains. All building drains shall be laid in class B bedding unless otherwise specified.

4. Where a pipe is within 1m of a foundation the trench shall be filled with class GEN 3 concrete up to the lowest level of the foundation. Where the trench is further than 1m from the foundation, the trench shall be filled with class GEN 3 concrete to a level below the lowest level for the foundation equal to the distance from the foundation less 150mm. In both cases the pipe shall be bedded and surrounded in 150mm thick class GEN 3 concrete.

5. Where pipes, external to the structures, have a depth to soffit from ground level of less than 450mm they shall have a class GEN 3 concrete encasement (150mm thick). In all other cases the pipes shall be bedded and surrounded with 100mm thick granular material.

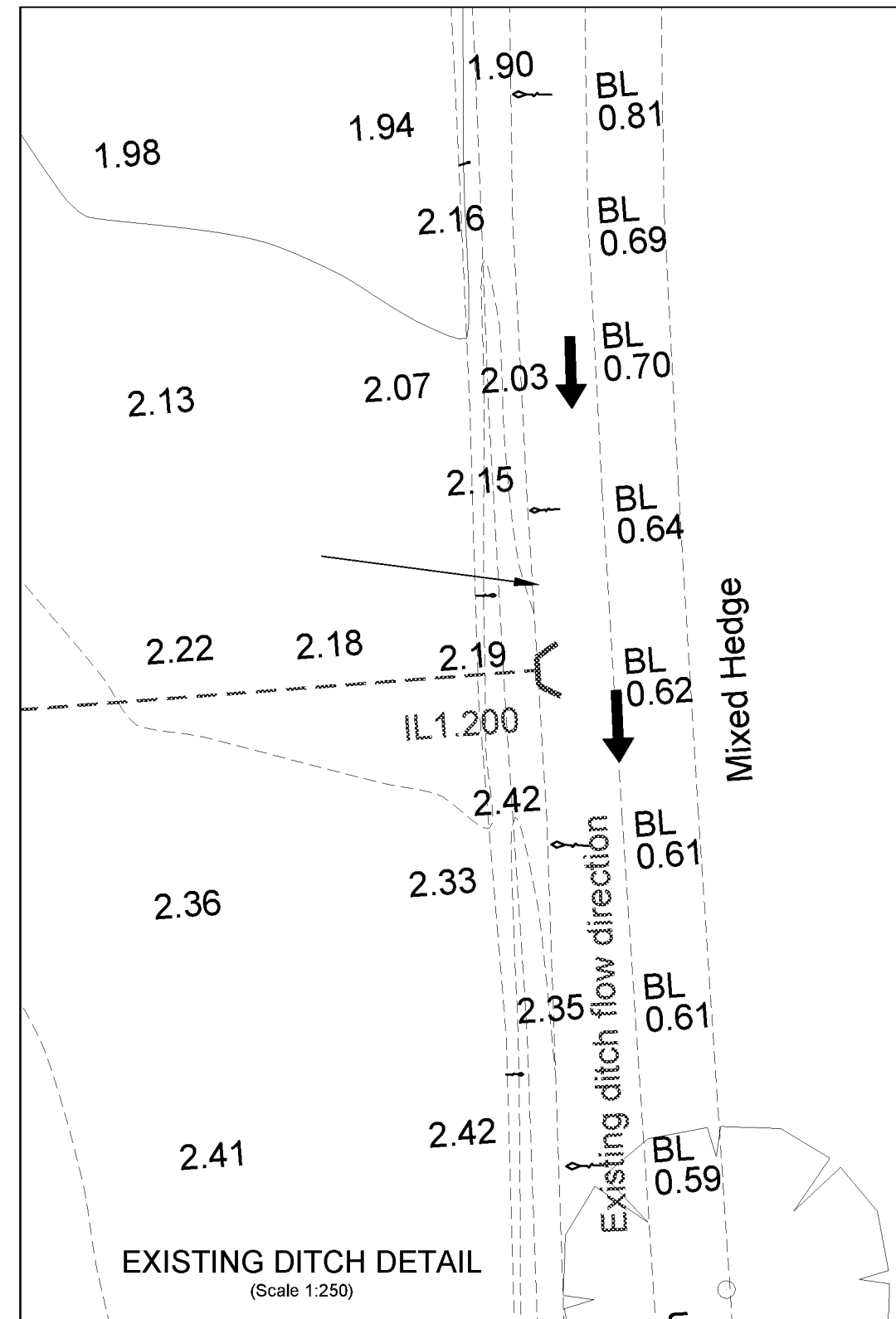
6. In any circumstances where pipes are bedded and surrounded in concrete flexible joints should be provided. Compressible boards (fibroboard or polystyrene) shall be provided at a maximum of 8m centres (coinciding with pipe joints). The boards shall be pre-cut to pipe diameter and to a height and width equal to the concrete cross section. A board thickness of 18mm for pipes up to 450mm nominal diameter and 36mm for pipes over 450mm nominal diameter.

7. All svps shall have rodding access plates fitted at their bases (ground floor level).

8. Where existing pipes are to be abandoned they shall be dug out together with any abandoned manholes.

9. Any discrepancy between the drawing and site should be reported immediately to the Engineer.

10. All manhole and chamber sizes are given as a minimum to meet the SSG Appendix C-Design and Construction Guidance



C	09.05.22	AJD	Updated to suit F/7/21/PL Planning Condition 3 and 5	SRM
B	05.04.22	AJD	Existing ditch detail added	SRM
A	17.03.22	AJD	Updated to suit Planning Condition 3	SRM

Issue Status

FOR APPROVAL

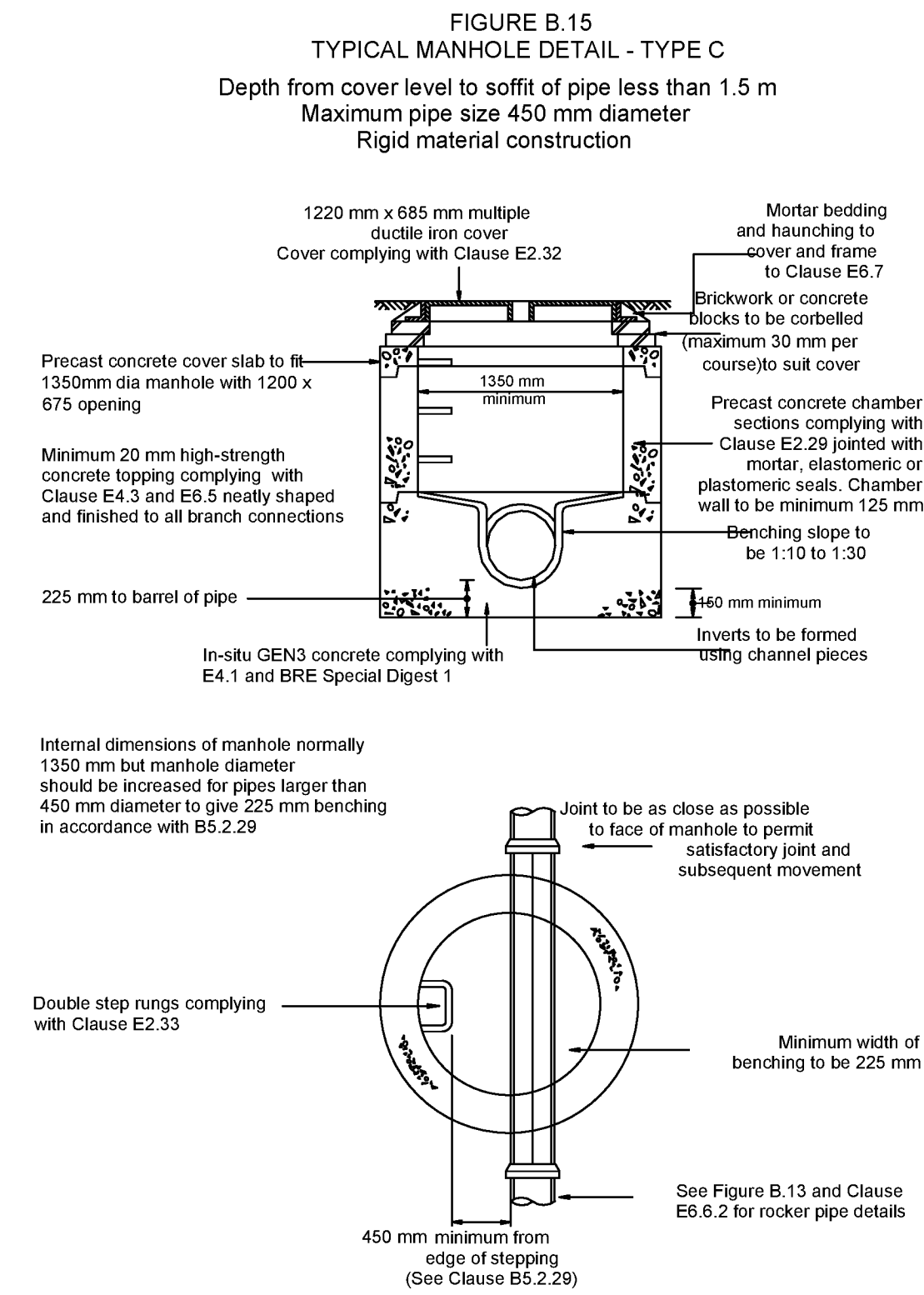


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CLIENT
DPS Limited
PROJECT
Wicks Farm - East, Ford Lane

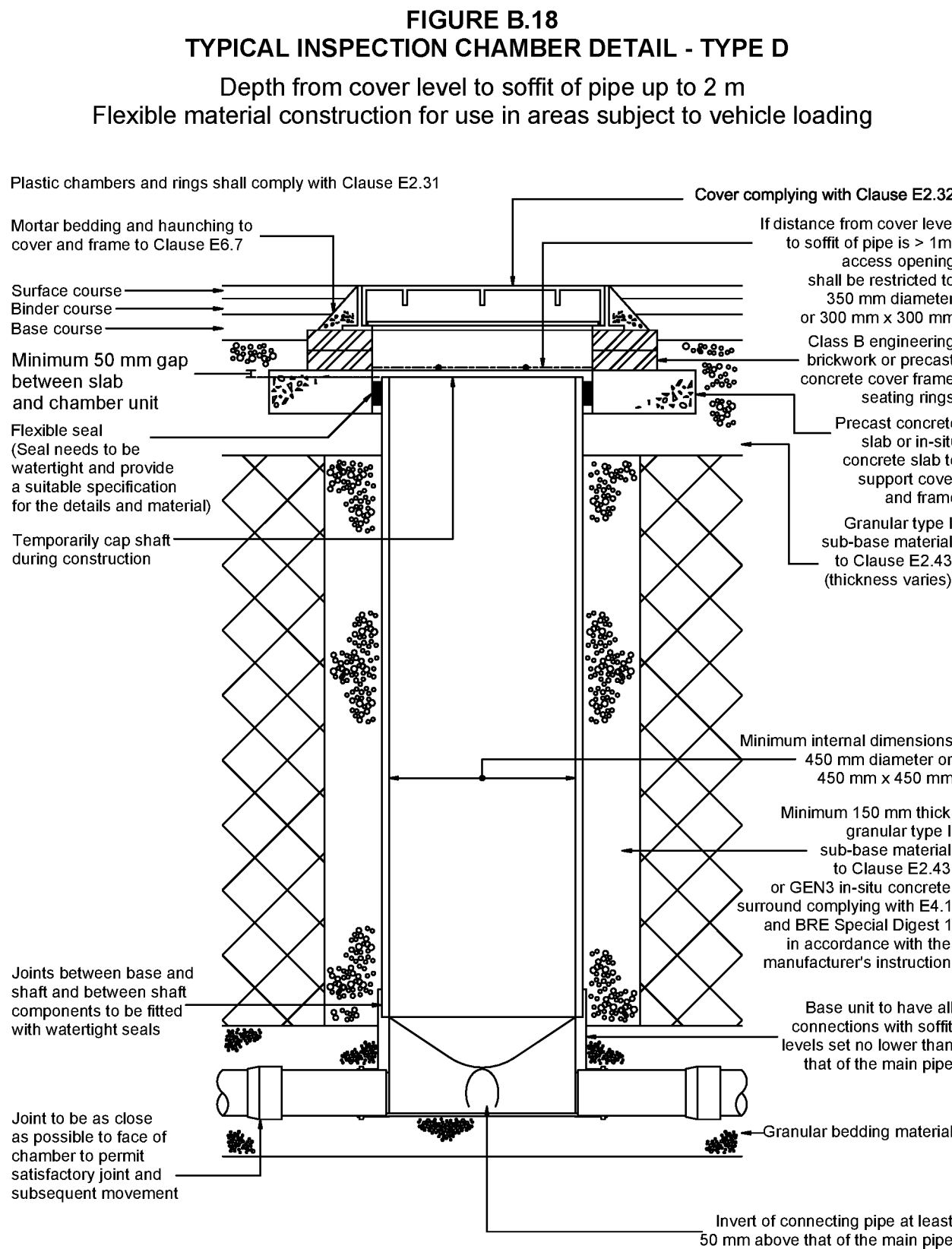
TITLE
Site Layout - Proposed Drainage And Levels

DRAWN A Davies	DATE Feb 2022	PROJECT NO. 23482
ENGINEER S Magowan	CHECKED SRM	REV C
SCALE 1:500 @ A1, 1:1000 @ A3	DWG NO. 101	



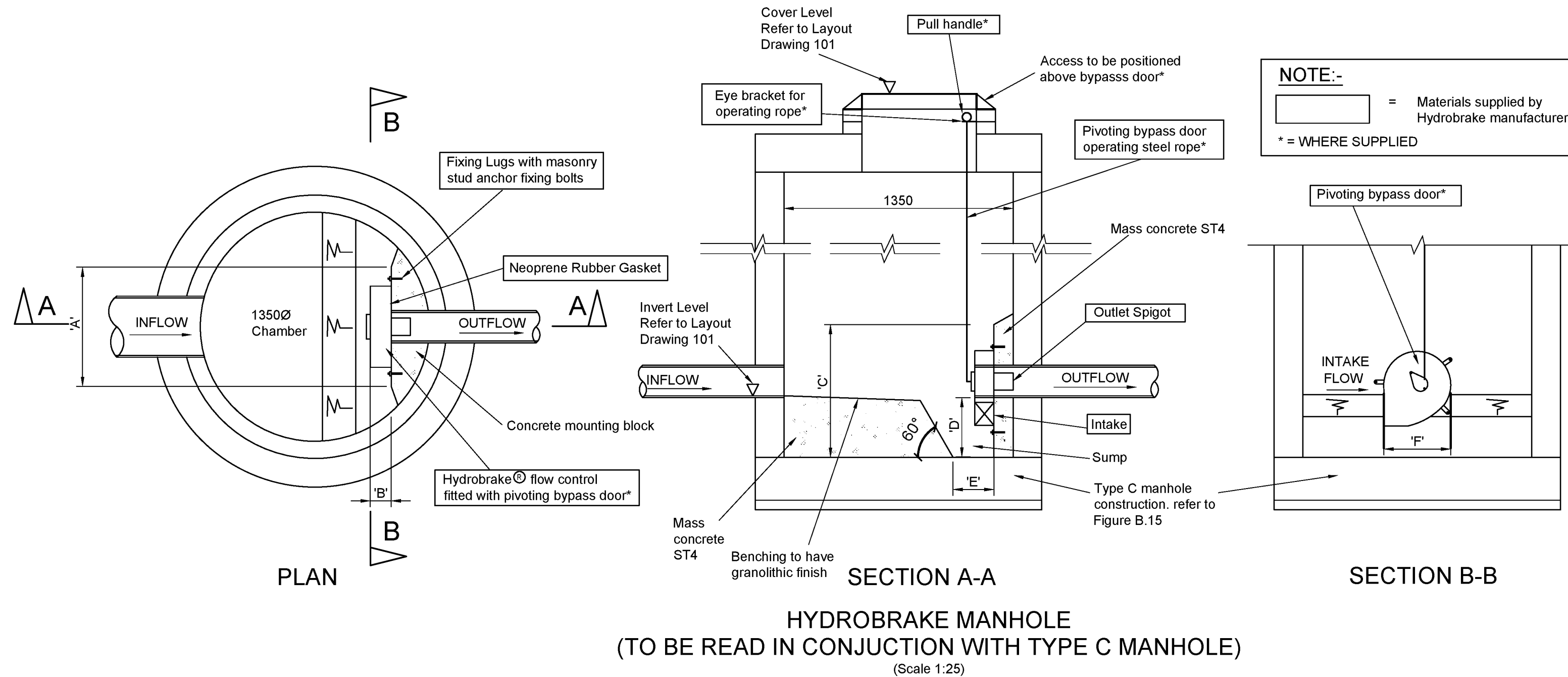
Note: The use of precast concrete chamber units to E2.29 with 150 mm GEN3 in-situ concrete complying with E4.1 and BRE Special Digest 1 in place of brickwork construction is permitted.

Not to scale



Note: Where the access chamber is in the highway (including any footway), the highway authority can have specific requirements.

Not to scale

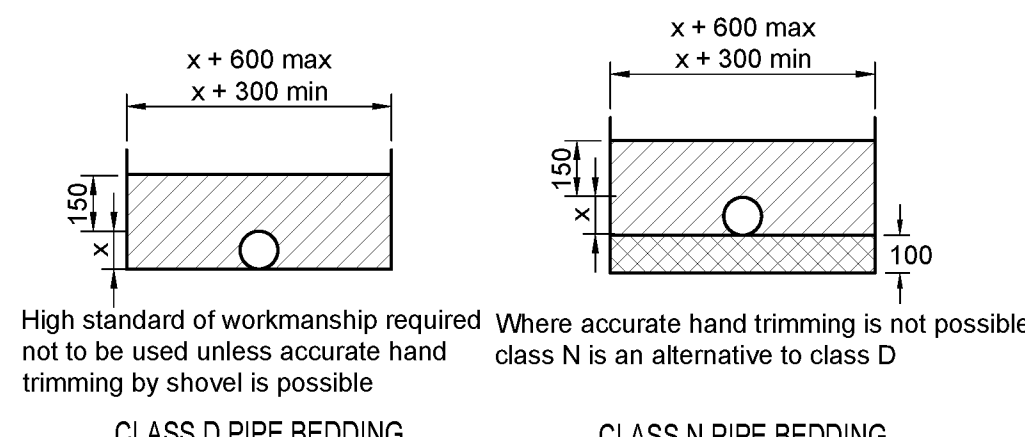


NOTE:-
[Symbol] = Materials supplied by Hydrobrake manufacturer
* = WHERE SUPPLIED

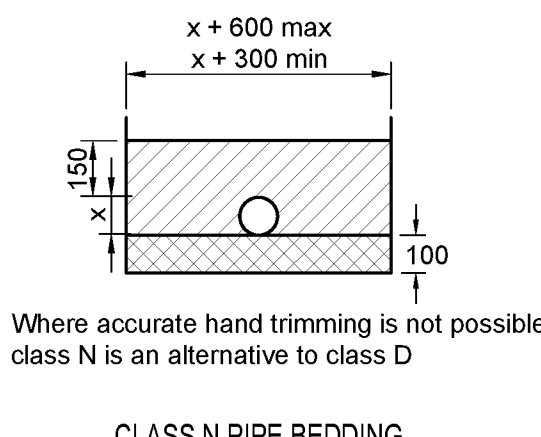
Hydrobrake HB01 SHE-0076-2000-0375-2000 manhole dimensions	
Ref	Dimension mm
'A'	475
'B'	85
'C'	615
'D'	255
'E'	170
'F'	270

Note: All dimensions and specifications shall be confirmed with manufacturer prior to construction

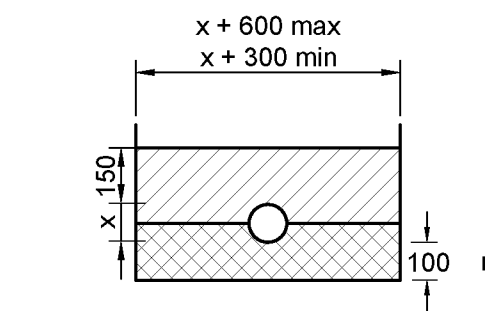
Hydrobrake HB02 SHE-0084-2600-0503-2600 manhole dimensions	
Ref	Dimension mm
'A'	530
'B'	90
'C'	675
'D'	275
'E'	180
'F'	325



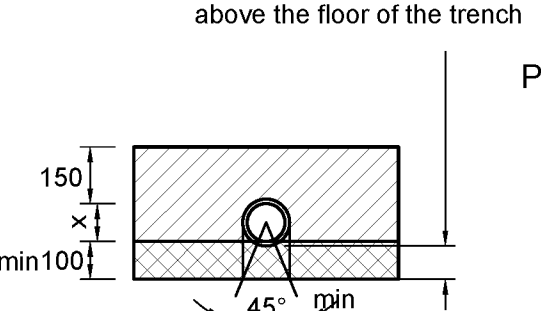
CLASS D PIPE BEDDING



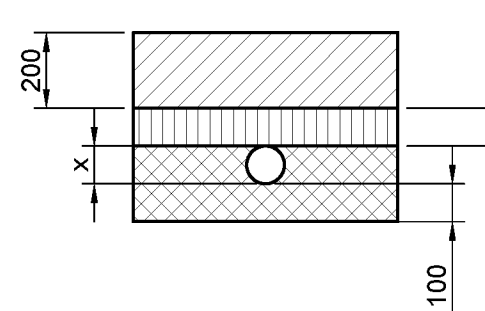
CLASS N PIPE BEDDING



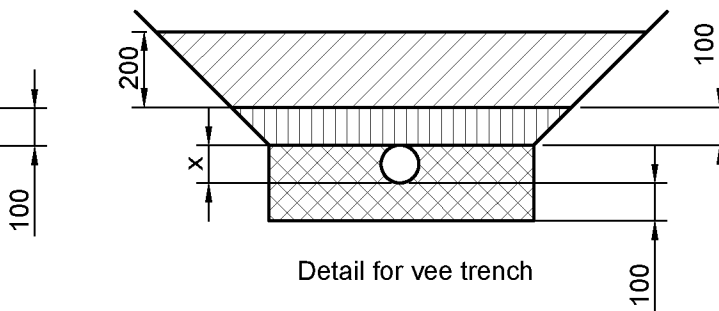
CLASS B PIPE BEDDING



CLASS F PIPE BEDDING



PIPE BEDDING FOR RIGID APPLIES (NON ADOPTIVE DRAINS)



PIPE BEDDING FOR FLEXIBLE PIPES

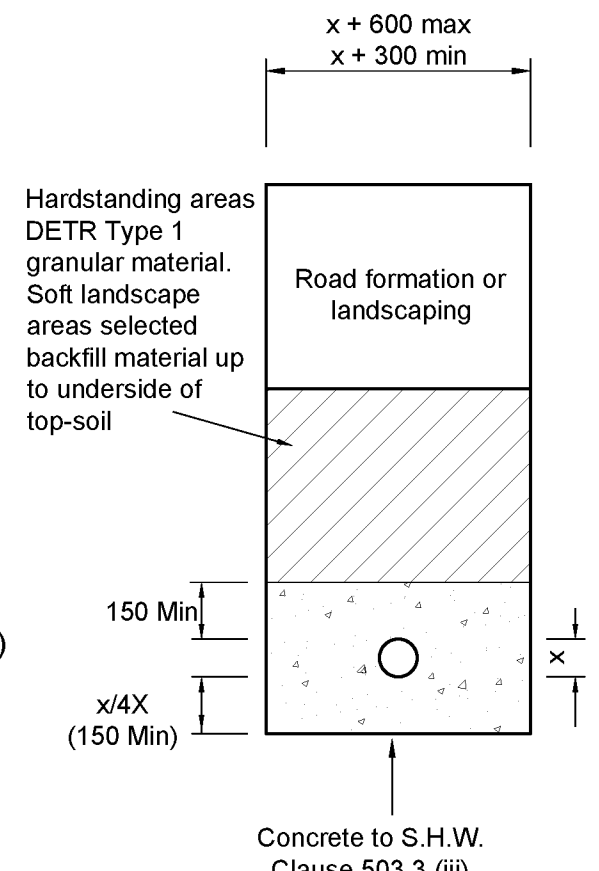
PIPE BORE	BEDDING CLASS	Fields and gardens		Light traffic roads		Heavy traffic roads	
		MIN	MAX	MIN	MAX	MIN	MAX
100mm	D or N F B	0.4 0.3 0.3	4.2 5.8 7.4	0.7 0.5 0.4	4.1 5.8 7.4	0.7 0.5 0.4	3.7 5.5 7.2
150mm	D or N F B	0.6 0.6 0.6	2.7 3.9 5.0	1.1 0.7 0.6	2.5 3.8 5.0	-- 0.7 0.6	-- 3.3 4.6
225mm	D or N F B	-- 0.6 0.6	-- 2.5 3.3	-- 1.2 0.8	2.1 3.2	-- 0.9	-- 2.4

PIPE BEDDING FOR RIGID APPLIES (NON ADOPTIVE DRAINS)

LEGEND:

- Selected fill: free from stones larger than 40mm, lumps of clay over 100mm, timber frozen material and vegetable matter
- Granular material: should conform to BS 882:1983 table 4 or BS8301:1985 Appendix D. Compaction fraction > 0.3 for class N > 0.2 for class F and B.
- Selected fill or granular fill free from stones larger than 40mm
- 'x' - Denotes external pipe diameter.

PIPE BEDDING DETAILS
(NON ADOPTABLE DRAINS)
(Not To Scale)



CLASS Z PIPE BEDDING
COVER LESS THAN 1.2m IN VEHICULAR LOADING
(Scale 1:25)

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DRAINAGE NOTES:

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- All Adoptable sewers shall be in strict accordance with the SSG Appendix C - Design and Construction Guidance. Unless otherwise stated adoptable sewers shall be 150mm diameter and shall be laid in a class S bedding. Where the depth to soffit is less than 1.2m under a public highway or 0.5m elsewhere the pipe shall be laid with a class Z bedding.
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- Where a pipe is within 1m of a foundation the trench shall be filled with class GEN 3 concrete up to the lowest level of the foundation. Where the trench is further than 1m from the foundation, the trench shall be filled with class GEN 3 concrete to a level below the lowest level for the foundation equal to the distance from the foundation less 150mm. In both cases the pipe shall be bedded and surrounded in 150mm thick class GEN 3 concrete.
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B	09.05.22	AJD	Updated to suit F/7/21/PL Planning Condition 3 and 5	SRM
A	17.03.22	AJD	Updated to suit Planning Condition 3	SRM
REV	DATE	BY	DESCRIPTION	CHK

Issue Status
FOR APPROVAL

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CLIENT
DPS Limited

PROJECT
Wicks Farm - East, Ford Lane

TITLE
Construction Details

DRAWN
A Davies

DATE
Feb 2022

PROJECT NO.
23482

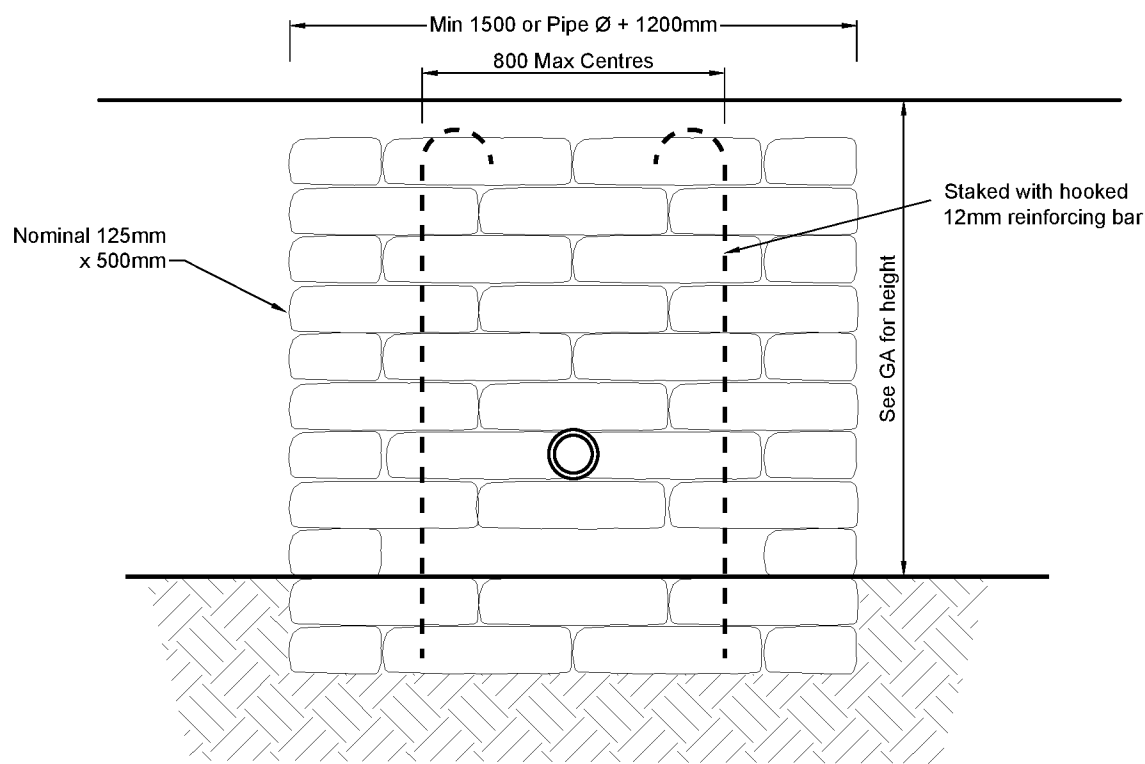
ENGINEER
S Magowan

CHECKED
SRM

REV
501

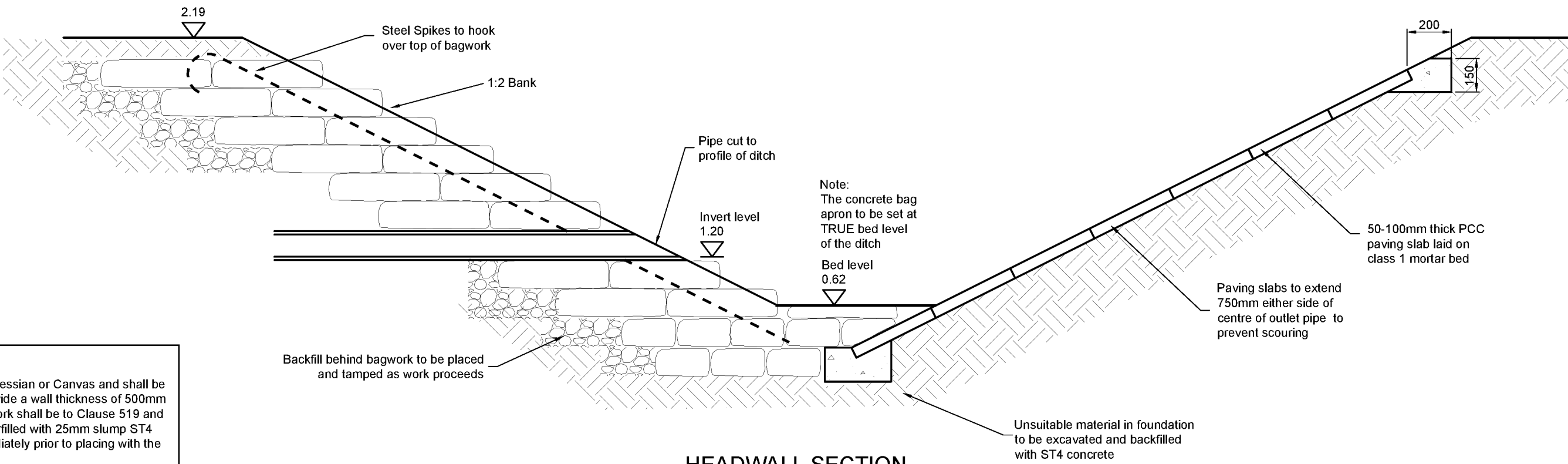
SCALE
As Shown @ A1

10 0 10 20 30 40mm

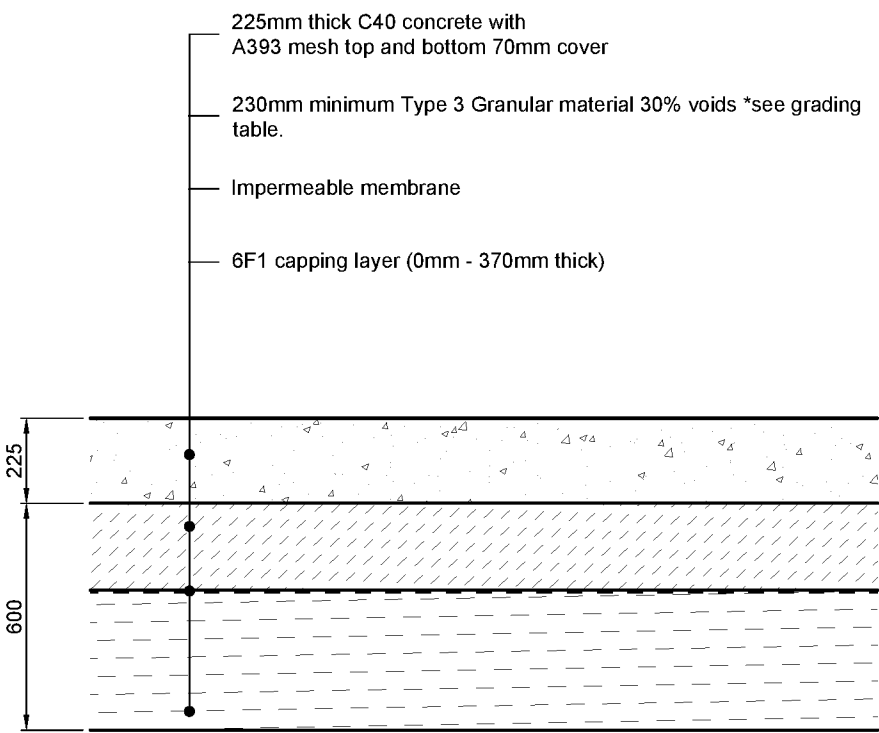


ELEVATION OF HEADWALL
OUTFALL TO SIDE OF EXISTING DITCH
(Scale 1:20)

- Notes
1. Bags shall be Hessian or Canvas and shall be of a size to provide a wall thickness of 500mm
 2. Concrete bagwork shall be to Clause 519 and be three quarterfilled with 25mm slump ST4 concrete immediately prior to placing with the end seams
 3. The bags shall be placed in a modified Flemish bond so as to 'break joint' with the mouths away from the surface and be tamped into position to form a rectangular block.
 4. Extent of outlet protection to be the greater of 1500mm or pipe diameter + 1200mm spanning the outlet pipe.
 5. All exposed pipework to be certified UV stable



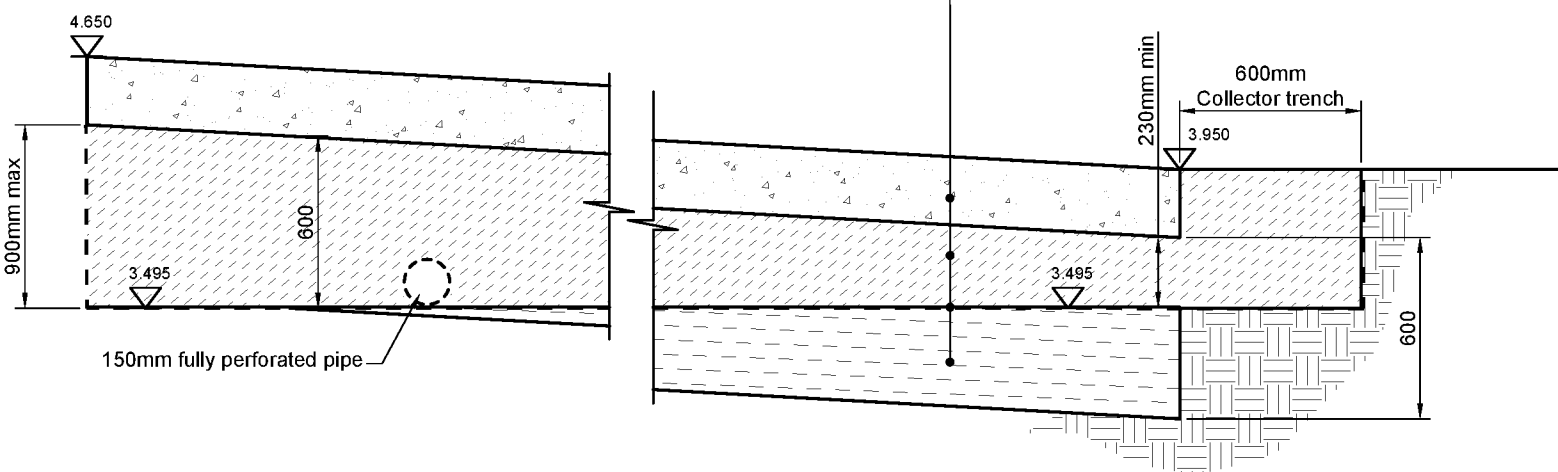
HEADWALL SECTION
OUTFALL TO SIDE OF EXISTING DITCH
(Scale 1:20)



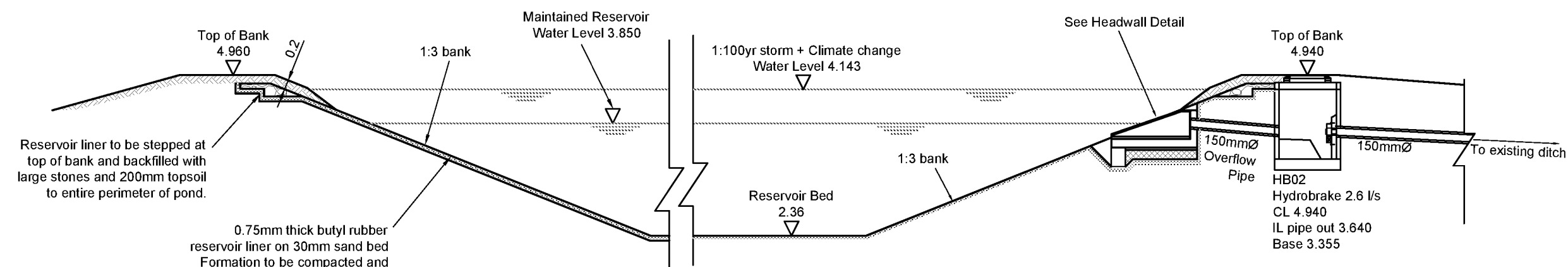
CONCRETE YARD
CONSTRUCTION
(Scale 1:20)

Grading of Sub-base stone	
SEIVE SIZE	% PASSING
100mm	100
80mm	80-100
50mm	60-80
20mm	15-50
10mm	0-5

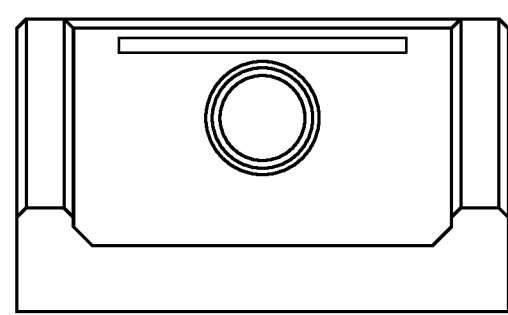
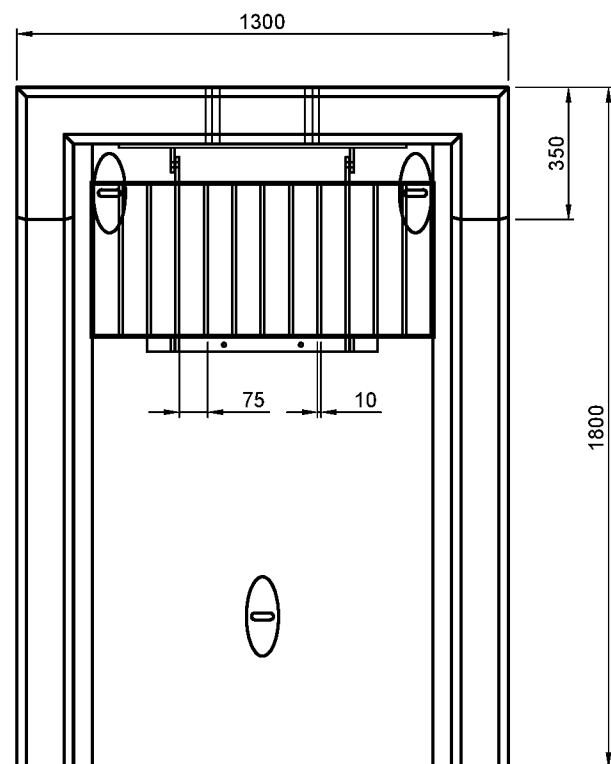
NOTES
Supplied by WTB Geotextiles or UGS
To be installed in accordance with the
manufacturers instructions
www.geotechnics-uk.com
Tel: 0845 800 5505
Email: geotechnics@wtbgroup.com



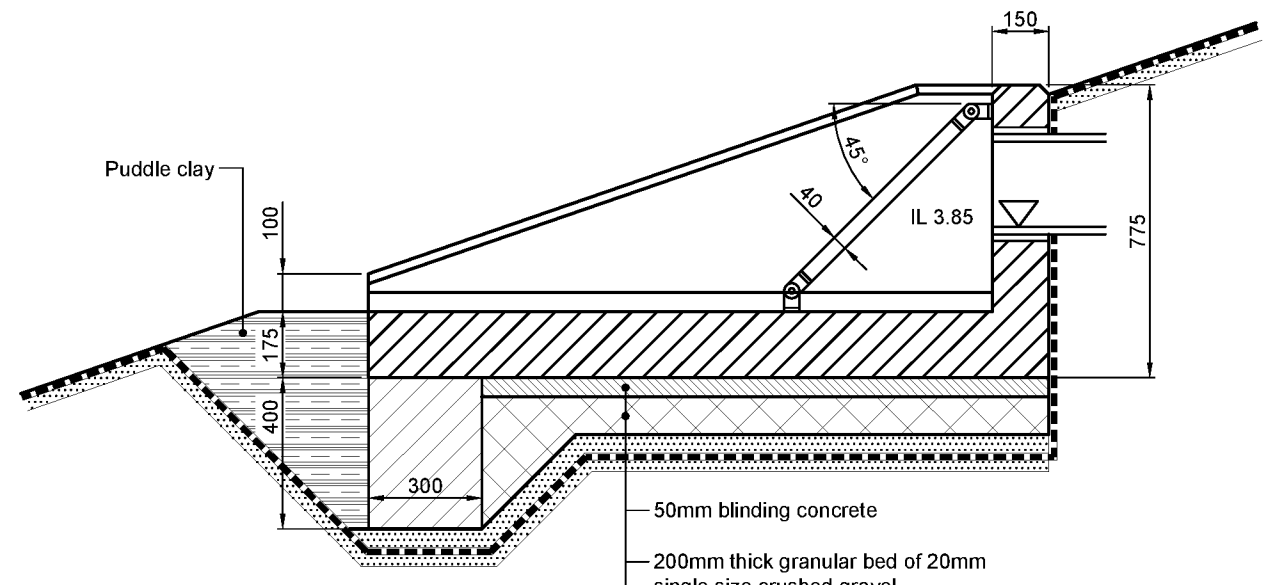
CONCRETE YARD SECTION
(Scale 1:20)



RESERVOIR SECTION
(Scale 1:100)



Grating manufactured from 40 x 10 flat. Unit fully welded then hot dip galvanised.



POND OUTLET HEADWALL
ALTHON HEADWALL RSFA12A
(Scale 1:20)

10 0 10 20 30 40mm

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DRAWN	DATE	PROJECT NO.	
A Davies	Feb 2022		23482
ENGINEER	CHECKED	DWG NO.	REV
S Magowan	SRM	502	B
SCALE	As Shown @ A1		

Technical Specification

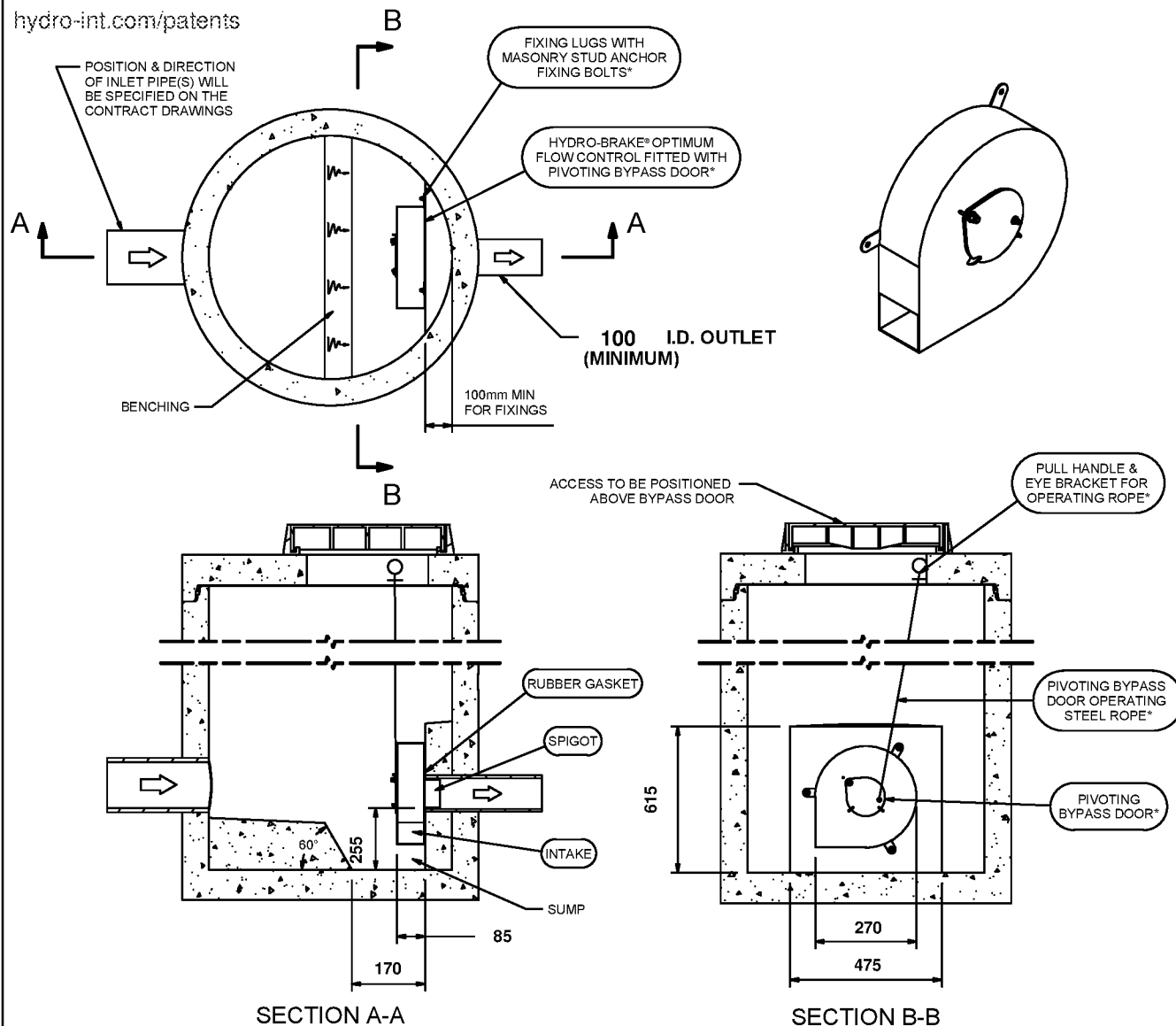
Control Point	Head (m)	Flow (l/s)
Primary Design	0.375	2.000
Flush-Flo™	0.121	1.997
Kick-Flo®	0.272	1.732
Mean Flow		1.657

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



hydro-int.com/patents



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-0076-2000-0375-2000 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 3/17/2022 9:35 AM

SITE Wicks East

DESIGNER Paul Reynolds

REF Hb01

SHE-0076-2000-0375-2000

Hydro-Brake® Optimum

© 2022 Hydro International Ltd, Shearwater House, Clevedon Hall Estate, Victoria Road, Clevedon, E

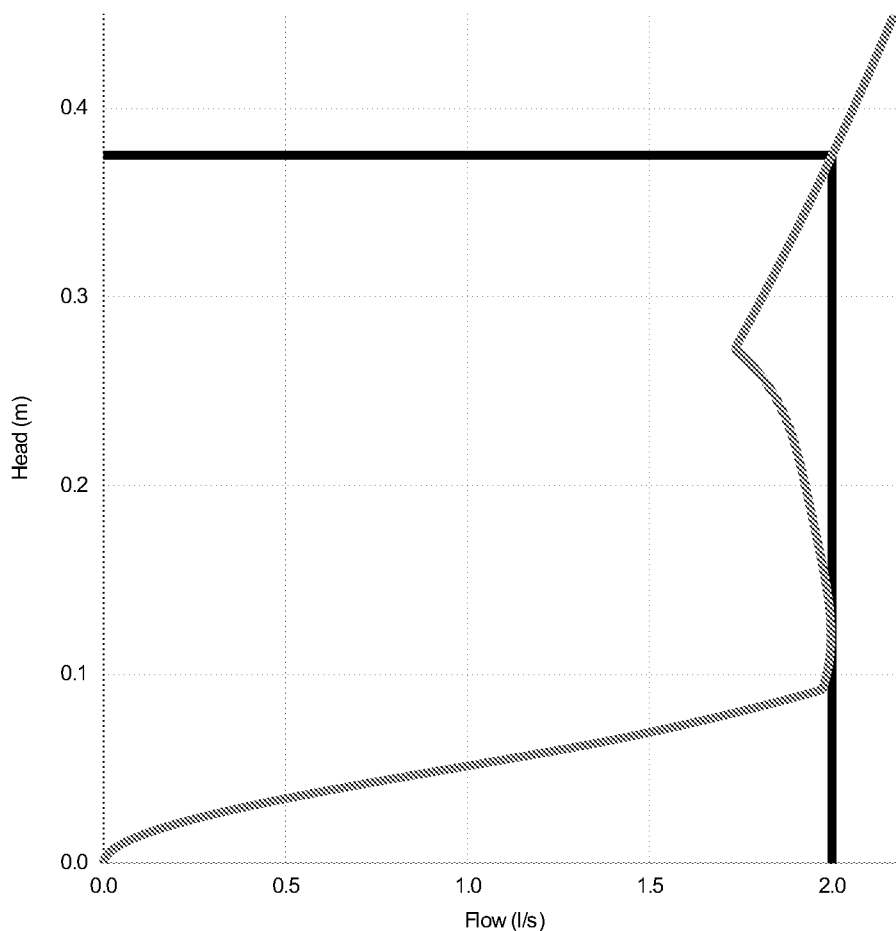
paul@civil.co.uk

Technical Specification

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Kick-Flo®	0.272	1.732
Mean Flow		1.657



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.013	0.080
0.026	0.301
0.039	0.625
0.052	1.007
0.065	1.383
0.078	1.689
0.091	1.949
0.103	1.989
0.116	1.997
0.129	1.996
0.142	1.988
0.155	1.977
0.168	1.963
0.181	1.949
0.194	1.934
0.207	1.919
0.220	1.901
0.233	1.879
0.246	1.848
0.259	1.803
0.272	1.739
0.284	1.767
0.297	1.802
0.310	1.837
0.323	1.871
0.336	1.904
0.349	1.936
0.362	1.968
0.375	2.000

DESIGN ADVICE



The head/flow characteristics of this SHE-0076-2000-0375-2000 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 17/03/2022 09:35

Site Wicks East

DESIGNER Paul Reynolds

Ref Hb01

SHE-0076-2000-0375-2000

Hydro-Brake Optimum®

Technical Specification

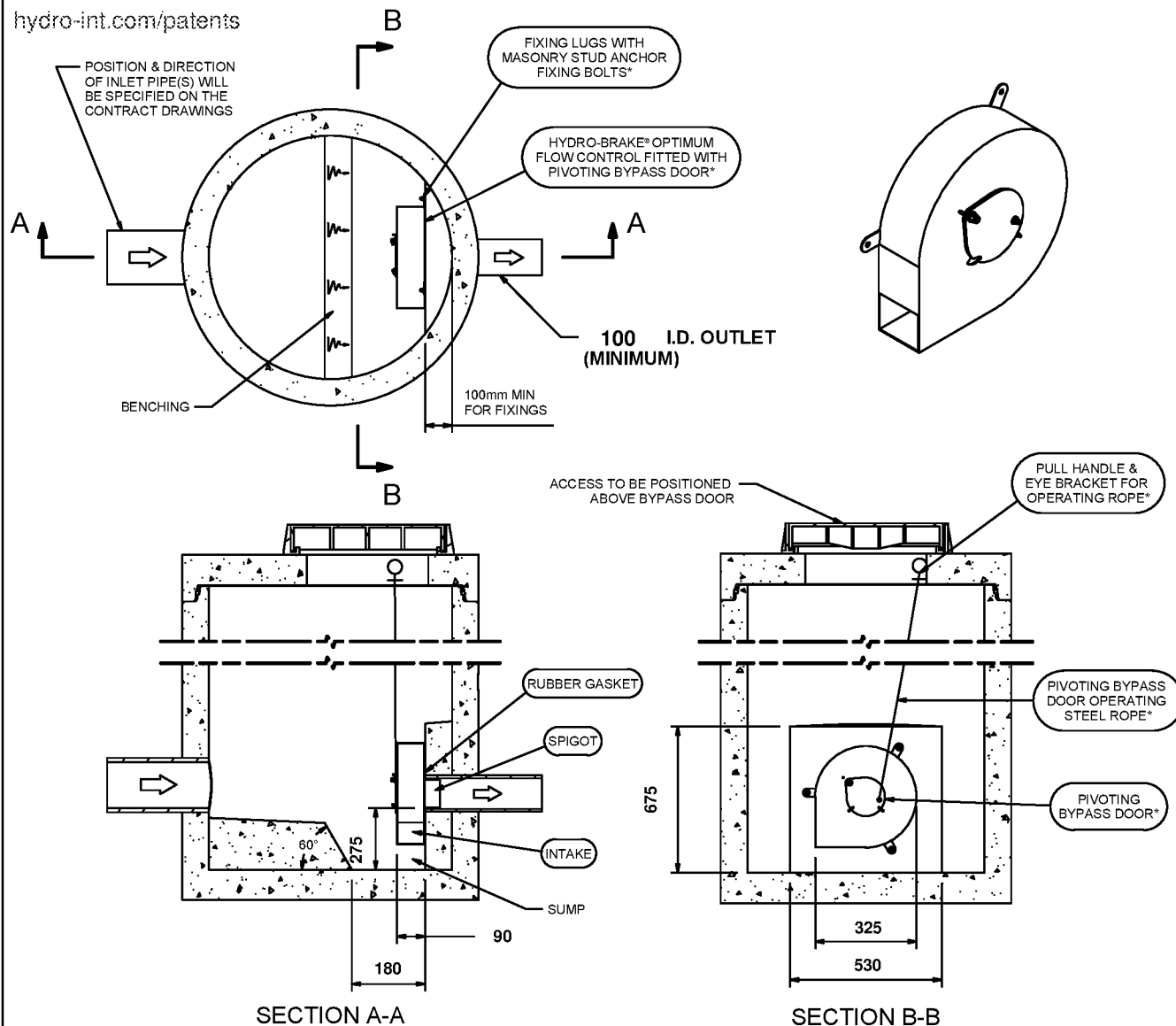
Control Point	Head (m)	Flow (l/s)
Primary Design	0.503	2.600
Flush-Flo™	0.154	2.599
Kick-Flo®	0.354	2.215
Mean Flow		2.203

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



hydro-int.com/patents



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-0084-2600-0503-2600 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 3/17/2022 11:07 AM

SITE Wicks East

DESIGNER Paul Reynolds

REF Hb02

SHE-0084-2600-0503-2600

Hydro-Brake® Optimum

© 2022 Hydro International Ltd, Shearwater House, Clevedon Hall Estate, Victoria Road

paul@civil.co.uk

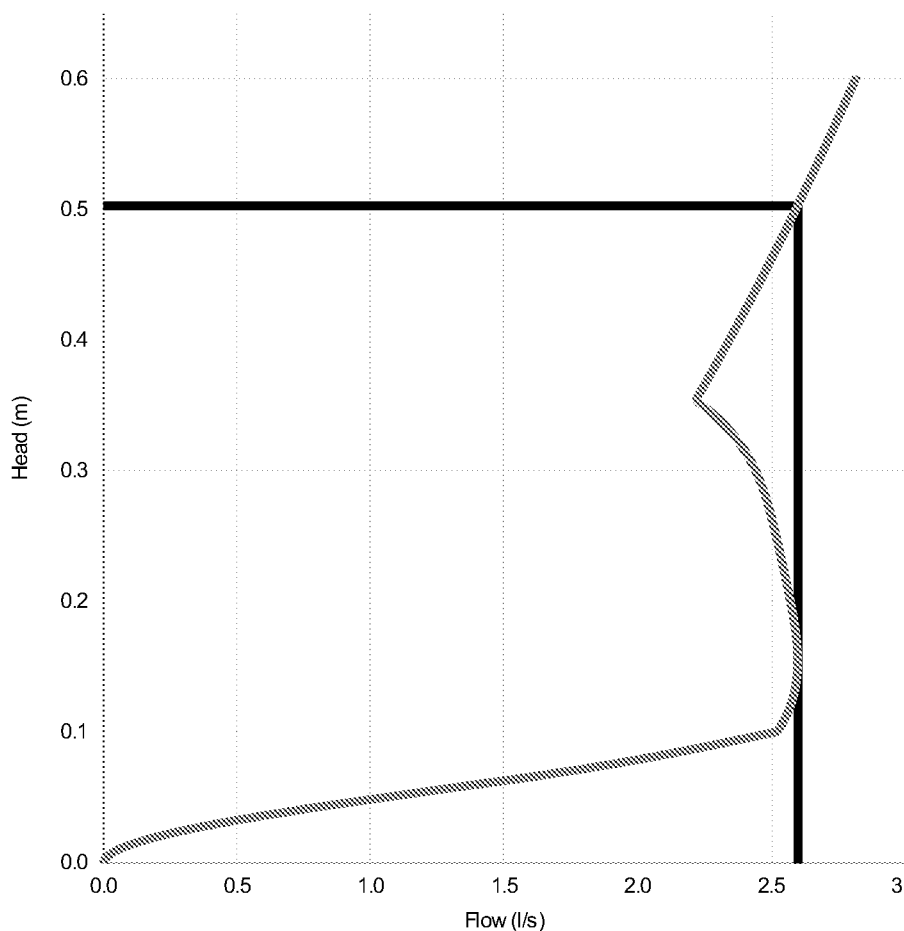
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	0.503	2.600
Flush-Flo	0.154	2.599
Kick-Flo®	0.354	2.215
Mean Flow		2.203



PT/329/0412

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Head (m)	Flow (l/s)
0.000	0.000
0.017	0.150
0.035	0.552
0.052	1.115
0.069	1.713
0.087	2.196
0.104	2.533
0.121	2.574
0.139	2.594
0.156	2.599
0.173	2.593
0.191	2.581
0.208	2.564
0.225	2.546
0.243	2.527
0.260	2.507
0.278	2.483
0.295	2.453
0.312	2.411
0.330	2.350
0.347	2.263
0.364	2.245
0.382	2.292
0.399	2.339
0.416	2.384
0.434	2.429
0.451	2.472
0.468	2.515
0.486	2.557
0.503	2.598

DESIGN ADVICE



The head/flow characteristics of this SHE-0084-2600-0503-2600 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 17/03/2022 11:07

Site Wicks East

DESIGNER Paul Reynolds

Ref Hb02

SHE-0084-2600-0503-2600

Hydro-Brake Optimum®

Downstream Defender® Select

Meet stormwater quality objectives with customised treatment performance

Product Summary

The Downstream Defender® Select is the **new generation of advanced hydrodynamic vortex separator** for treatment of urban surface water runoff. Its customisable performance and extended range of chamber sizes allows engineers to tailor their drainage designs to meet specific pollutant removal standards.

The Downstream Defender® Select also offers easier installation with much more flexibility of pipe sizes and connections and can accept up to three inlets.

Applications

Treat runoff from any impermeable surfaces:

- » Highways
- » Car parks
- » Industrial areas
- » Pre-treatment for natural SuDS features (such as swales and ponds).
- » For use with other natural SuDS treatment to meet required performance standards.
- » Retrofit surface water treatment for space-constrained urban areas.

Benefits

Customise performance to suit site stormwater quality objectives

Engineers can meet stormwater quality objectives with customisable performance and the ability to work alongside other treatment solutions such as ponds, swales and constructed wetlands.

Cut costs with more specific sizing for performance

The Downstream Defender® Select is offered in an extended range of chamber sizes helping engineers match flow rates and removal rates more cost-effectively.

Save money with improved connectivity

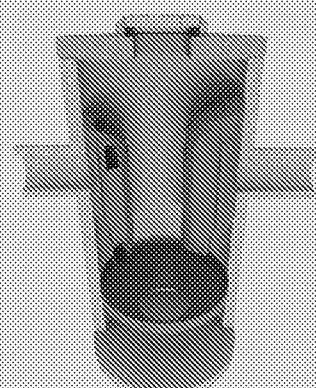
The Downstream Defender® Select can accept up to three inlets and a wider range of connecting pipe sizes, helping to make design and installation on site easier and cheaper.

Downstream Defender® Select Options

Engineers can select from three models, depending on the level of treatment required.

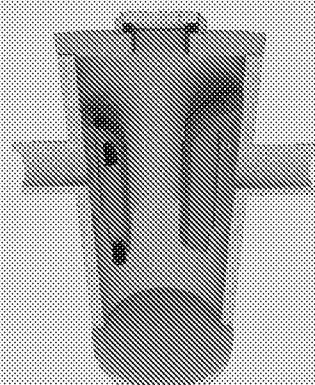
Advanced Vortex

Our recommended model which provides sediments, litter and hydrocarbon (oil) removal with enhanced sediment retention up to four times the treatment flow rate.



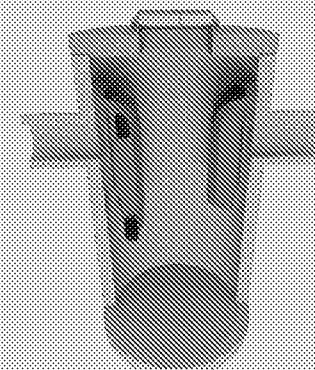
Vortex Plus

Provides sediments, litter and hydrocarbon (oil) removal, with sediments retained at up to two times the treatment flow rate.



Vortex

A simpler model providing removal of sediments, with retention up to two times the treatment flow rate.

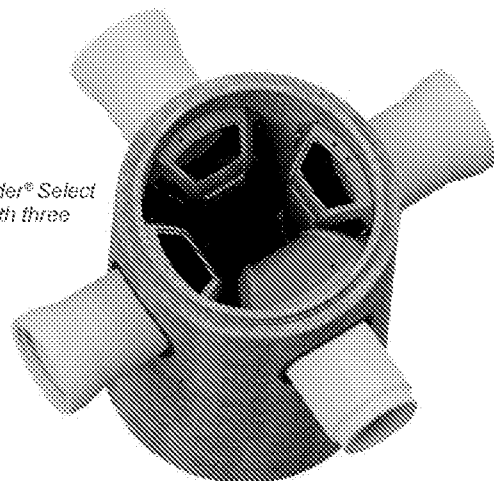


Find out more about how the Downstream Defender® Select can help you meet your planning and stormwater quality objectives:

Technical information

- » Selectable performance levels for pollutant targets and retention.
- » Extended range of chamber sizes.
- » Can accept up to three inlet pipes.
- » Can accept a range of pipe sizes.
- » No moving parts and no power requirement.
- » Available in concrete or plastic chambers.

Downstream Defender® Select Advanced Vortex with three inlet pipes.



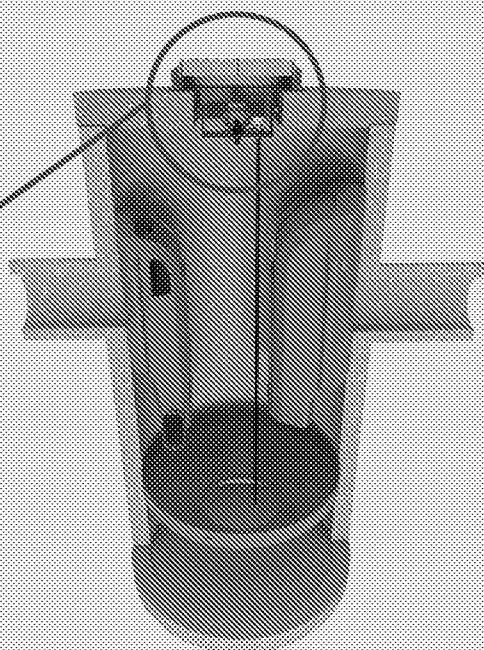
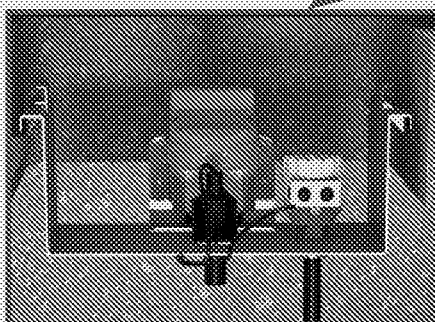
Enhancement Options

Make Maintenance Smart

To help with SuDS maintenance plans and to ensure that maintenance is cost-effective, add Hydro-Logic® Smart Monitoring to any model and **get automated maintenance alerts**.

Hydro-Logic® Smart Monitoring can also **reduce risk and save costs** by reducing the need for inspection visits for units installed alongside roads or rail tracks.

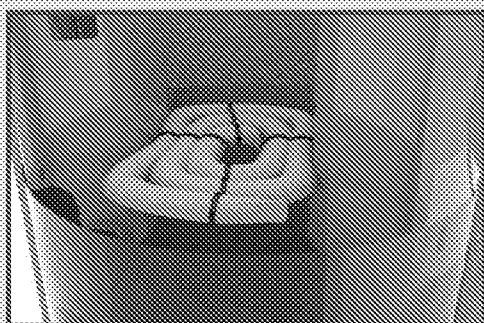
The ATEX/IECEX rated logger and sensors capture real-time data for flow levels and/or sediment build-up. Level monitoring will enable the detection of blockages relating to the unit, and sediment level monitoring can be set to a trigger point and **self-report to the client's maintenance team when maintenance is due**.



Improve hydrocarbon retention

The option of storing hydrocarbons (oils) as solids can be added, **providing increased retention**, even at flow rates where the unit is bypassing.

This option is available for the Advanced Vortex and Vortex Plus models only.



Hydro
International

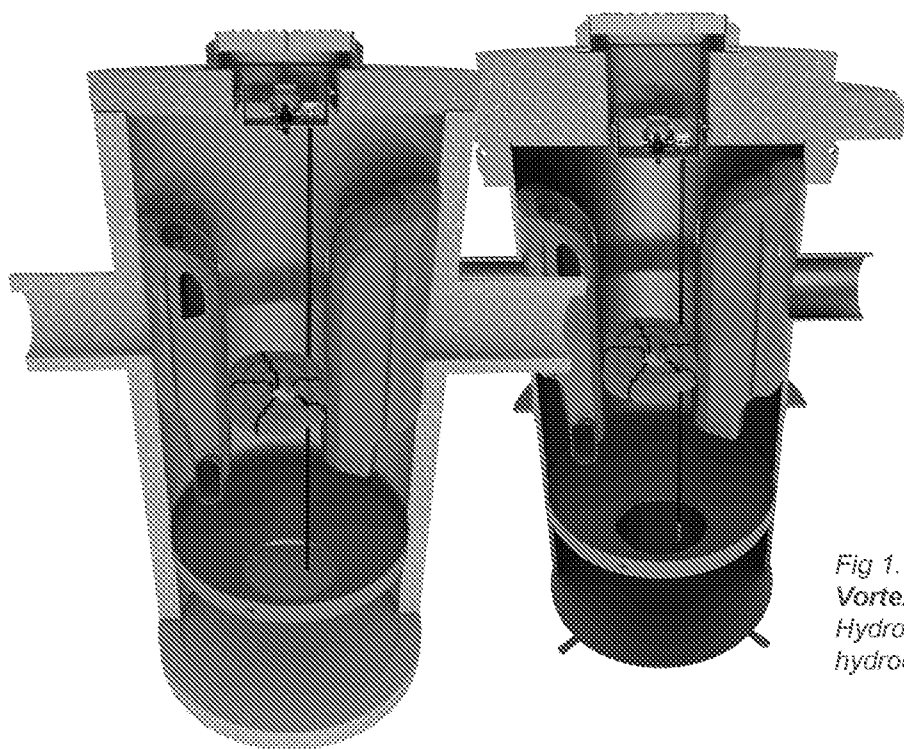
Hydro International, Shearwater House,
Clevedon Hall Estate, Victoria Road,

Patent: www.hydro-int.com/patents



Design your own Downstream Defender® Select with the free online design tool at:

The Downstream Defender® Select is the new generation of advanced hydrodynamic separator for treatment of urban surface water runoff. Its customisable performance and extended range of chamber sizes allows engineers to tailor their drainage designs to meet specific pollutant removal standards. The Downstream Defender® Select also offers easier installation with much more flexibility of pipe sizes and connections and can accept up to three inlets.



Key Features

- » Selectable performance levels for pollutant targets and retention.
- » Extended range of chamber sizes.
- » Can accept up to three inlet pipes.
- » Can accept a range of pipe sizes.
- » No moving parts and no power requirement.
- » Available in concrete or plastic chambers.

Fig 1. Downstream Defender® Select. Advanced Vortex models in concrete and plastic shown with Hydro-Logic® Smart Monitoring and enhanced hydrocarbon (oil) retention options.

Targeted pollutant removal

The Downstream Defender® Select performance can be tailored to remove some or all of the following pollutants:

Sediment (Total Suspended Solids)



The Downstream Defender® Select is a highly effective sediment/TSS removal device. It can be sized in a number of ways to suit the application and level of protection required (see Table 2).

Gross Pollutants



100% removal of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons.

Sediment Bound Hydrocarbons (including Polycyclic Aromatic Hydrocarbons - PAHs)



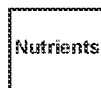
PAHs have low solubility in water and are readily adsorbed onto sediment particles. Effective removal of sediment particles will also ensure the removal of many PAHs.

Liquid Hydrocarbons (oils)



Effective spill containment device that meets the BS EN 858-1:2002 Class I and Class II effluent targets at low flow rates. Note these systems are not considered oil separators according to the BS EN 858-1 and must not be used in applications where full certification is required.

Sediment Bound Heavy Metals and Nutrients



As an efficient device for removal of fine sediment, the Downstream Defender® Select is also effective for the removal of sediment bound pollutants.

Downstream Defender® Select model options

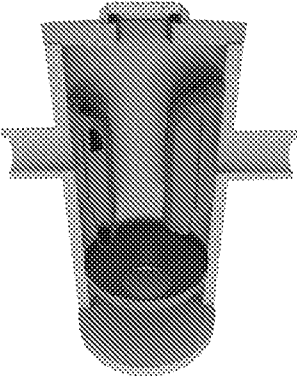
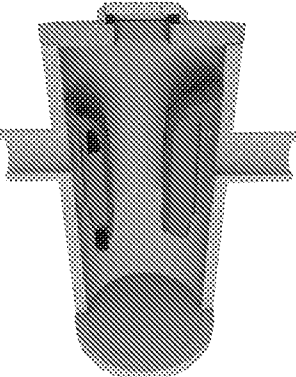
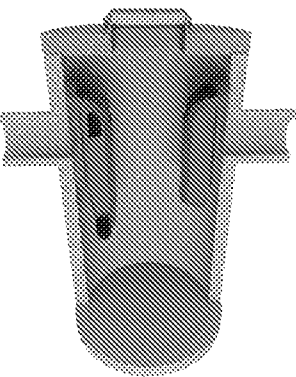
Downstream Defender® Select Model			
	Advanced Vortex	Vortex Plus	Vortex
	Our recommended model which provides sediments, litter and hydrocarbon (oil) removal with enhanced sediment retention up to four times the treatment flow rate.	Provides sediments, litter and hydrocarbon (oil) removal, with sediments retained at up to two times the treatment flow rate.	A simpler model providing removal of sediments, with retention up to two times the treatment flow rate.
			
Key Pollutants			
Sediments	Coarse and fine	Coarse and fine	Coarse and fine
Sediment retention	Retained up to 4 x treatment flow rate	Retained up to 2 x treatment flow rate	Retained up to 2 x treatment flow rate
Litter, debris	✓	✓	✗
Liquid hydrocarbons (oils)	✓	✓	✗
Hydrocarbon (oil) retention	Option for increased retention on request	Option for increased retention on request	✗
Sediment bound metals	✓	✓	✓

Table 1 - Downstream Defender® Select pollutant removal performance

The Downstream Defender® Select may be sized for different target particle sizes and removal efficiencies – contact us for site specific design.

Enhancement Options

Make Maintenance Smart

To help with SuDS maintenance plans and to ensure that maintenance is cost-effective, add Hydro-Logic® Smart Monitoring to any model and get automated maintenance alerts.

Hydro-Logic® Smart Monitoring can also reduce risk and save costs by reducing the need for inspection visits for units installed alongside roads or rail tracks.

The ATEX/IECEX rated logger and sensors capture real-time data for flow levels and/or sediment build-up. Level monitoring will enable the detection of blockages relating to the unit, and sediment level monitoring can be set to a trigger point and self-report to the client's maintenance team when maintenance is due.

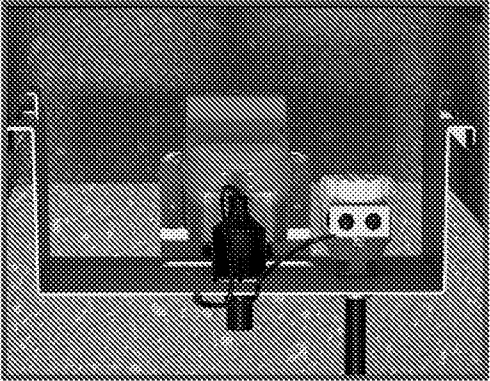


Fig 2. Downstream Defender® Select Hydro-Logic® Smart Maintenance. Available for all models.

Improve hydrocarbon retention

The option of storing hydrocarbons (oils) as solids can be added, providing increased retention, even at flow rates where the unit is bypassing.

This option is available for the Advanced Vortex and Vortex Plus models only.

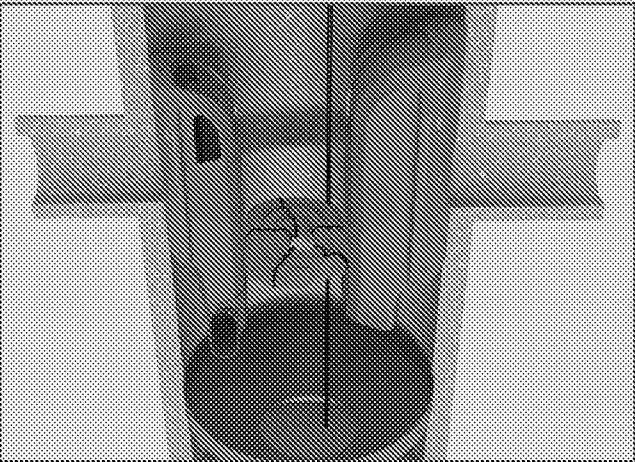


Fig 3. Enhanced hydrocarbon (oil) retention option for the Downstream Defender® Select. Available for the Advanced Vortex and Vortex Plus models only.

Pollutant retention

It is important to ensure that pollutants in a rainfall event are retained throughout subsequent events. The Downstream Defender® Select offers engineers the option of specifying the retention performance of sediments. The Vortex and Vortex Plus models provide sediment retention up to twice the treatment flow rate, and the Advanced Vortex, with its benching skirt creating a calm sediment storage zone, provides sediment retention up to four times the treatment flow rate.

An option for enhancing the retention of hydrocarbons (oils) by storing them as a solid is available, ensuring no wash out during extremely high flows. This option is only available for the Advanced Vortex and Vortex Plus models

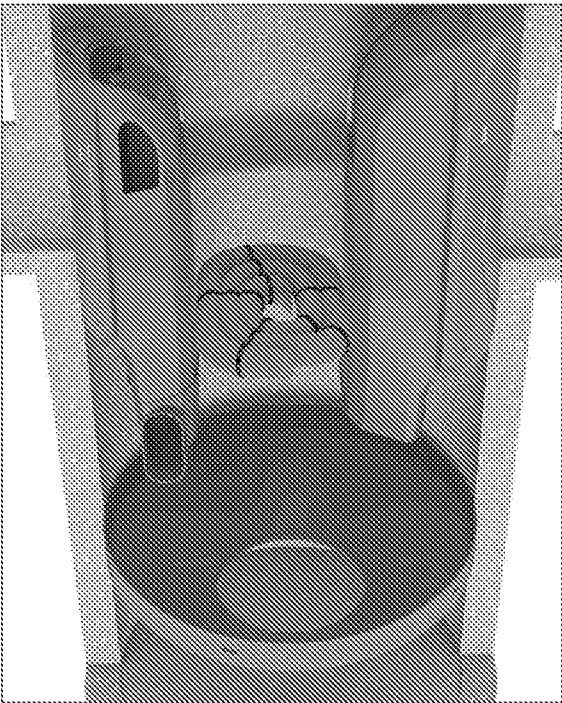


Fig 4. Downstream Defender® Select with enhanced sediment retention and enhanced hydrocarbon (oil) retention options.

The Simple Index Approach (SIA)

The Simple Index Approach outlined in CIRIA C753 The SuDS Manual is a water quality design method for sites with a low to medium risk pollution hazard level. Sites with a high risk pollution hazard level should consider a more precautionary approach.

The approach assigns pollution hazard indices to the given land use for three pollutant groups, total suspended solids (TSS), metals and hydrocarbons. SuDS components are then selected until their combined pollution mitigation index score is greater than the pollution hazard index for each pollutant group.

Model	Downstream Defender® Select Mitigation Indices (a)(b)		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons (Oils)
Vortex	0.3	0.2	0.2
Vortex Plus	0.5	0.4	0.5
Advanced Vortex	0.5	0.4	0.5

Notes:
(a) All mitigation indices supplied by Hydro International Ltd are independently verified and calculated using the methods laid out in the British Water How To Guide: Applying the CIRIA SuDS Manual Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices. Performance declarations are available on request or on the British Water website.
(b) Mitigation Indices quoted for the Downstream Defender® Select are valid when the unit is designed according to the Treatment Flow Rate (see Table 3).

Table 2 - SuDS Mitigation Indices for Downstream Defender® Select

Sizing a Downstream Defender® Select

The Downstream Defender® can be sized for different treatment goals and objectives. For design purposes, the selected model's Treatment Flow Rate should be greater than or equal to the site's Water Quality Flow Rate.

The hydraulic capacity of the selected model should be considered with respect to the peak discharge flow rate from the site.

If there is no treatment objective, just betterment, do not use a treatment flow rate and only compare the hydraulic capacity to the peak discharge flow rate.

Model diameter (m)	Treatment flow rate (a)(b) (l/s)	Hydraulic capacity (c) with recommended pipe size (l/s)	Hydraulic capacity (d) with maximum pipe size (l/s)	Maximum catchment area m²	Maximum headloss at treatment flow rate (mm)
1.0	21	46	70	2800	160
1.2	30	84	107	4000	170
1.5	48	144	170	6400	220
1.8	69	217	278	9200	230
2.1	94	271	355	12500	240
2.4	123	422	529	16400	250
3.0	192	652	787	25600	260

Notes:
(a) The Treatment Flow Rate is based on an annualised removal efficiency of >50% of all particles up to 1000 microns with a mass-median particle size (D50) of 63 microns and a specific gravity of 2.65. The testing was conducted in line with the British Water Code of Practice.
(b) Alternative sizing based on different sediment grades available on request.
(c) Maximum flow rate that can pass through the chamber with a maximum headloss of 500mm. Figures shown are when using the recommended pipe size in Table 5.
(d) Maximum flow rate that can pass through the chamber with a maximum headloss of 500mm. Figures shown are when using the maximum pipe size in Table 5.

Table 3 - Downstream Defender® Select design information.

Model diameter (m)	Oil Storage Capacity (l)		Minimum sediment storage capacity (c) (m³)
	Minimum liquid hydrocarbon (oil) storage capacity up to Treatment Flow Rate (a)	Solid state storage capacity with enhanced retention option (b)	
1.0	256	43-70	0.31
1.2	442	43-70	0.45
1.5	849	85-140	0.71
1.8	1458	85-140	1.02
2.1	2550	128-210	1.39
2.4	3586	170-280	1.81
3.0	6811	231-350	2.83

Notes:

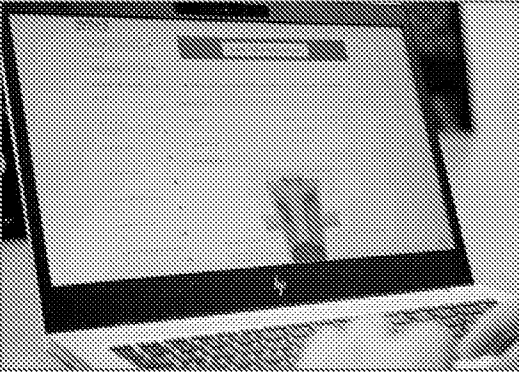
(a) Liquid oil storage capacity is valid up to the Treatment Flow Rate. Oil capture and retention is only available for the Advanced Vortex and Vortex Plus models only.

(b) Permanent oil storage capacity when using the enhanced oil retention option (available for the Advanced Vortex and Vortex Plus models only).

(c) Additional sediment storage capacity for all Downstream Defender® Select models (Advanced Vortex, Vortex Plus and Vortex) can be provided to extend maintenance intervals if required.

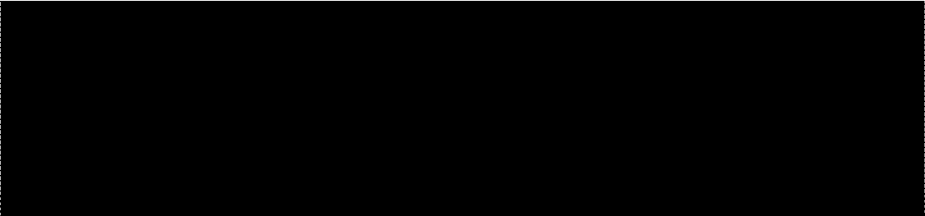
Table 4 - Downstream Defender® Select capacities.

Design your own Downstream Defender® Select with our Online Design Tool



Register free and design your own Downstream Defender® Select and try out different performance objectives.

Project designs can be saved and submitted for a free review by our expert technical team if required. General arrangement drawings and quotes can also be requested from the tool for any saved design.

visit 



Pipe sizes

Downstream Defender® Select can accept a range of inlet / outlet pipe sizes, removing the need for complicated pipe connections or couplers. The inlet pipe size must always be equal to or smaller than the outlet pipe size.

Additional pipe sizes may be accommodated, please contact us for assistance.

Chamber size	1.0 m	1.2 m	1.5 m	1.8 m	2.1 m	2.4 m	3.0 m
Pipe sizes	150	150	300	375	375	500	600
	225 ^{a)}	225	375 ^{a)}	400	400	600 ^{a)}	675 ^{b)}
	300	300 ^{a)}	400	450 ^{a)}	450	675 ^{b)}	750 ^{a)}
		375	450	500	500 ^{a)}	750	900
				600	600		
					675 ^{b)}		

Notes:

a) The recommended pipe size for optimum performance.

b) 675 mm is only available for concrete chambers.

Table 5 - Downstream Defender® Select pipe sizes.

Setting out

The Downstream Defender® Select can accommodate a change in pipe direction to suit site specific requirements and accept up to three inlet pipes.

Pipe angles can be adjusted to suit. Minimum angle between inlets and outlet is 90°.

For ease of installation the Downstream Defender® Select can now accept a range of pipe sizes.

Head loss across the chamber is kept to a minimum (see Table 3). The inlet and outlet pipes should be sized in accordance with Table 5.

Inlet and outlet pipe connections are at the same invert level.

Additional manhole sections can be provided to extend the chamber to meet site cover and invert levels or provide additional pollutant storage where required.

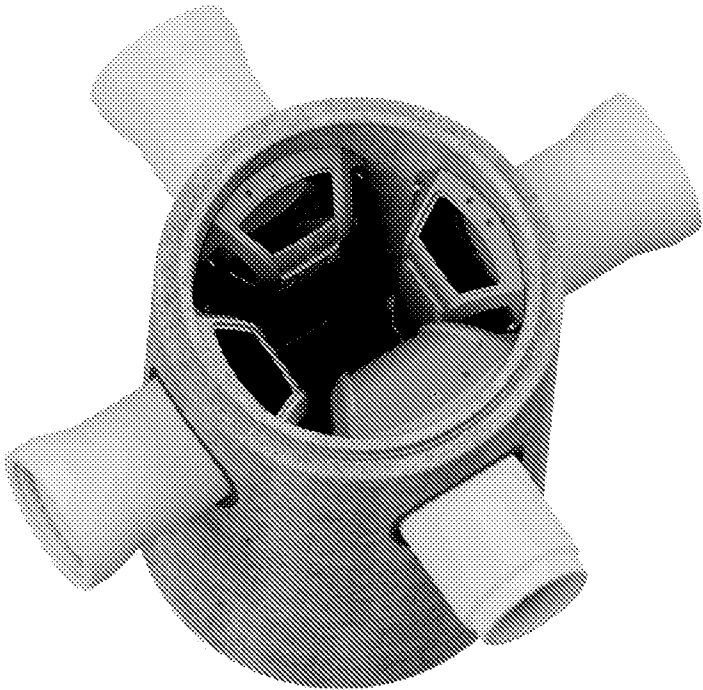


Fig 5. Downstream Defender® Select Advanced Vortex with three inlet pipes

Dimensions and weights for concrete chambers

Material	Chamber Diameter - Internal (mm) (C)	Chamber Diameter External (mm) (includes base slab and any extrusions)	Recommended Inlet and Outlet Internal Diameter (mm) (1)	Minimum Depth to Invert (mm) (A) (2)	Total Chamber Height Including cover (mm) (B) (3)	Maximum Component Lift Weight (kg) (4)
Concrete	1050	1420	225	1550	2390	2770
Concrete	1200	1460	300	1757	2831	2320
Concrete	1500	1760	375	2050	3276	3530
Concrete	1800	2160	450	2550	4090	5250
Concrete	2100	2650	500	2682	4364	6670
Concrete	2400	2950	600	3146	5375	8600
Concrete	3000	3480	750	3384	5174	14080

- Notes:
- (1) Recommended inlet and outlet internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
 - (2) Minimum depth to invert shown. Depth to invert can be increased if required.
 - (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for concrete units **includes** the cover.
 - (4) Maximum component weight is based on a single inlet and includes internal components.

Table 6 - Downstream Defender® Select dimensions and weights for concrete chambers

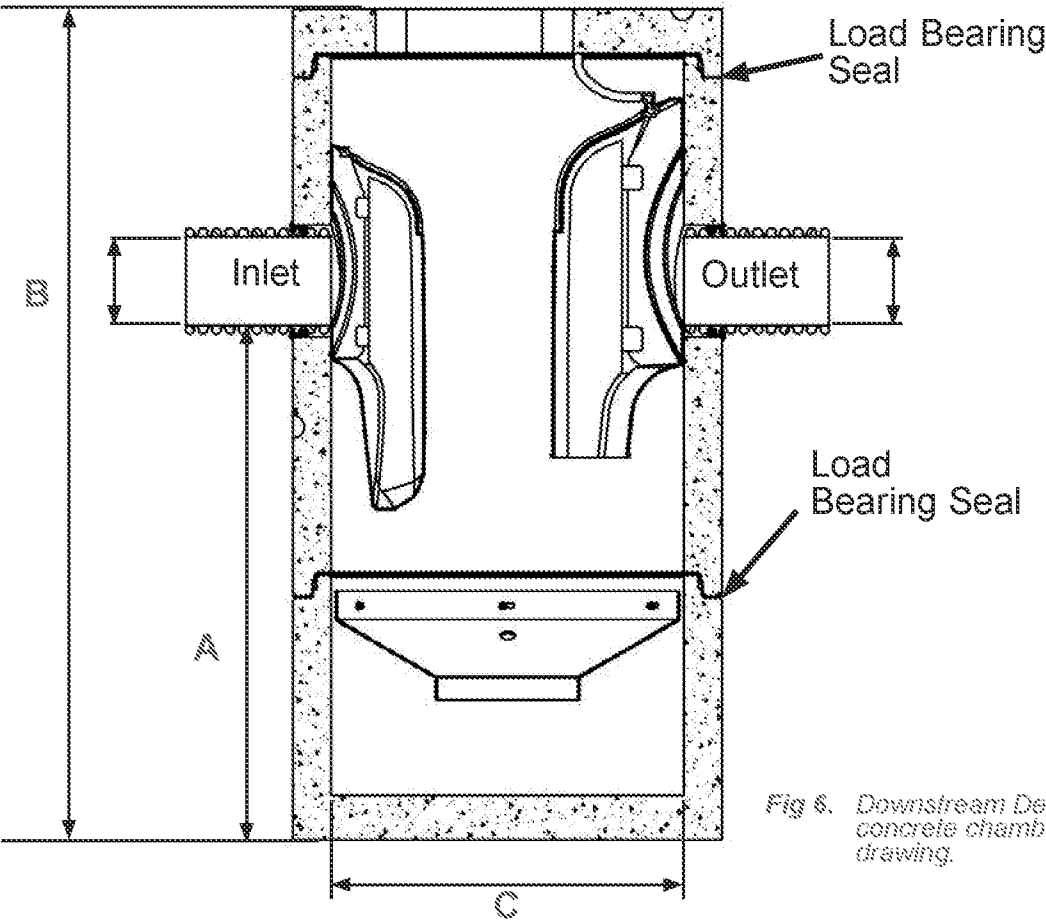


Fig 6. Downstream Defender® Select concrete chamber dimension drawing.

Dimensions and weights for plastic chambers

Material	Chamber Diameter - Internal (mm) (C)	Chamber Diameter External (mm) (includes base slab and any extrusions) (B)	Recommended Inlet and Outlet Internal Diameter (mm) (1)	Minimum Depth to Invert (mm) (A) (2)	Total Chamber Height Excluding Cover (mm) (B) (3)	Maximum Component Lift Weight (kg) (4)
HDPE Single Wall	1030	1282	225	1412	2012	125
HDPE Single Wall	1200	1452	300	1612	2512	170
HDPE Single Wall	1500	1752	375	1976	3012	240
HDPE Single Wall	1800	2316	450	2220	3520	410
HDPE Single Wall	2100	2626	500	2570	3920	750
HDPE Single Wall	2400	2926	600	2820	4420	950
HDPE Single Wall	3000	3520	750	3145	4770	1200

- Notes:
- (1) Recommended inlet and outlet internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
 - (2) Minimum depth to invert shown. Depth to invert can be increased if required.
 - (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for plastic units **excludes** the cover.
 - (4) Maximum component weight is based on a single inlet and includes internal components.
 - (5) Maximum external diameter includes lifting lugs and base slab.

Table 7 - Downstream Defender® Select dimensions and weights for plastic chambers

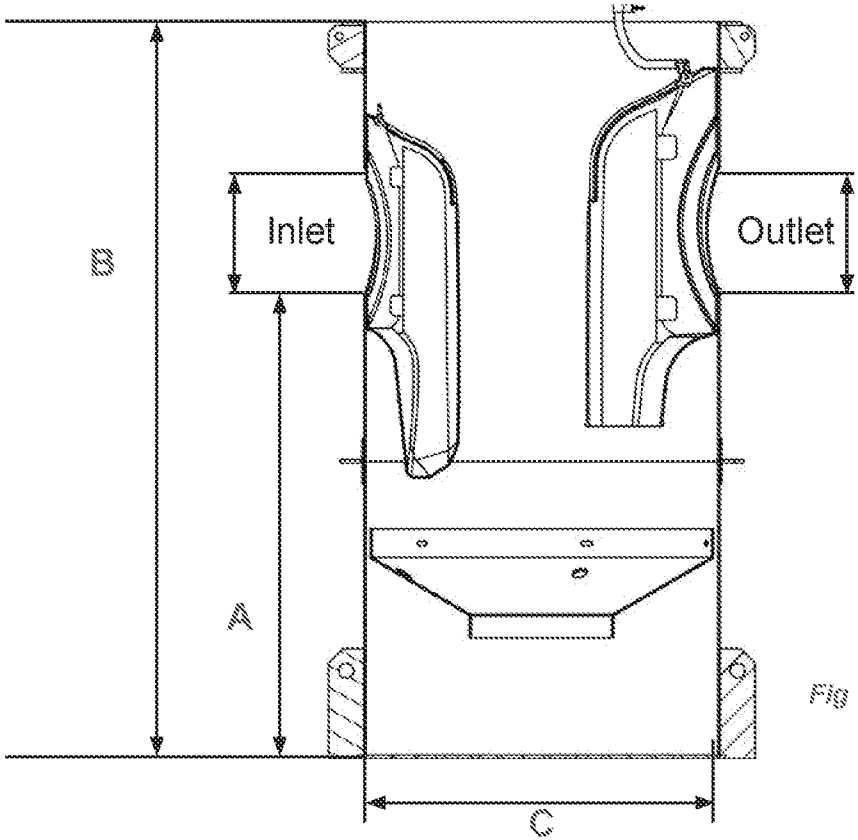


Fig 7. Downstream Defender® Select plastic chamber dimension drawing.

Maintenance for a Downstream Defender® Select

Periodic removal of captured pollutants is essential to the continuous, long-term functioning of your Downstream Defender® Select. The device will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® Select will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 4.

If a Hydro-Logic® Smart Maintenance system is installed in the Downstream Defender® Select, when captured sediment volumes reach a predetermined level, the system will send an automated alert to request maintenance.

Maintenance events may include hydrocarbons (oils), floatables and sediment removal. These can be removed safely from the surface, no entry into the Downstream Defender® Select is required. The Hydro-Logic® Smart Maintenance system will need to be removed to allow access for the Jet Vac truck / Vacuum Tanker. This is easily done by carefully lifting the bracket holding the Hydro-Logic® Flexi Logger 300Ex and sensors out of the unit and putting them to one side prior to inserting the Vacuum Tanker hose into the unit. The internal components of the Downstream Defender® Select do not need to be removed as the jet / vacuum hose can access the full depth of the unit through the centre of the chamber.



Determining a maintenance schedule

The frequency of clean-out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months or sooner to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump.

To enable the provision of maintenance plans for planning applications, a typical maintenance schedule for a Downstream Defender® Select would be:

Activity	Frequency
Inspection	- Regularly during first year of installation. - Every 6 months after the first year of installation
Hydrocarbons (oils) and floatables removal	- Once per year, or as needed with sediment removal. - Following a spill in the drainage area.
Sediment removal	- As and when alerted by the Hydro-Logic® Smart Maintenance system, or - At intervals as determined by the first year's inspections - Following a spill in the drainage area.
Note: For most clean-outs it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	

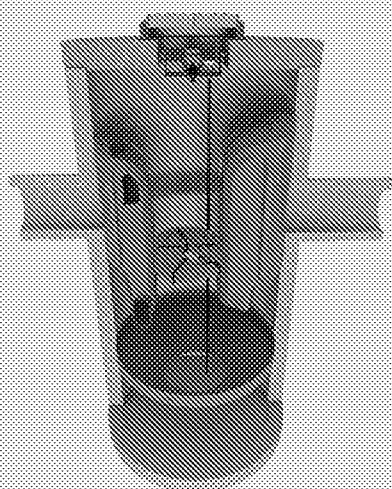
Table 8 - Typical maintenance schedule for a Downstream Defender® Select

We can provide full inspection and maintenance services for the Downstream Defender® Select, as well as for any other Sustainable Drainage Systems (SuDS) on your site - providing peace of mind and saving you time and money.

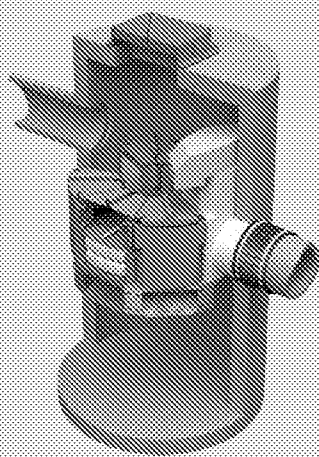
For more information, please call 01275 878371 or email sudservices@hydro-int.com

Our full range of stormwater treatment solutions

We have a range of stormwater treatment devices to treat stormwater flows of varying quality. All our solutions can work alongside, enable or enhance natural SuDS, helping to meet or improve on biodiversity and amenity targets.



Downstream Defender® Select



Up-Flo™ Filter



Hydro Biofilter™

Product		Description	Targeted pollutants						
			Sediments	Litter debris	Liquid hydrocarbons	Sediment bound hydrocarbons, nutrients and heavy metals	Dissolved metals	Nutrients	
Downstream Defender Select	Vortex	Vortex separator	Coarse & fine	Retained up to 2 x treatment flow rate	✗	✗	✓	✗	✗
	Vortex Plus	Vortex plus separator	Coarse & fine	Retained up to 2 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
	Advanced Vortex	Advanced hydrodynamic vortex separator	Coarse & fine	Retained up to 4 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
Up-Flo™ Filter	Sand	Fluidised bed up flow filtration system with Sand media	Very fine sediment		✓	✓	✓	✗	✓
	CPZ	Fluidised bed up flow filtration system with CPZ media	Very fine sediment		✓	✓	✓	✓	✓
Hydro Biofilter™		Biofiltration system	Very fine and dissolved sediments		✓	✓	✓	✓	✓

To find out more about our range of stormwater treatment solutions visit hydro-int.com.

[Downstream Defender® Select](#)

[Up-Flo™ Filter](#)

[Hydro-Biofilter™](#)