

D-Rainclean

Bio-remediation channel systems for
surface water pollution control

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With increasingly intense, frequent, and extreme weather events, there is a need to mitigate the flooding and pollution risks caused by uncontrolled surface water run-off. D-Rainclean is a robust, 300mm polypropylene channel drainage system with a unique bio-remediation medium.

The system deals with surface water run-off and treats the flow at source, making it an ideal treatment component in a Sustainable Drainage (SuDs) solution.

- ◆ Forms part of a SuDs solution
- ◆ Excellent hydraulic capacity
- ◆ Long service life 10-20 years – years before media replacement
- ◆ Excellent solids retention and prevents soil migration when laid to a fall
- ◆ Unique filter media – optimised grain size lowers clogging risk
- ◆ Adsorber agents provide a high retention of dissolved pollutants
- ◆ Active soil microbiology, gives a vitalised soil
- ◆ Helps decomposition of organic pollutants
- ◆ Resistant to de-icing salt
- ◆ Simple replacement of filter-media in the event of accidental spillage (e.g. oil spillage)
- ◆ Internal baffle walls allows the system to be laid level or to a fall
- ◆ Simple and easy to lay
- ◆ Suitable for use in a range of trafficked areas with B and D class gratings
- ◆ Non trafficked areas require no concrete reinforcement, reducing installation cost and time
- ◆ Filter media can be used for other applications (e.g. ponds, swales)
- ◆ Eight 100mm holes in the channel base allow infiltration at source
- ◆ Calculable hydraulic capacity over its service life
- ◆ Cast iron grates are fixed via a tamper proof tensioned spring or can be bolted for extra security
- ◆ Emergency overflow allows exceedence events to be accommodated
- ◆ D-Rainclean can be installed in soils with very low permeability when used in combination with geocellular units

Flooding and pollution

The problem

Flooding is an issue that needs no introduction in the UK.

Pluvial flooding has become a regular occurrence as our drainage networks become incapable of coping with increased urbanisation combined with climate change.

Since the turn of the millennium, the construction industry has sought to tackle the problems associated with more intensive rainfall, and in particular the volumes of water generated.

This culminated in the Flood and Water Management Act 2010, which sets out the responsibilities for the design, construction, and maintenance of sustainable drainage systems.

What is perhaps less well known is that, enshrined in this legislation, is the requirement to address surface water quality leaving development sites in order to comply with the Water Framework Directive.

Much of the onus to comply with the FWM Act falls on Local Authorities whose role it is to mitigate and minimise both flood and pollution risk by ensuring that hard-landscaping design and installation 'design-out' and build-out' both flood risk and pollution risk, usually by employing SuDs techniques.

The solution

Stormwater Management Limited offer the highly innovative and proven D-Rainclean porous channel and bio-remediation filter media system that treats the priority pollutants identified by the regulatory authorities (Environment Agency and Highways Authority), principally total suspended solids (TSS) and dissolved heavy metals such as copper and zinc – meeting both these key requirements within a single solution.



The Water Framework Directive 2015



The Water Framework Directive 2015 has identified 44 chemicals, 16 of which are deemed as hazardous and 8 that are bio accumulative. On heavily trafficked

roads and parking areas, heavy metal waste water reaches critical concentrations and regularly exceeds the threshold values for pollution run off. Heavy metal pollution increases the toxicity of river water that can be damaging to aquatic life, reduces the quality of crops and plant life and ultimately this can be damaging to human life.

D-Rainclean

The solution

D-Rainclean comprises a 300mm polypropylene channel system filled with a unique engineered bio-remediation filter media that treats run-off from any impermeable surface.

Using the processes of separation, adsorption, absorption, and bioremediation D-Rainclean allows contaminated run-off to be treated to a sufficient quality to allow infiltration back into the ground at the closest point to its generation, meeting one of the key requirements in drainage hierarchy – 'source control'.

D-Rainclean uses a unique engineered bio-remediation filter media containing selected natural minerals with a high cation exchange and filtration capacity. These media clean surface water as it passes through the filter layers, degrading and diffusing hydrocarbons, and dissolved heavy metal like copper and zinc.

A properly installed D-Rainclean system can drain areas of up to one hectare and the system has been proven to meet the stringent requirements set down by the DIBt.

Cover options **A**

D-Rainclean can be covered by either flush or raised cast iron grill sections, suitable for heavily trafficked areas. The D400 cast iron cover can support HGV traffic. D-Rainclean can also be left open to allow for vegetation growth at car park borders and similar areas.

Bulkheads **B**

Built in to the channels section at 500mm intervals, these ensure dimensional stability and more importantly, limit pollution spillages to a confined section of the system.

Channel units **C**

Robust and durable 500mm length polypropylene sections have an integrated bulkhead at mid point (250mm from either end). Each mid-section has 8 apertures in its base to allow the controlled infiltration of filtered water into the sub-base.

Filter media **D**

This unique engineered bio-remediation mixture lies at the heart of the D-Rainclean system.

Surface water flowing from impermeable areas contaminated with pollutants passes through the D-Rainclean filter media layer where it is treated before being discharged through the base holes.

The remarkable levels of performance are due to selected natural minerals with a high exchange capacity and filtration efficiencies. Diffuse hydrocarbons (oil drops) emitted in trafficked areas are virtually degraded. An accidental oil spill of up to 10 litres can be retained within 1 linear metre of channel for up to 24 hours.

Full details of the filter-media are shown on pages 6-7.

Controlled, **E** pollution-free water

Components & accessories

The D-Rainclean system contains an extensive range of components and accessories allowing designers to achieve a broad spectrum of project criteria.



Filter-media

- ◆ 14 litre sack
- ◆ Code: DRFC005



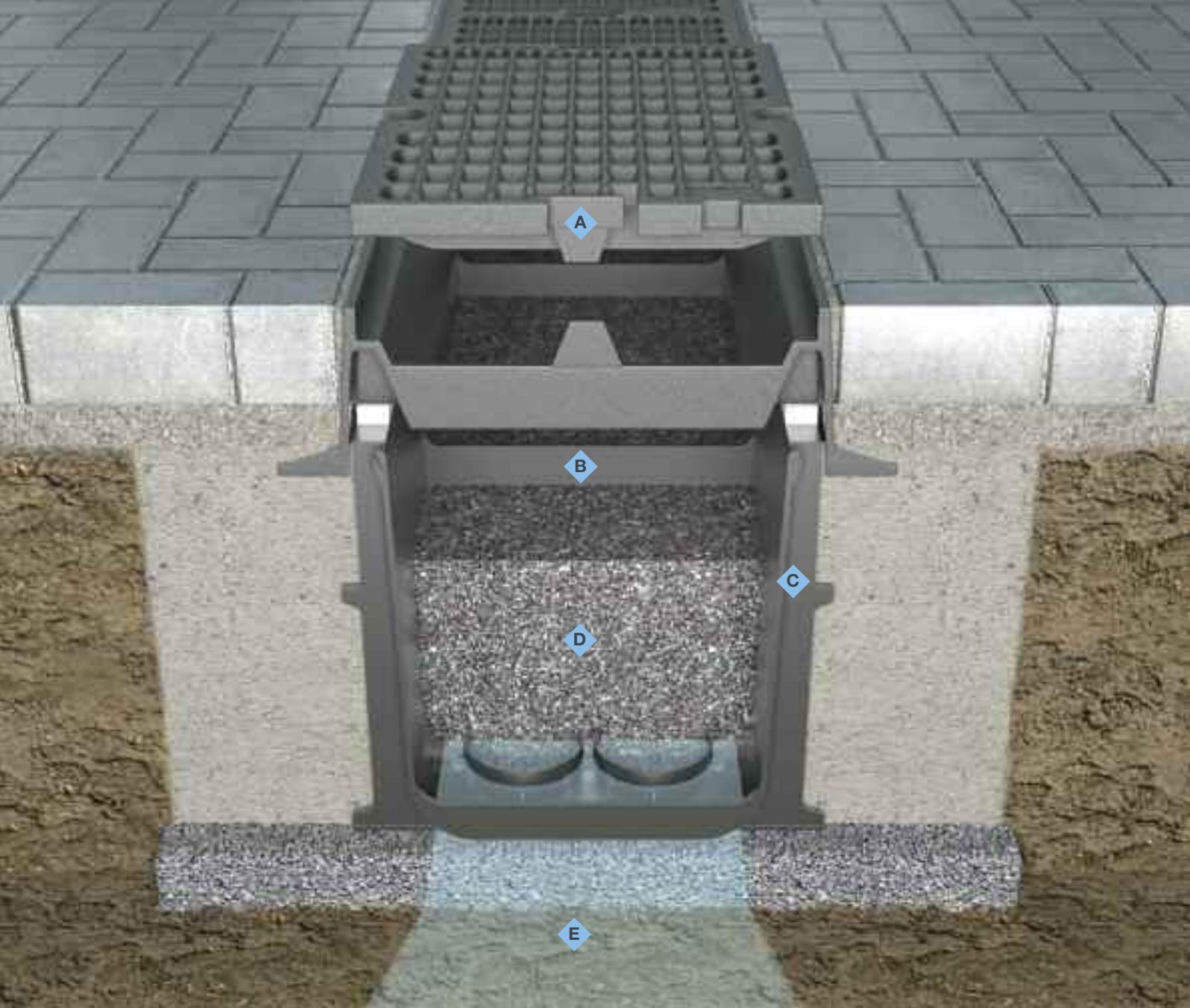
Filter-media

- ◆ 1.5m³ bulk bags
- ◆ Code: DRFC006



Channel

- ◆ Colour: Black
- ◆ Dimensions: 500 x 400 x 366mm with integrated middle bulkhead
- ◆ Material: PP
- ◆ 8 infiltration apertures
- ◆ Code: DRFC001



End piece

- ◆ Can be used for left or right hand ends
- ◆ Dimensions: 250 x 400 x 366mm
- ◆ Code: RH: DRFC002
LH: DRFC003



Emergency overflow unit

- ◆ With 110mm socket connections for left or right hand
- ◆ Dimensions: 500 x 400 x 366mm
- ◆ Code: DRFC004



Cast-iron cover

- ◆ Class B125
- ◆ Includes cast iron frame. Connection clamps need to be ordered separately
- ◆ Includes child safeguard
- ◆ Code: DRFC007



Cast-iron cover

- ◆ Class D400
- ◆ Includes cast-iron frame and child safeguard
- ◆ Code: DRFC009



Tools and clips

- ◆ Wrench
Code: DRFC011
- ◆ Security bolts:
Code DRFC010
- ◆ Joint Clamps
Code: DRFC008
- ◆ Aluminium rails
Code: DRFC012

Filter media

D-Rainclean Filter Media is a unique series of media that perform different functions in order to clean surface water runoff using the processes of filtration, adsorption, ion exchange, phosphate and retention.

The unique D-Rainclean filter media can be used in other SuDs applications including:

- ♦ Swales
- ♦ Infiltration basins
- ♦ Rain gardens
- ♦ Special Filter Media is available for Innolet gully (see back cover)



Absorption area/exchanger **A**

Water storage/filter **B**

Organic matrix/settlement area **C**

pH-buffer area/acid limiter **D**

Components pictured schematically – grain size not to scale.

Filtration

Many contaminants attach themselves to sediment particles. The smaller the particle, the higher its concentration. The filter-media in D-Rainclean retains these sediments by depth filtration, ensuring they are retained in the upper 5-10cm of the filter media. This significantly reduces the risk of surface clogging (colmatage) and ponding, particularly in extreme events, something which some surface filtration systems, such as permeable paving are prone to.

Heavy metal absorption/desorption and precipitation

D-Rainclean uses a number of processes to remove dissolved heavy metals:

- Nickel – sorption
- Lead, cadmium, copper and zinc – sorption, precipitation and PH balancing
- Chromium – ion exchange

Water retention

Soil microbiology performs a valuable degradation role, particularly during periods of warmer weather. As such the D-Rainclean filter media retains moisture to allow this degradation process to occur. Large pore spaces within strata of the media combined with organic substances and the design of the D-Rainclean channel allow 3.0 litres per linear metre to be stored to ensure that this optimised process can occur.

Soil Testing Values*

Arsenic (As)	10 µg/l
Lead (Pb)	25 µg/l
Cadmium (Cd)	5 µg/l
Chromium (Cr)	50 µg/l
Copper (Cu)	50 µg/l
Nickel (Ni)	50 µg/l
Mercury (Hg)	1 µg/l
Zinc (Zn)	500 µg/l

* Ground Water according to German Federal Soil Conservation Law (Bundesbodenschutzgesetz)

Laboratory testing

Tested independently and compared with natural 'good soil', Filter media has considerably better adsorption properties. On average: 99% adsorption of zinc and 99% of copper based on a 10 years total load input (source: DIBt test report).

Hydraulic capacity

The D-Rainclean filter media has a water permeability coefficient of 9×10^{-4} m/s, the secret to this high permeability rate is due to the graduated grain sizing within the media that produces a widely spaced distribution curve. The coefficient has been derived by testing which allows sufficient detention time for adsorption to occur.

The water reservoir built into the channel design also ensures that soil microbiology continues to occur and does not dry out during extreme dry spells.

Harmful organic materials

D-Rainclean uses an organic matrix and a specific activated carbon that supports bonding and degradation of organic pollutants, as such D-Rainclean degrades mineral oils from impermeable trafficked areas such as car parks.

De-icing salts

The use of de-icing salts can block adsorption and reverse the adsorption of already captured hazardous material.

The performance of the filter-media is not adversely affected by sodium chloride even in shock loads. However frequency and concentration of de-icing will have an effect on overall service life – see Design life on page 7.

Oil bonding and degradation

The large void space within the media allows oil to lose its fluidity and cover the pore space where micro organisms can degrade it. In the event of accidental spillage the internal baffles within the D-Rainclean channel design ensure that 10 litres of oil per linear metre can be retained for up to 24 hours so that it can be removed, professionally disposed, and the media replaced.

Phosphate bonding

The enhanced adsorption capacity within the filter media is crucial to maintaining clean water courses.

pH Value

The carbonate buffer range of the media is above pH 7.2

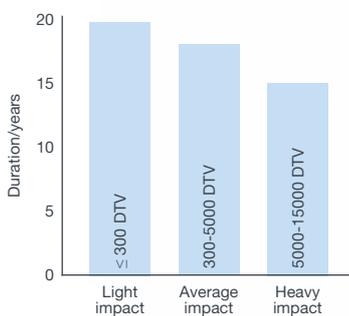
Cation exchange capacity

D-Rainclean filter media acts as an ion exchanger using zeolites and adsorptive elements that ensure bonding with heavy metal ions.

Design life

The design life of the D-Rainclean filter media is a function of its daily use. The Filter media has been tested to DIBt standard approval and based on applications since 2002.

Design life of D-Rainclean filter media**



** DTV = average daily traffic volume

Disposal

The filter media should be removed and disposed in line with local authority and regulatory guidelines.

Planting

The filter media contains sufficient nutrients for selected plants e.g. pachysandra, mahonia, vinca minor or cotoneaster. For further information please contact the Stormwater Management technical department.



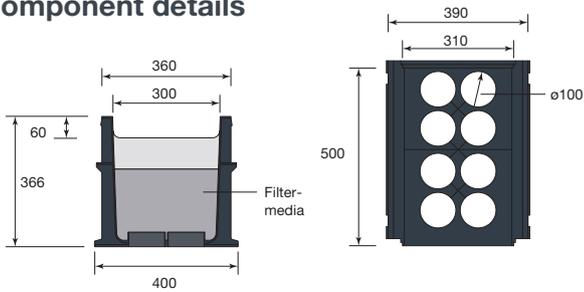
Component and installation details

Stormwater Management provide technical support from concept design right through to the construction phase. We are able to offer site specific design solutions to provide our clients with the most cost effective and environmentally sympathetic solutions. Our engineering department can provide preliminary calculations and CAD details.

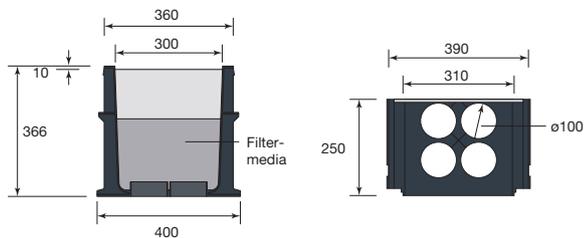
The B125 Cast-iron grate is ideal for occasionally or constantly light trafficked areas.

The D400 cast-iron grate and frame is suitable for heavier trafficked areas and heavy goods vehicles.

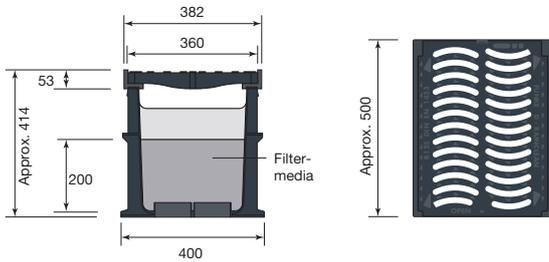
Component details



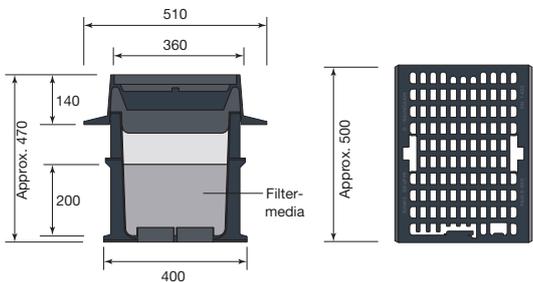
D-Rainclean open



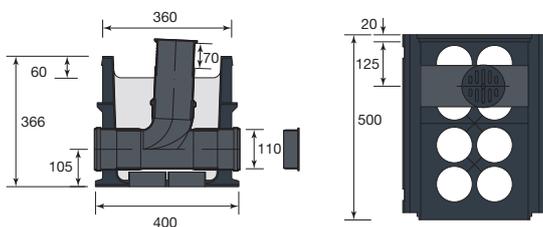
D-Rainclean end unit



D-Rainclean cast-iron – class B125

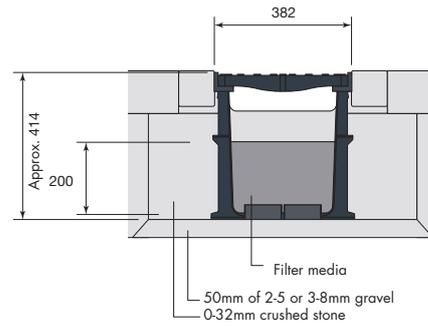


D-Rainclean cast-iron – class D400



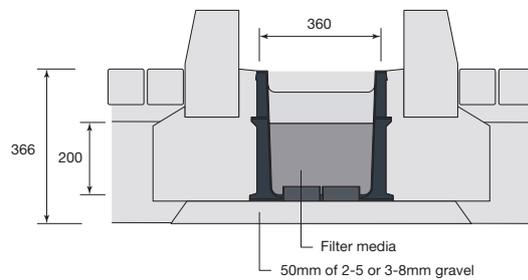
D-Rainclean overflow unit

Installation details

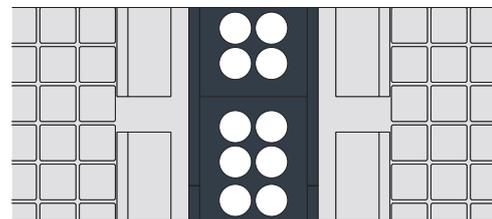


D-Rainclean cast-iron - class B125

No supporting concrete haunching is needed, only compactible materials (e.g. gravel 0-32mm) installed and compacted in layers along both sides of the channel.

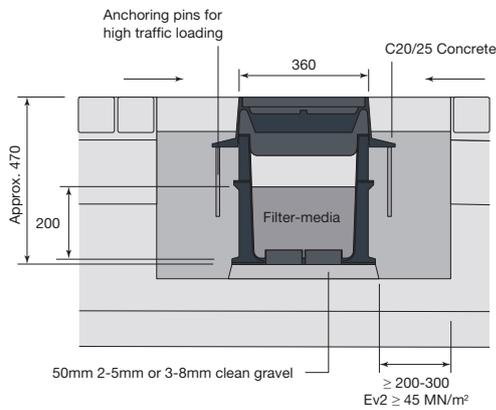


Top view



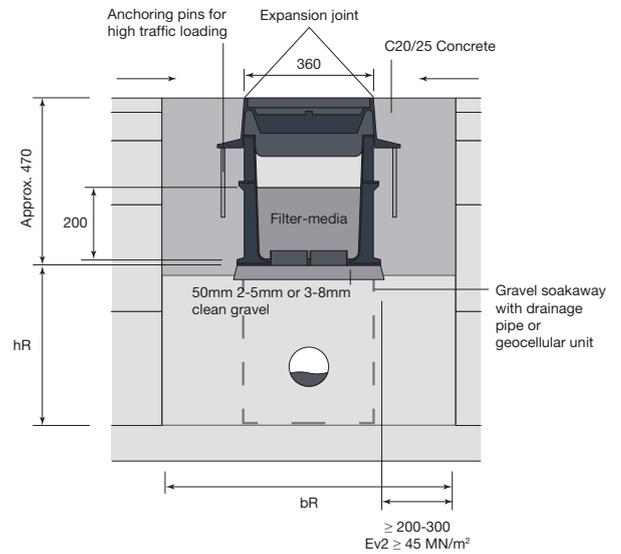
D-Rainclean open with elevated kerbs

The use of D-Rainclean with raised open kerbs is an option between rows of car parks.



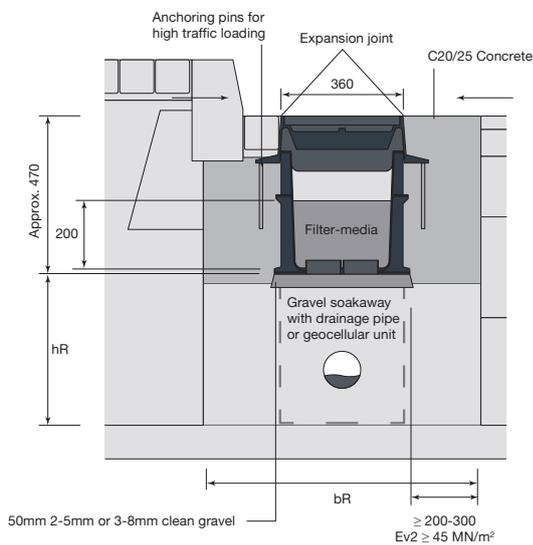
D-Rainclean cast-iron – class D400

The D-Rainclean filter channel has a D400 cast iron cover and frame (500mm × 360mm) is particularly suitable for use in trafficked areas.



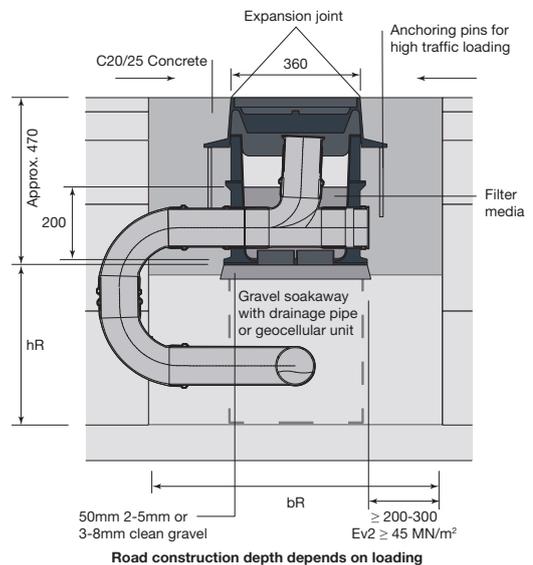
D-Rainclean Class D with perforated drain pipe

Combination with a perforated, high strength carrier pipe allows the D-Rainclean System to be installed in soils with low water permeability.



D-Rainclean Class D abutting kerb with perforated drain pipe

Combination with a perforated, high strength carrier pipe allows the D-Rainclean System to be installed in soils with low water permeability.



Overflow detail for exceedence events

The 110mm overflow pipe connects to a perforated high strength carrier pipe in a trench drain.

Sizing the system

The D-Rainclean system can be sized by our engineering team if the following information is provided:

- ◆ Location of project
- ◆ Design rainfall event
- ◆ Soil infiltration coefficient at the required location
- ◆ Drainage catchment area
- ◆ Surface material type
- ◆ Allowable discharge rate
- ◆ Groundwater level
- ◆ Available area for channel system
- ◆ Receiving water body
e.g. ground, watercourse, etc.

From this data our engineers will be able to calculate the quantity of channel required and where necessary, design in exceedence measures to meet the rainfall design criteria.



Worked example for a car park in Witley, Surrey.

The above car park has an impermeable area of 900m² with 38 car spaces. With a run off coefficient of 0.66 this equates to an effective drainage area of 590m². Using the rainfall data for Witley, Surrey:

$N = 0.2 \text{ a}^{-1} = 5 \text{ year storm event}$

The D-Rainclean filter media has an infiltration coefficient of 9×10^{-4} , and it is assumed that the natural soil has the same coefficient.

Using DWA138 method of sizing, this equates to 55m of D-Rainclean channel being needed, in the above example, 27.5m has been designed using a trafficable B125 cast-iron grating, and 27.5m in an open channel design adjacent to a landscaped area.

Not only will the D-Rainclean channel hydraulically control and treat the runoff it also negates the need for positive drainage, silt traps, oil separator and flow control.

Case study: B&Q, South Gloucester



D-Rainclean offered an economical and high-performance alternative to the originally proposed porous paving design concept. The use of conventional tarmac combined with the D-Rainclean system offered time and cost savings without compromising the car park area's ability to control run-off and deal with contaminants. The efficiency of D-Rainclean filter media means that contaminated run-off is effectively treated at source before being returned to the water course – in this case, the river Trym. This removed the need for an expensive Petrol Interceptor and the associated electrical hook up and maintenance ramifications. Independent performance testing of the installation has indicated that the media will perform for 18 years before replacement of the media becomes necessary.

For further information and a copy of the test report, please contact Stormwater Management Ltd directly on sales@storm-water.co.uk



D-Rainclean Specification Clause



The stormwater bio-remediation channel system shall be D-Rainclean by Stormwater Management Ltd. The system shall comply with EN1433 and have been tested and approved for Stormwater treatment in accordance with DIBt requirements. The system shall be designed to remove TSS to sub 63µg and nominated dissolved heavy metals (Zinc and Copper).

NBS Specification



The D-Rainclean bio-remediation channel should be specified in NBS section R17:315. Assistance in completing this clause can be found in the Stormwater Management entry in NBS Plus or a model specification can be downloaded from www.storm-water.co.uk. For further assistance, please contact the Stormwater Engineering Team.

Stormwater Management Ltd



Stormwater Management Ltd are specialists in the design, supply and install of surface water and sustainable drainage systems, whether the requirement is for landscaped, hybrid or more

engineered drainage systems Stormwater Management Ltd are able to offer a solution.

Based in Hinckley, Leicestershire with a team of design and site engineers, Stormwater Management Ltd provide a wide range of drainage solutions for volume control and surface water treatment.

This brochure is produced to give an example of the products we supply and how, subject to your own testing, our products may be used. Nothing in this brochure shall be construed so as to make any ascertain or give any warranty as to the fitness for purpose of any of our products in respect of any specific job. You should satisfy yourself through your own testing as to the suitability of our products for any specific purpose and rely solely on such testing and/or the advice of any professional(s) you commission. While we ensure as far as is possible that all information given in this brochure is accurate at the time of print, information and examples given in this brochure are by way of illustration only and nothing contained in this or any other promotional literature produced by us shall in any way constitute an offer or contract with you or shall be relied upon by you as a statement or representation of fact.

Maintenance

Replacing the filter-media

Where required use the installation wrench open the cast iron cover of the D-Rainclean® filtration channel.

Remove the filter media using a standard suction and rinsing vehicle.

Carefully remove filter media using suction hose. A weak water jet can be used in order to accelerate the process if desired.

Continue removing the media until the openings on the lower edge of the filtration channel are visible.

This will ensure that the substructure gravel remains in situ.

Pour the new filter media into the channel. This requires four standard bags per metre of channel.

A 1.5m³ bag is sufficient for approx. 27 linear metres of channel.

When laying the media, ensure that it is evenly spread along the channel to a depth of 200mm.

Once completed, replace the cast iron gratings in their frames and lock in place.

Other products and applications



The D-Rainclean filter-media

This unique and versatile filter media can be used for other sustainable drainage treatment train components, such as:

- ♦ Infiltration basins (shown above)
- ♦ Swales
- ♦ Rain gardens



Innolet

Innolet is a range of point drain cartridges that treat Stormwater run-off from roads and comprise aerobic and anaerobic filter to remove priority pollutants such as

- ♦ Heavy metals – zinc, copper, cadmium and lead
- ♦ Hydrocarbons
- ♦ PAH
- ♦ Phosphates

Technical Support

Stormwater Management design service

Stormwater Management provide full technical support from design right through to installation and commissioning – from product and system selection, design calculations and CAD drawings, we aim to provide clients with all the relevant technical information.

Whether your scheme uses soft, engineered or hybrid drainage systems Stormwater Management have a range of product and system solutions to allow you to meet your objectives.

On site support

Stormwater Management Ltd. now boasts the largest product range of its kind in the UK. Fully conversant in all D-Rainclean solutions as well as other associated products, our well- trained staff are always available to discuss the technical merits of D-Rainclean and to advise which solution would be most suited to a particular application.

Tel 01455 502222

Email sales@storm-water.co.uk

Stormwater Management Limited

Fleming Road, Harrowbrook Industrial Estate, Hinckley, Leicestershire LE10 3DU

Tel 01455 502222 **Fax** 01455 502223 **Email** sales@storm-water.co.uk **www** www.storm-water.co.uk

