

SuDS for Housing

Attenuation

SEL SOURCE AT



Introduction

Attenuation is a surface water drainage technique which is promoted by many UK planning departments as an integral component within a sustainable drainage system (SuDS). Currently, most UK planning departments limit the discharge to sewer for new housing developments to ease the burden on existing aged sewer networks. The incorporation of robust attenuation strategy can assist developers in meeting these targets.

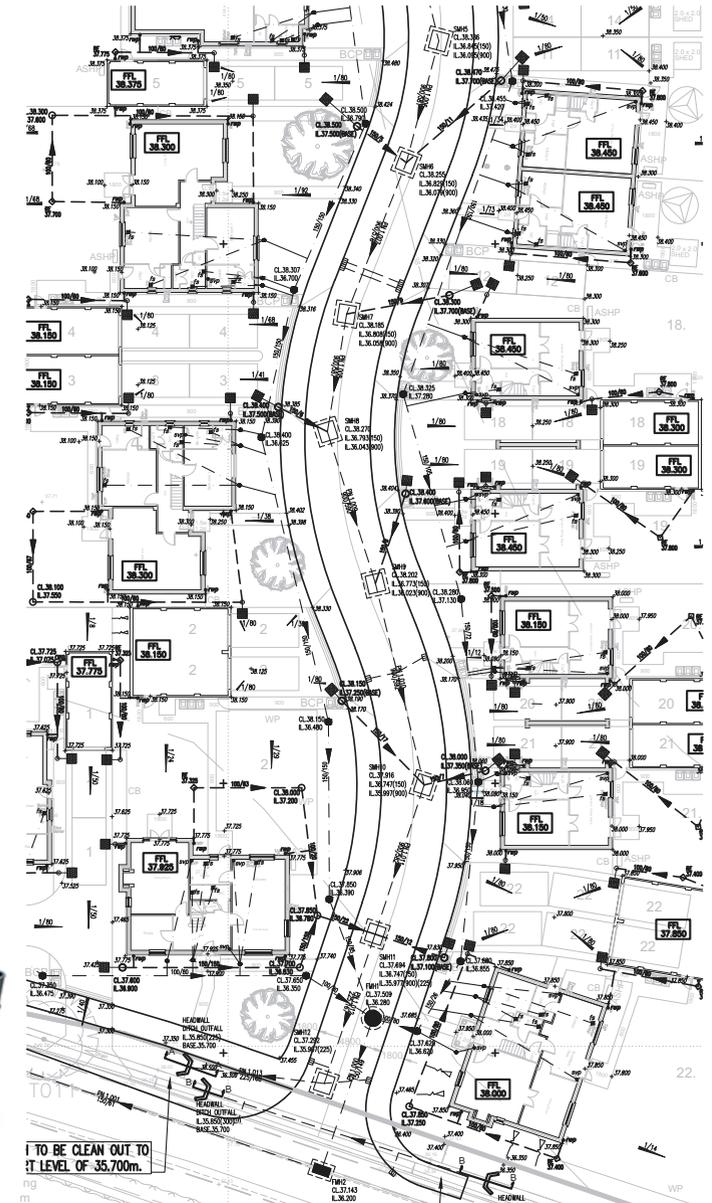
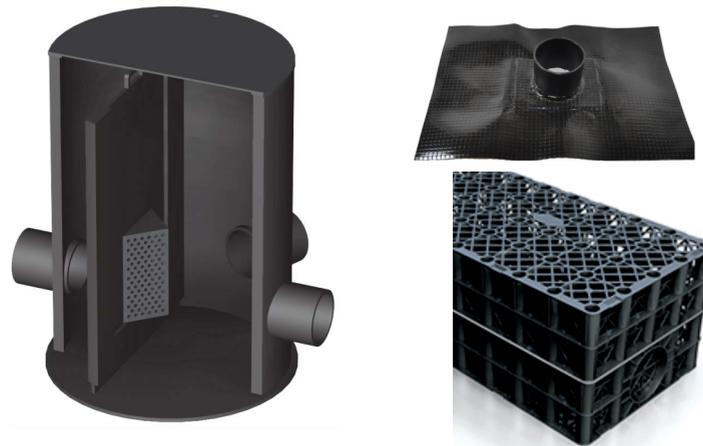
Offering both 'source control' (where rainwater run-off is managed as close to where it falls as possible) and treatment (cleansing of collected run-off), attenuation can also help to meet planning conditions relating to surface water drainage systems. They can be used to temporarily store runoff water at source before controlled release.

SEL has developed the SEL Source AT range of products to simplify the design and enhance the efficiency of attenuation. These products can standardise construction depths, offer enhanced hydrocarbon treatment and optimise the attenuation potential of individual catchments. They allow shallow and deep installation to enable Engineers to overcome site specific issues in the ground.

The use of SEL Source AT components can provide a robust watertight attenuation system whether within curtilage or within public open spaces. They can offer treatment and control the flow of surface runoff.

SEL Source AT products can be utilised below a wide range of surfacings, such as clay, concrete or natural stone pavers, permeable asphalt and resin-bound aggregates.

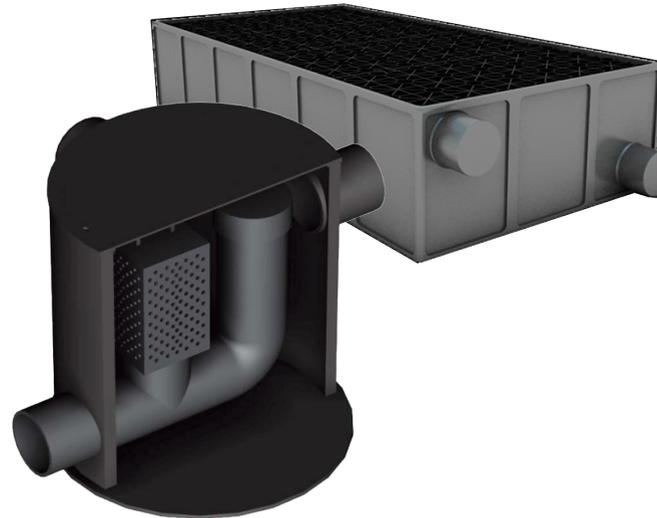
Solutions are available small and large attenuation systems.





The use of SEL Source AT components can:

- Control the flow of water from micro catchments to provide efficient and managed attenuation.
- Allow for simple within curtilage management of surface water.
- Increase the storage capacity of sub-base layers without increasing construction depths
- Allow the use of impermeable pavements with voided sub-base below.
- Provide efficient treatment and distribution of water from downpipes into attenuation structures.
- Reduce the risk of silt and debris entering underground networks.
- Simplify and speed up construction.
- Enhance hydrocarbon treatment.



SEL Source AT Components are fully compliant with all current guidance and legislation.

This brochure outlines some typical scenarios. However, the modular SEL Source AT components can be combined to produce a flexible and robust site-specific SuDS design.

Please contact our technical department for more details.



SEL Source AT Design Principles:

- Utilise driveways and shared access roads where possible to form micro-catchments with standalone attenuation.
- Infiltrate surface water run-off wherever possible.
- If infiltration is not viable, maximise attenuation volumes within the voided sub-base for each micro-catchment by optimising flow rates.
- Treat and introduce run-off from downpipes into the attenuation of each micro-catchment.
- Standardise attenuation for within curtilage simplifying installation.

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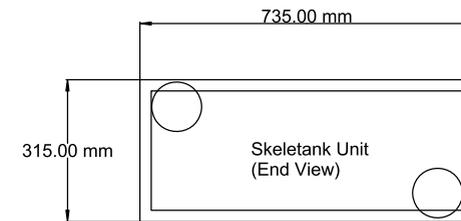
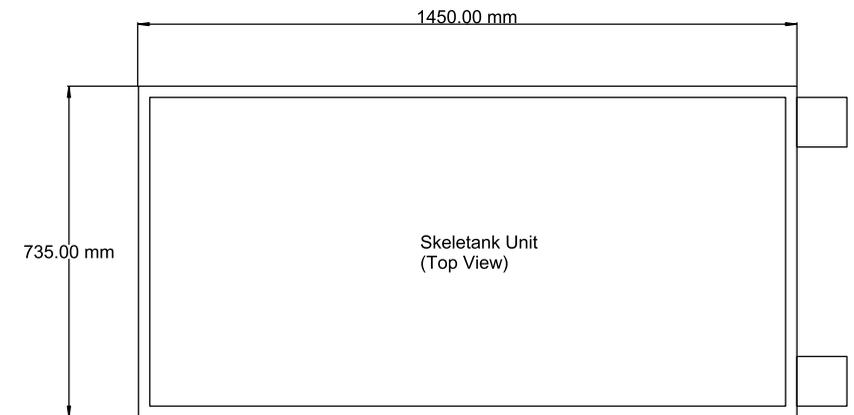
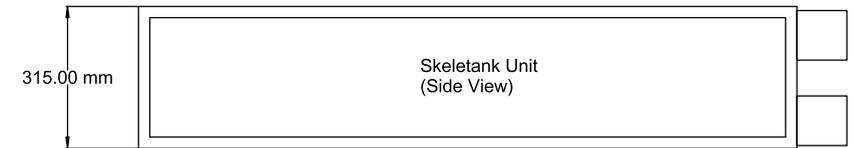
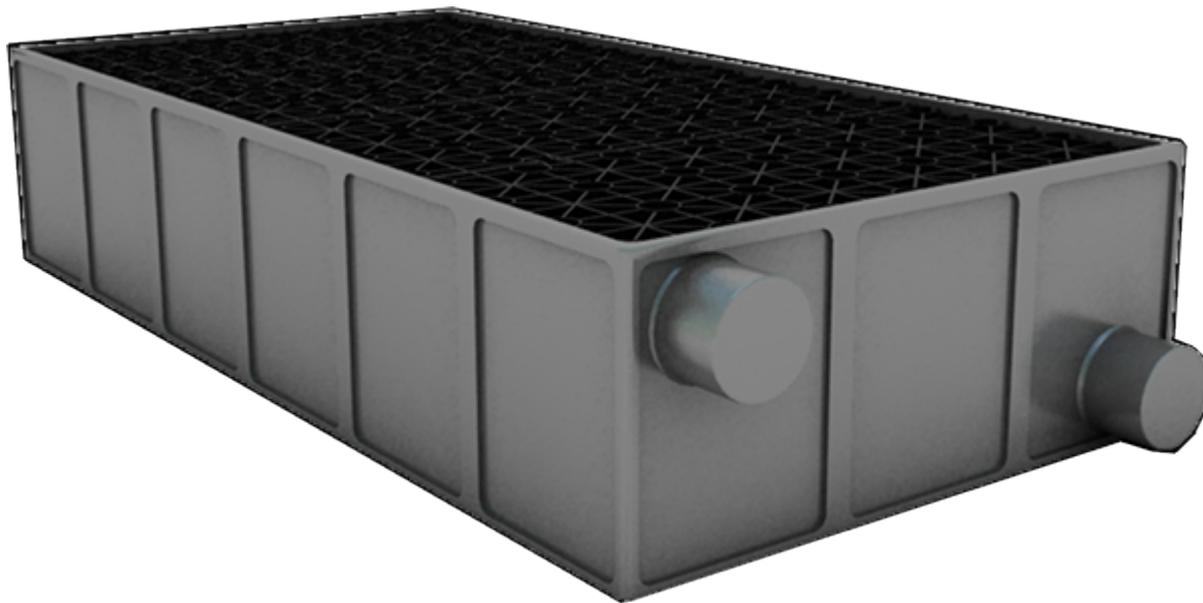
SEL SOURCE AT

High Strength Modular Attenuation

PVOD08201 Skeletank Attenuation Tank; 300 Litres, 1450 x 735 x 315mm

Skeletank attenuation tanks are unique, pre-formed, high strength, fully sealed attenuation modules which can be utilised to provide shallow storage under trafficked or landscaped areas, either for temporary attenuation or for rainwater recycling.

Each **Skeletank** tank comprises 8 Permavoid sub-base replacement modules, housed in a rotationally moulded, watertight shell. Permavoid is a unique and patented system for the replacement of sub-base below both pervious and impervious surfacings. It is fully compliant with the requirements of BS7533-13:2009 Annex B, 'Typical physical properties of replacement systems (geo-cellular) units'.



PVOD08201 Skeletank Attenuation Tank;
300 Litres, 1450 x 735 x 315mm

SEL SOURCE AT



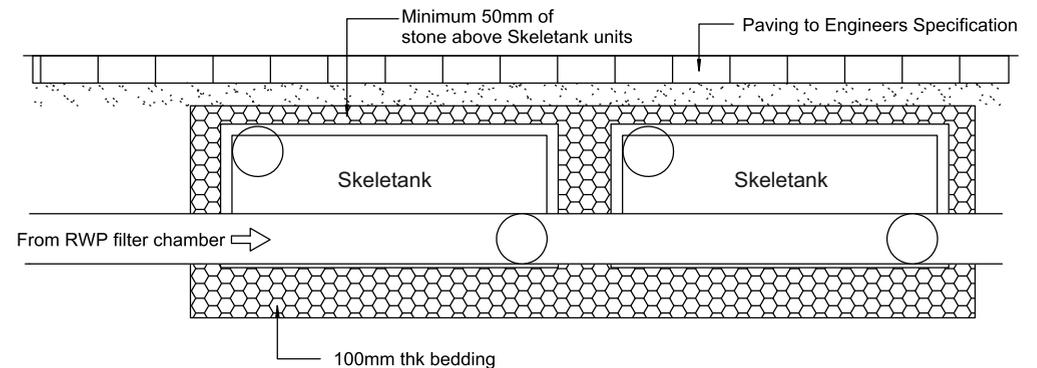
The benefits of using Skeletank attenuation units are:

- Skeletank storage units are extremely robust, the outer shell being formed from HDPE (High Density Polyethylene) using rotational moulding techniques.
- They can withstand loads of up to 700kN/m². This means that they can be installed directly below the surface of a driveway or patio with a minimum of 150mm cover.
- Can be used within permeable and impermeable pavement construction.
- No specialist installer required.
- Connects to standard underground push-fit PVCu drainage sockets.

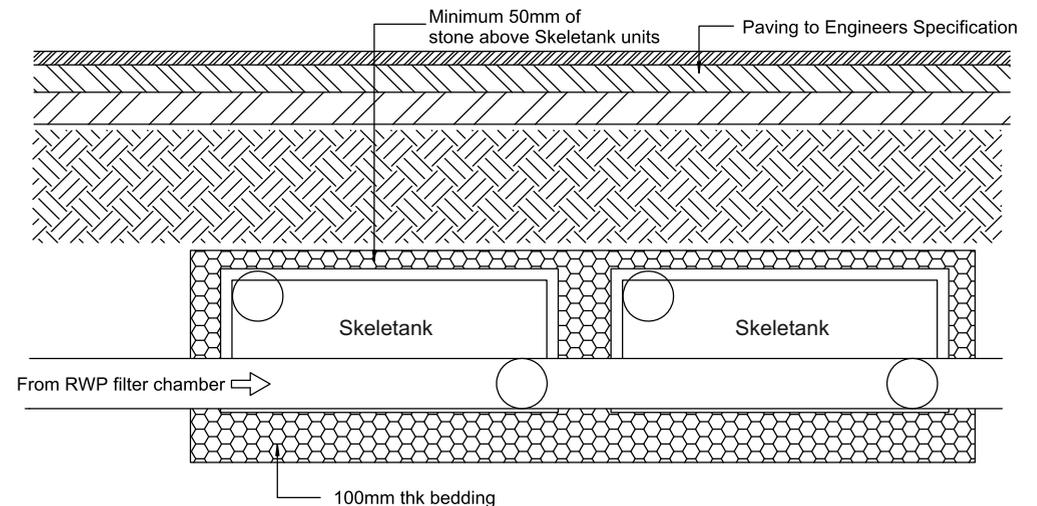
Skeletank storage units have a storage capacity of 300 litres. Storage volumes can be increased by linking together multiple units using standard 110mm diameter PVC-u drainage pipework and fittings. This offers designers significant flexibility and thus the opportunity to provide bespoke designs for individual properties.

Each Skeletank storage unit has 2no. 110mm diameter spigots, one at invert level and the other at soffit level. These spigots are sized to fit standard 110mm diameter PVC-u underground drainage pipe and fittings. The inlet/outlets are sealed during the manufacturing process.

SKELETANK ATTENUATION TANKS WITH MINIMUM 150mm COVER



SKELETANK ATTENUATION TANKS WITH MAXIMUM 477mm COVER



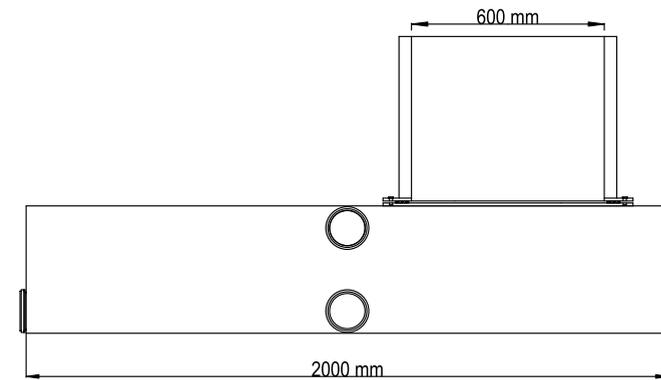
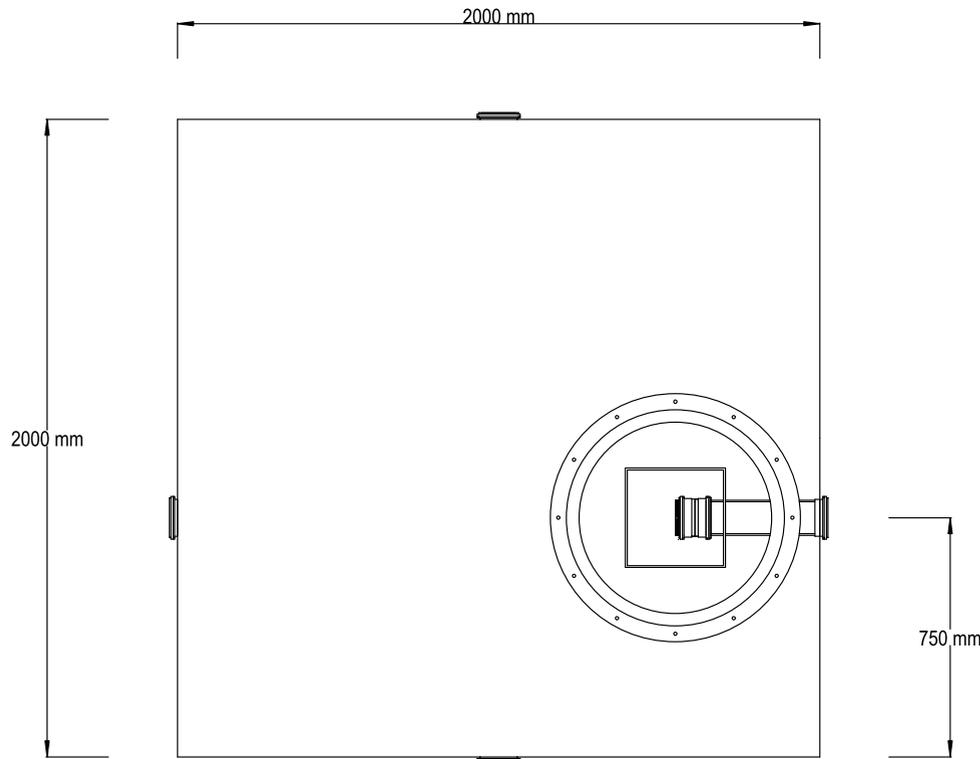


Raintaina Modular Attenuation

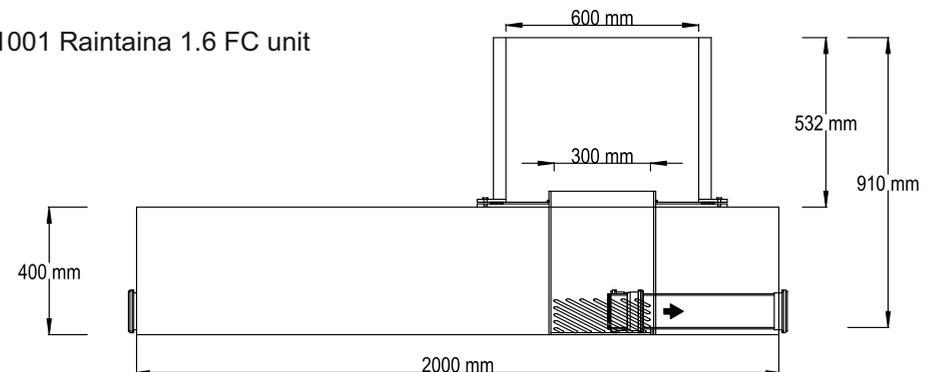
RTNA01001 Raintaina 1.6 FC

Raintaina 1.6 FC is a pre-formed, fully sealed attenuation module with an integrated flow control chamber. The RTNA01001 has been developed as a 'within curtilage' attenuation solution and provides 1600 litres of storage.

A range of supplementary Raintaina units offering 1600, 1200, 800 and 400 litres of attenuation can be connected in series to meet each plot requirement. The units can be installed under trafficked or landscaped areas for temporary attenuation.



RTNA01001 Raintaina 1.6 FC unit



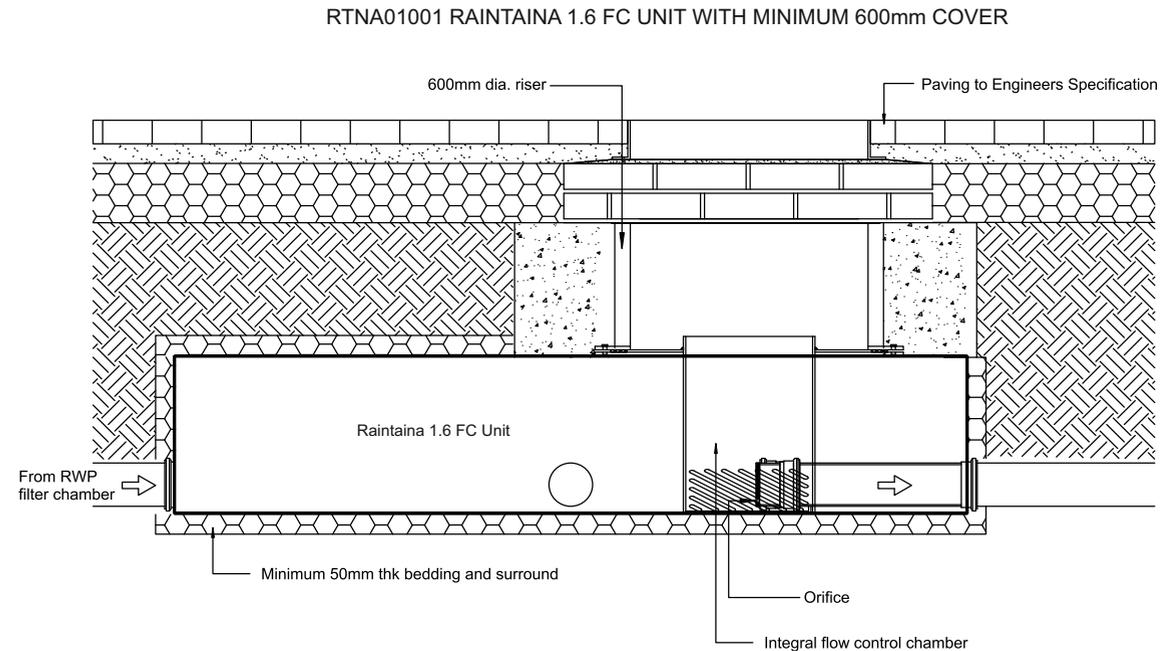


The benefits of using RTNA01001 Raintaina 1.6 FC are:

- Raintaina 1.6 FC units arrive to site ready to install.
- The flow control orifice can be sized to suit plot requirements.
- Are provided with lifting straps for easy installation.
- Provide 1600 litres of attenuation and can be upscaled.
- They can withstand loads of up to 610kN/m². This means that they can be installed below the surface of a driveway or patio with a minimum of 600mm cover.
- No specialist installer required.
- Connects to standard underground push-fit PVCu drainage sockets.

Raintaina 1.6 FC storage units have a storage capacity of 1600 litres. Storage volumes can be increased by linking together multiple units using standard 110mm diameter PVC-u drainage pipework and fittings. This offers designers significant flexibility and thus the opportunity to provide bespoke designs for individual properties.

Each Raintaina 1.6 FC unit has 5no. 110mm diameter spigots, on each side at invert level and one at soffit level. This allows excellent flexible for installation. These spigots are sized to fit standard 110mm diameter PVC-u underground drainage pipe and fittings. The inlet/outlets are sealed during the manufacturing process.





Shallow High Strength Attenuation

PVOD00001 Permavoid Unit; 710mm X 355mm X 150mm

Permavoid® is a pre-formed, geo-cellular sub-base replacement system. It can be utilised to provide attenuation within the sub-base layers of a pavement, without increasing construction depths.

Permavoid® can be used in place of a traditional aggregate sub-base within trafficked pavements, providing a unique high strength, consistent structural raft in accordance with BS7533-13:2009.

The system is suitable beneath asphaltic, block-paved or concrete pavements and for the full range of traffic conditions from domestic driveways to highways.

The use of Permavoid® is especially beneficial in developments with poor underlying ground conditions, such as high water tables, contamination or shallow rock layers and where there are shallow outfall connections (e.g. to adjacent water courses).

When combined with Controflow® Flow Control Chambers, Permavoid® can be used to manage storage requirements from individual housing plots, or combined 'local' areas of permeable paving.

The system's structural design life expectancy, based upon creep test data (tested according to CIRIA guidelines) is as follows; for lightly loaded areas such as car parks a design life of 50 years is achievable. For areas with prolonged HGV loading a typical design life may only be 25 years, depending on the design of the pavement surfacing and structural layers over the tank.



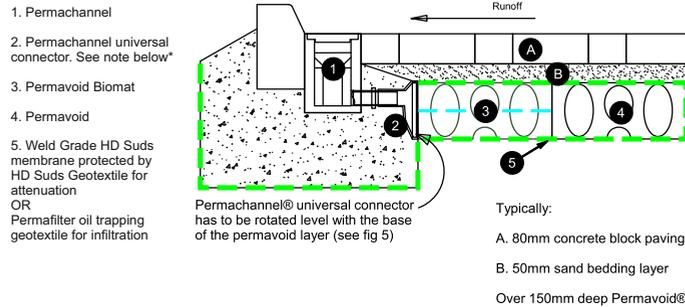
PVOD00001 Permavoid
710mm x 355mm x 150mm



The Permavoid system comprises of high strength modular cells suitable for sub-base replacement, plus components that incorporate silt / oil treatment and shallow flow controls into the system.



130mm cover, Cars Only Typical car parking bay. Single permavoid® layer



* For cover levels of 300mm or less the permachannel connection should be installed horizontally.

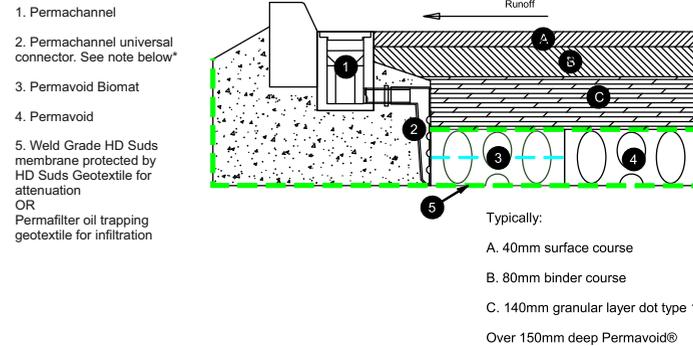
For cover levels greater than 300mm the permachannel connector should be installed vertically and will require a 40mm Ø 90° bend and a piece of 40mm Ø pipe

* where the distance from ground level to base of the permavoid® layer is less than 400mm, the permachannel connector must be rotated until its lowest point is level with the base of the permavoid® layer.

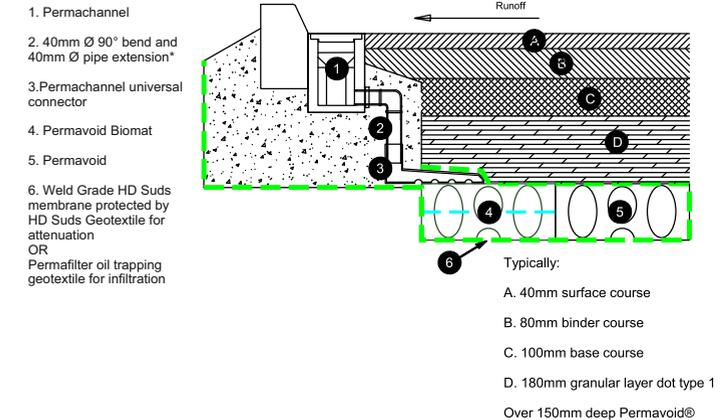
* All the minimum cover depths assume a minimum of 10% CBR for cases where infiltration occurs or a minimum of 5% CBR for tanked systems.

Note: a kerb has been shown for perspective only and is not a necessary component of the system.

260mm cover, Cars, Vans & Occasional HGV Typical access road, Single permavoid® layer



400mm cover & greater, Cars, Vans & HGV Typical service road, Single Permavoid® layer



PVOD0001 Permavoid Unit; 710mm X 355mm X 150mm

Features & Benefits

- Designed and tested for retention, attenuation or infiltration at shallower depths
- Effective source control
- Can be installed above a high water table
- Ideal for brownfield or contaminated sites
- Can remove silt and hydrocarbon deposits
- Removes the requirement for pumping stations
- Oil interception at source, no petrol interceptors
- High compressive and tensile strength under load
- Suitable beneath both porous and non-porous surfaces
- Reduces excavation depth and cost
- No need for trench supports or associated plant



Bulk Attenuation

WASP00001 Attenuation Crate; 1m x 0.5m x 0.4m

WASP00001 is used for trafficked and loaded applications and has a compressive strength of 61 tonne per square metre. WASP00001 has the added benefit of having up to 100% recycled material content. It is ideally suited for housing, commercial and infrastructure projects.

WASP00001 units are made from specially selected and controlled recycled materials making them an environmentally friendly, sustainable solution. The units have undergone stringent testing to ensure product performance with a compressive strength of 61 tonnes/m² and a 95% void ratio and 60 year creep limited life expectancy.

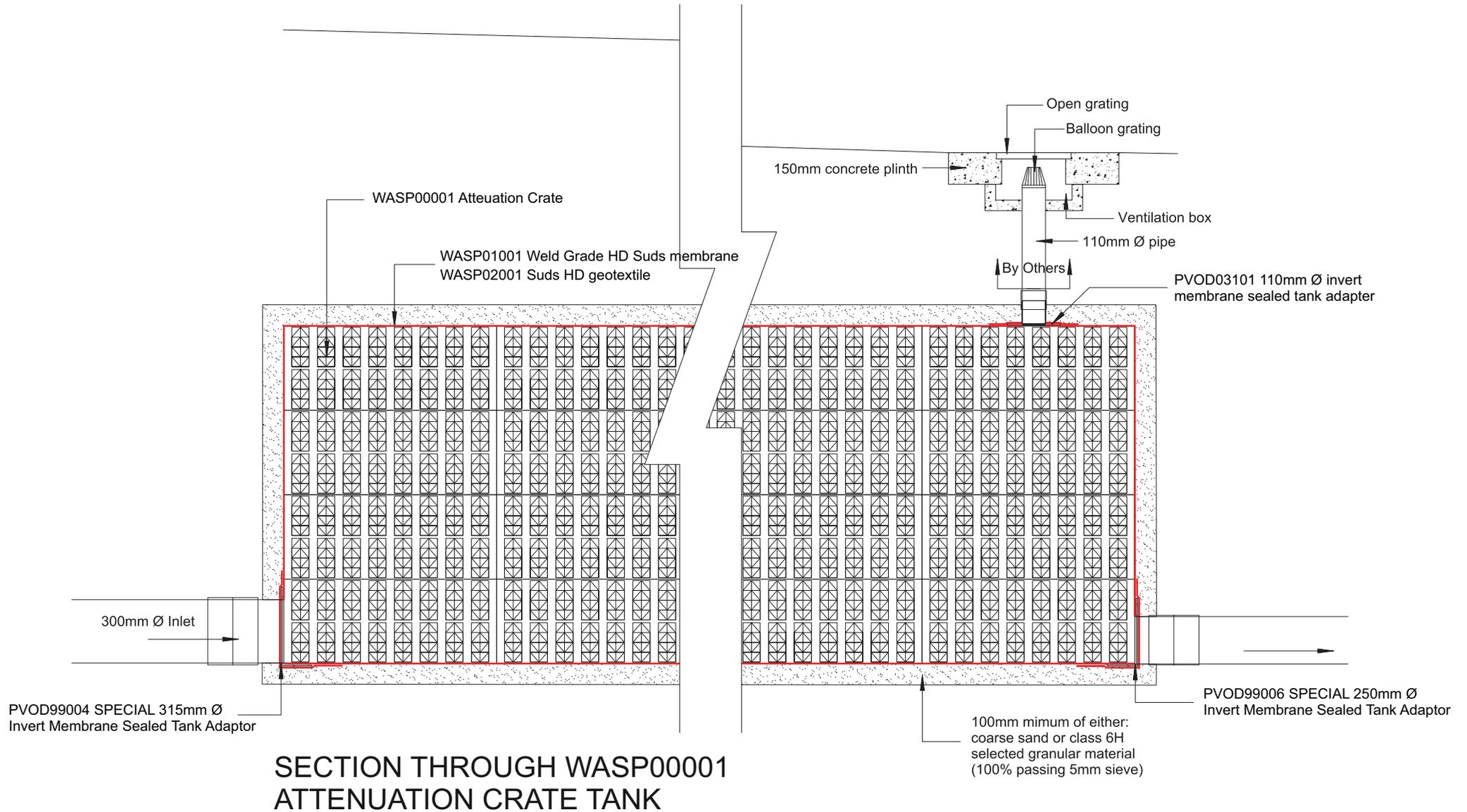
WASP00001 units are ideal for retention, attenuation and infiltration applications when used with a suitable geomembrane or geotextile. They are BBA approved and the modular nature of the system allows flexibility of shape - ideal for shallow excavation systems, narrow strips or use in restricted areas. They can be used as part of a value engineered hybrid system.

The system is suitable beneath asphaltic, block-paved or concrete pavements and for the full range of traffic conditions from domestic driveways to highways.

When combined with Controflow® Flow Control Chambers, WASP00001 units can be used to manage storage requirements from individual housing plots, or combined 'local' areas.



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Prefabricated Attenuation Tanks

Prefabricated attenuation tanks provide an ideal solution for sites with limited space or smaller developments with lower stormwater storage requirements. The tanks are available in sizes up to 6.5m long x 2.5m wide x 1.2m high which provides 18.5m³ of storage. Smaller tanks can be provided to specific site requirements. All tanks are provided with integral pipe connection spigots in a range of diameters that suit standard UPVc push-fit drainage.

The prefabricated attenuation tanks can be used in landscaped areas or in trafficked and loaded applications. They have a compressive strength of 61 tonne per square metre. The tanks have the added benefit of incorporating a high recycled material content. They are ideally suited for housing, commercial and infrastructure projects.

The tanks incorporate units that are made from specially selected and controlled recycled materials making them an environmentally friendly, sustainable solution. The units have undergone stringent testing to ensure product performance with a compressive strength of 61 tonnes/m² and a 95% void ratio and 60 year creep limited life expectancy and are BBA approved

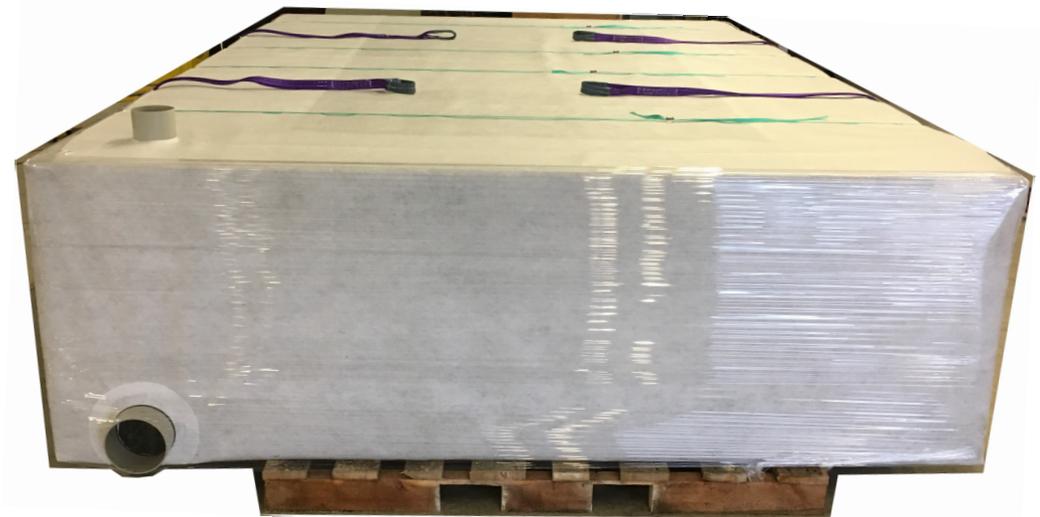
The system is suitable beneath asphaltic, block-paved or concrete pavements and for the full range of traffic conditions from domestic driveways to highways.

When combined with Controflow® Flow Control Chambers, WASP00001 units can be used to manage storage requirements from individual housing plots, or combined 'local' areas.

The tanks are delivered to site with lifting slings for easy handling.



Maximum Size is 6.5m long x 2.5m wide x 1.2m high





Prefabricated Attenuation Tank Encapsulation

Prefabricated attenuation tank encapsulation often referred to as 'Shoe Box' liners are ideal for smaller attenuation tanks allowing self-installation removing the need for a specialist subcontractor. Guidance can be provided on the installation.

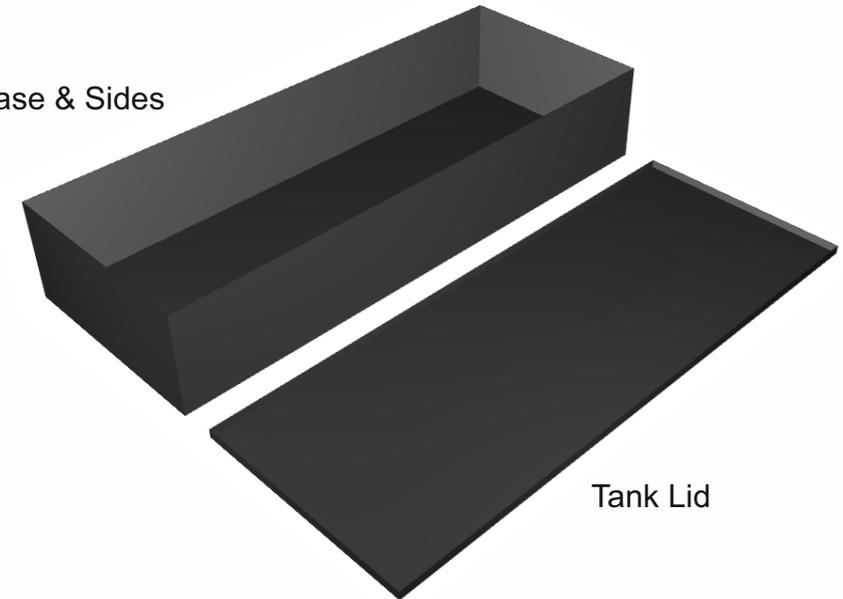
The liners can be manufactured in a variety of membrane types such as PP or LLDPE and sized to suit your project specific requirements. Pipe connections can be also be supplied, and are available in a range of diameters.

The prefabricated liners are compatible with all attenuation crates systems currently available.

Benefits:

- Economical
- Contractor self-installation reduces cost
- No specialist installation sub-contractor
- Avoids programming delays and mobilisation costs
- Provided with welded seams
- Built to any size
- Palletised for delivery
- Fully QA certified
- Free guidance on self-installation offered
- Quick turnaround for delivery

Tank Base & Sides



Tank Lid



Prefabricated liner ready for dispatch

SEL SOURCE AT



SudsAgg

Aggregate Industries SudsAgg is a graded, low fines, crushed aggregate with a maximum nominal aggregate size of 40mm.

It is designed to have a guaranteed void ratio greater than 30% and has been designed to be used as a direct replacement for Type 1 and therefore does not require any geogrid type reinforcement.

Laid thickness will be dependent on attenuation requirement / ground conditions / construction methods.

SudsAgg has a special grading for the purpose to provide a 30% void ratio while also maintaining all the physical properties necessary to fulfill the role of a standard granular Type 1 sub-base.

This blend has been formulated by Aggregate Industries on behalf of SEL Environmental Ltd and is known within the industry as SudsAgg.

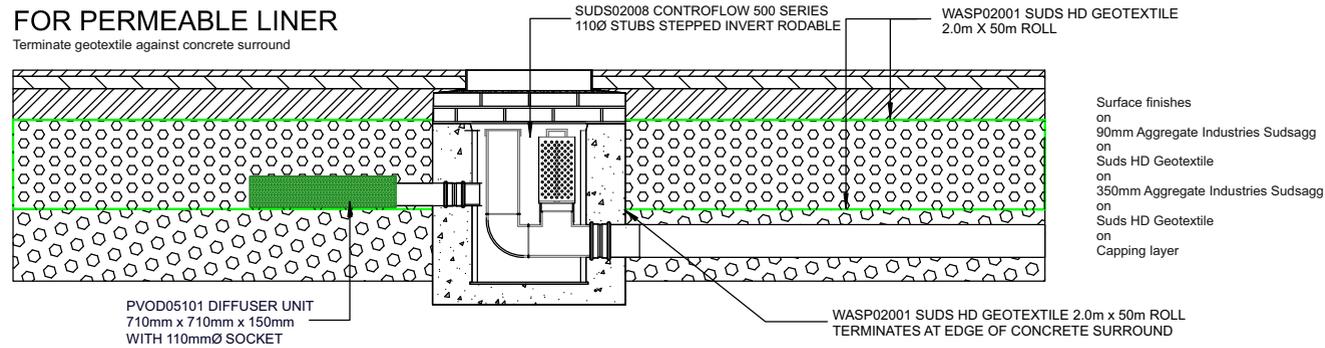
Aggregate Industries have offered this material at the same (or less) cost per m³ as the same volume of their type 1 sub-base (using the same rock source).





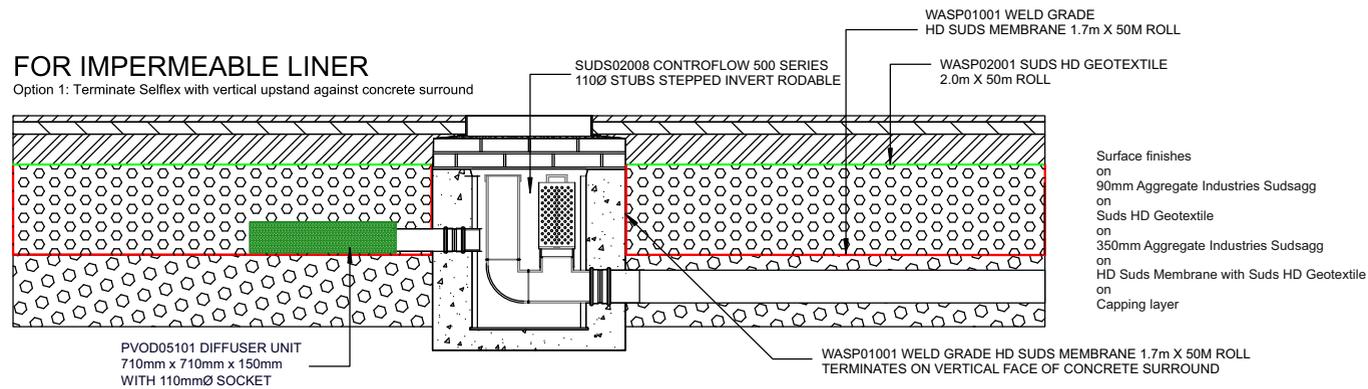
FOR PERMEABLE LINER

Terminate geotextile against concrete surround



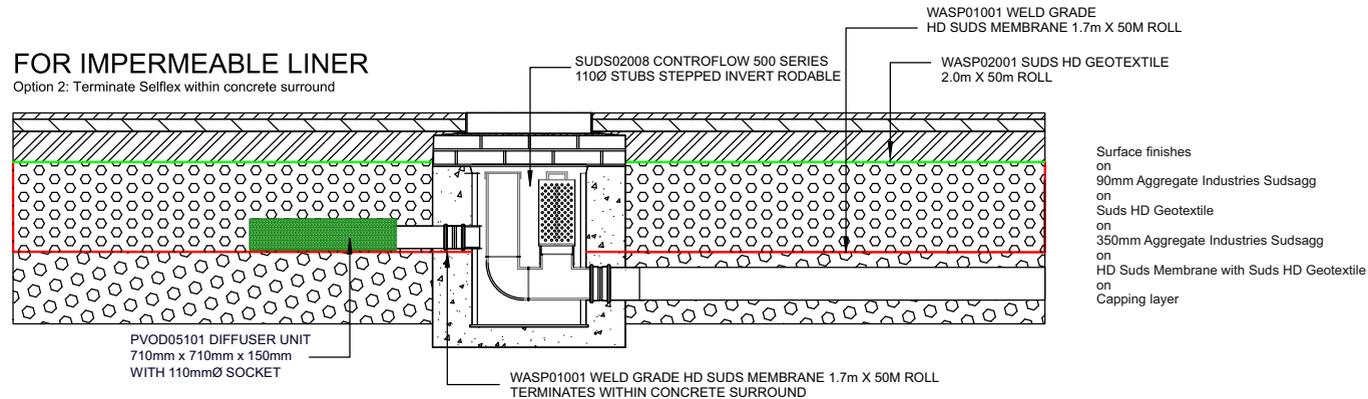
FOR IMPERMEABLE LINER

Option 1: Terminate Selfflex with vertical upstand against concrete surround



FOR IMPERMEABLE LINER

Option 2: Terminate Selfflex within concrete surround





Flow Control Chambers

SUDS01101 Controflow 300 Series Stepped Invert Protected Orifice

The SUDS01101 flow control chamber is specifically designed for use with the Skeletank attenuation tank. The standard 11mm diameter orifice, protected by a removable filter, allows for surface water runoff to be restricted to a flow rate of 0.2l/s, preferably within the curtilage of each plot to suit the site layout.

Orifices to suit higher flow rates of 0.4l/s and 0.6l/s are available should the drainage system need to accommodate more than one property for genuine design reasons.

Filters are removable to allow for cleaning and/or replacement. A specialised tool is required to facilitate removal and it is essential that filters are fixed back into position before replacing the filter tube.



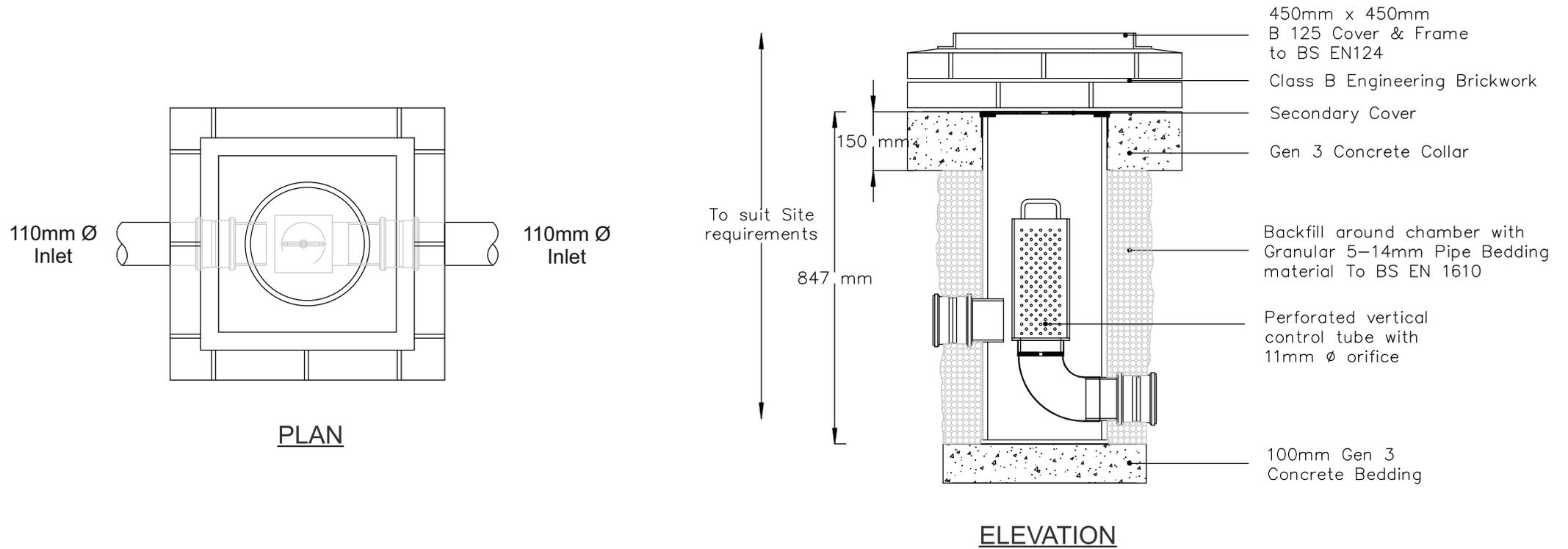
SUDS01101 Controflow 300 Series
Stepped Invert Protected Orifice



Each chamber has a 200mm deep sump to accommodate the deposition of any suspended solids remaining in the runoff which has passed through RWP Filter Chambers positioned at the base of all the downpipes.

The chamber spigots are sized to fit standard 110mm diameter underground push-fit PVC-u drainage sockets.

SEL SOURCE AT



SUDS01101 Controflow 300 Series Stepped Invert Protected Orifice



Flow Control Chambers

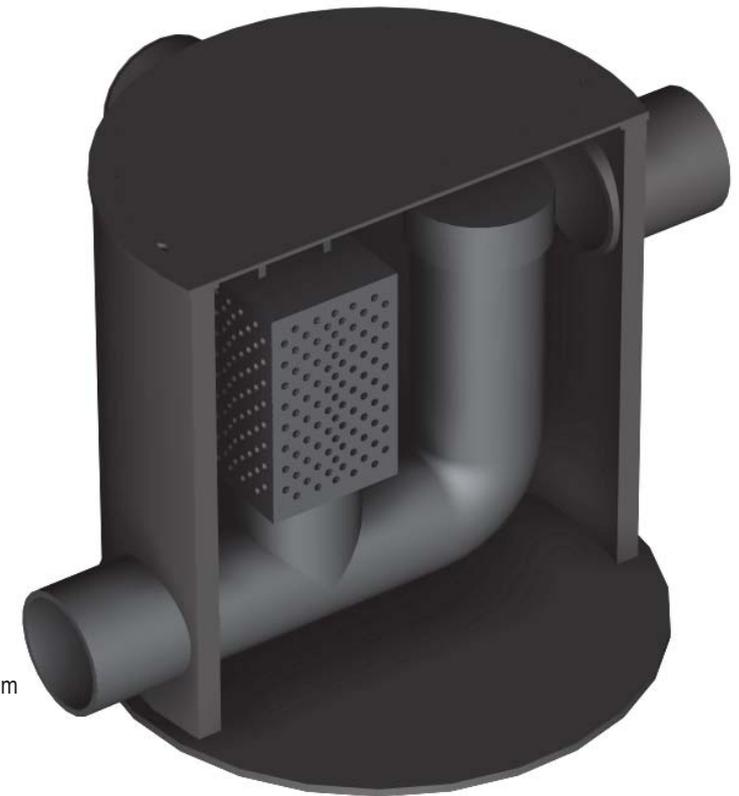
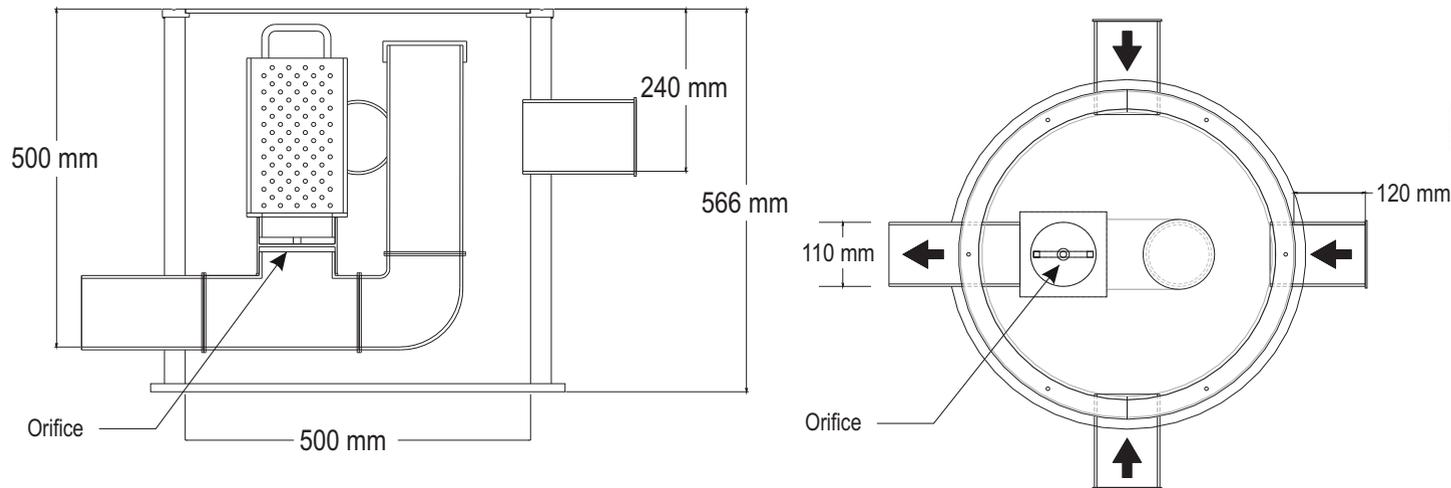
SUDS02008 Controflow 500 Series 110Ø Stubs Stepped Invert Rodable

Controflow® Flow Control Chambers have been developed, in association with Robert Bray Associates, to control flows around developments from shallow SuDS features, such as permeable pavements and swales.

The stepped invert version facilitates a simple transition in construction levels, from above to below formation level. This allows for deeper collection pipework to be installed ahead of the individual permeable pavement areas below formation level, away from construction traffic.

Controflow® units for permeable pavements are pre-manufactured to site-specific orifice diameter requirements and arrive on site ready for installation. The units incorporate rodding access and an integral removeable screen to protect the orifice.

SUDS02008 Controflow 500 Series 110mmØ stubs stepped invert rodable



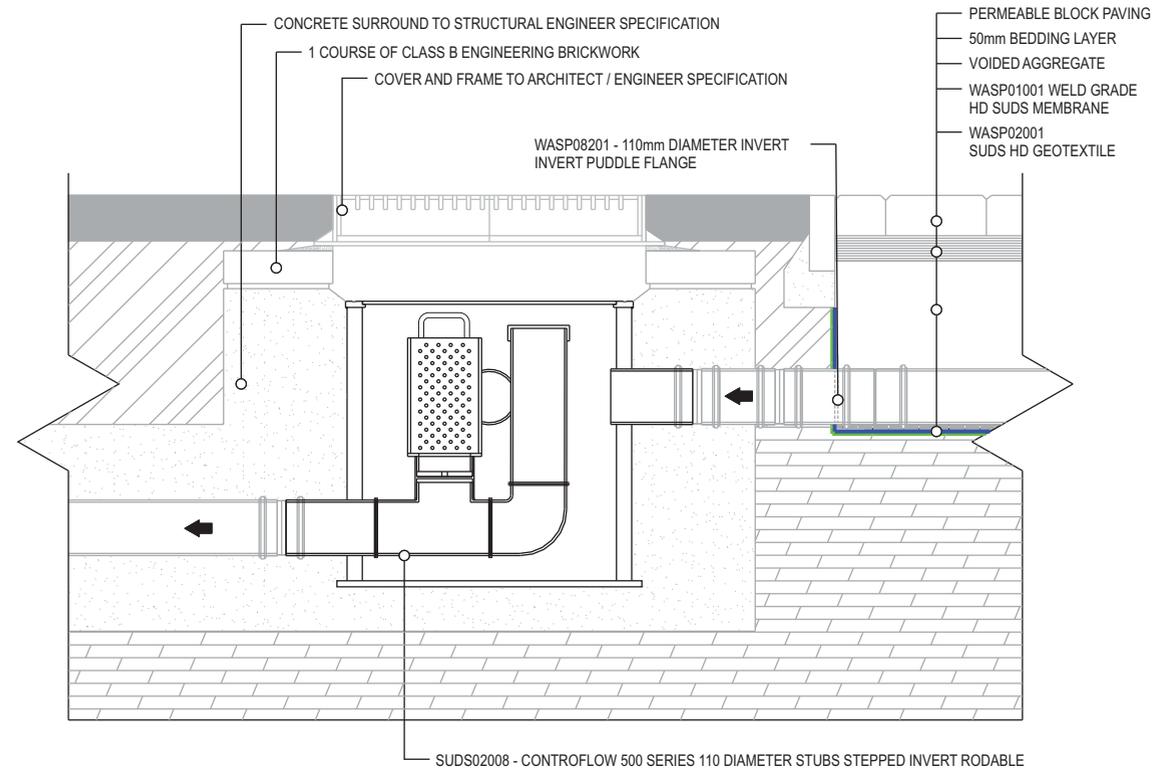


The benefits of using an Controflow® stepped invert chamber are:

- Receives flow from above formation and enables a transition in level with ongoing pipework below formation level.
- Orifice can be sized to suit individual micro-catchments to maximise attenuation.
- The orifice is fixed in place to prevent inadvertent removal.
- Removable filter to allow cleaning during routine maintenance schedules.
- Integral rodding access point for maintenance.
- Sump to accommodate the deposition of silt and debris.
- Connects to standard underground push-fit PVCu drainage sockets.

Controflow® chambers allow designers to take advantage of the full storage capacity within the voided sub-base when used to regulate the pass-forward flow from each micro-catchment of permeable pavement.

Across a whole site this can amount to a significant additional storage volume at source and affect the scope of drainage works downstream, potentially downsizing, or eliminating completely, the requirement for additional storage measures to deal with events above the 1 in 30 year storm event, such as geocellular tanks or attenuation ponds.



Flow Control Chambers

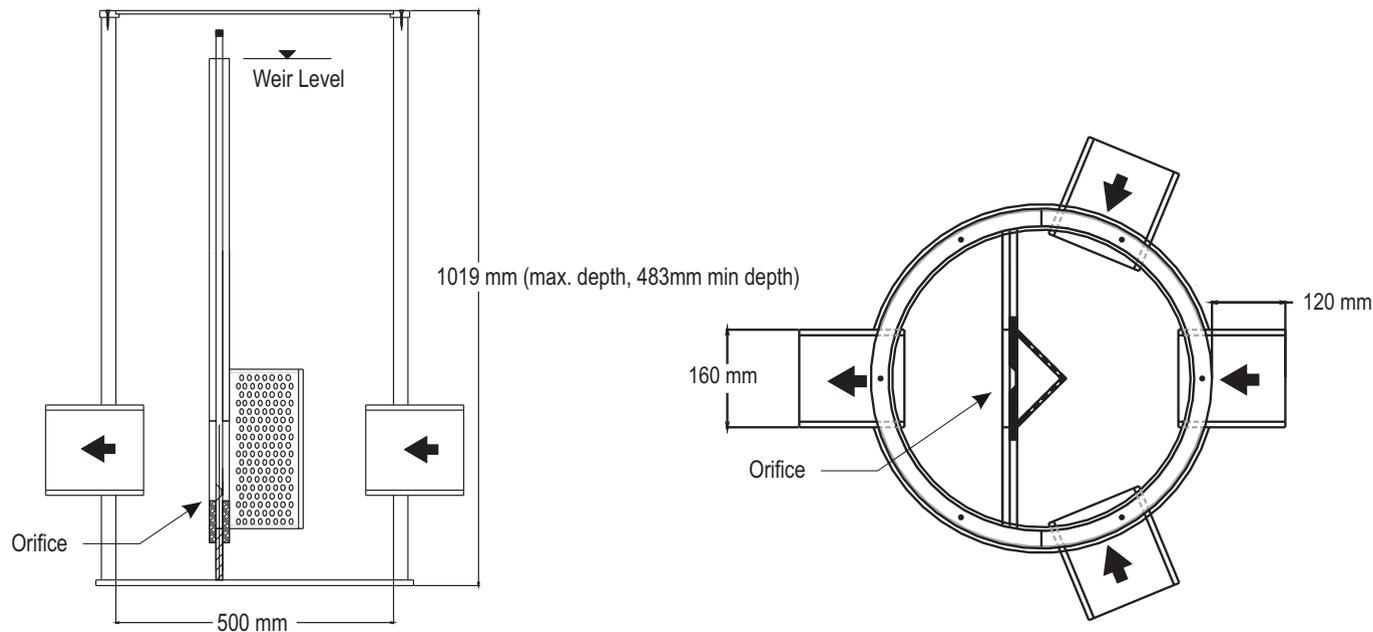
SUDS02005 Controflow 500 Series Universal Level Invert

Controflow® Flow Control Chambers have been developed, in association with Robert Bray Associates, to control flows around developments from shallow SuDS features, such as permeable pavements and swales.

The level invert version allows connection to shallow outfalls e.g. swales and ditches, or other areas of voided sub-base e.g. access roads. This chamber also includes a built-in weir wall, which is removable for easy maintenance.

Controflow® units for permeable pavements are pre-manufactured to site-specific orifice diameter and weir wall height requirements and arrive on site ready for installation. The units incorporate an integral screen to protect the orifice.

SUDS02005 - Controflow 500 Series 110mmØ stubs universal level invert

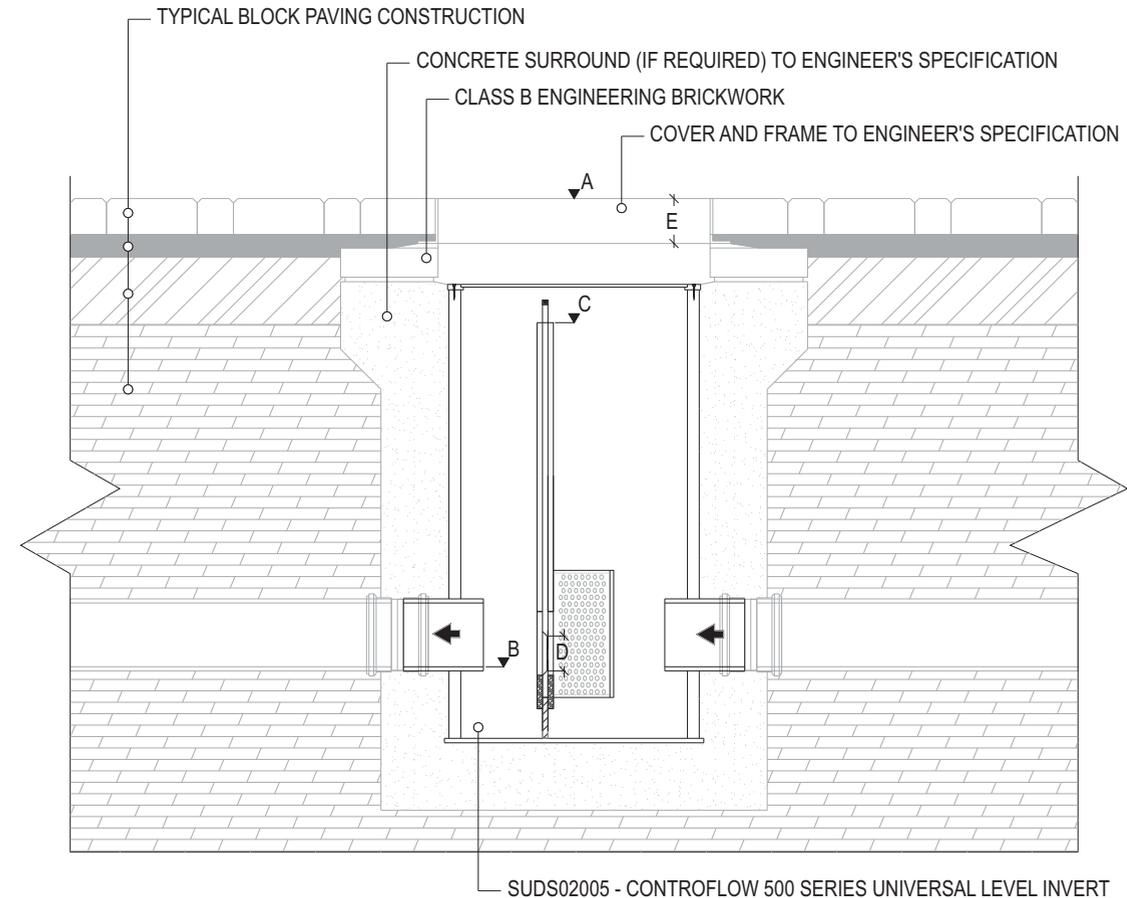




The benefits of using an Controflow® level invert chamber are:

- Allows gravity connection to shallow outfalls or permeable construction.
- Orifice can be sized to suit individual micro-catchments to maximise attenuation.
- The orifice is integral to the weir wall and is protected by a filter screen.
- Weir wall is removable to allow cleaning during routine maintenance schedules.
- Weir wall height is manufactured to site-specific requirements.
- Sump to accommodate the deposition of silt and debris.
- Connects to standard underground push-fit PVCu drainage sockets.

Controflow® chambers allow designers to take advantage of the full storage capacity within the voided sub-base when used to regulate the pass-forward flow from each micro-catchment of permeable pavement. Across a whole site this can amount to a significant additional storage volume at source and affect the scope of drainage works downstream, potentially downsizing, or eliminating completely, the requirement for additional storage measures to deal with events above the 1 in 30 year storm event, such as geocellular tanks or attenuation ponds.



- A - COVER LEVEL (m AOD)
- B - PIPE INVERT LEVEL (m AOD)
- C - WEIR LEVEL (m AOD)
- D - ORIFICE DIAMETER (mm)
- E - DEPTH OF COVER AND FRAME TO BE USED (mm)



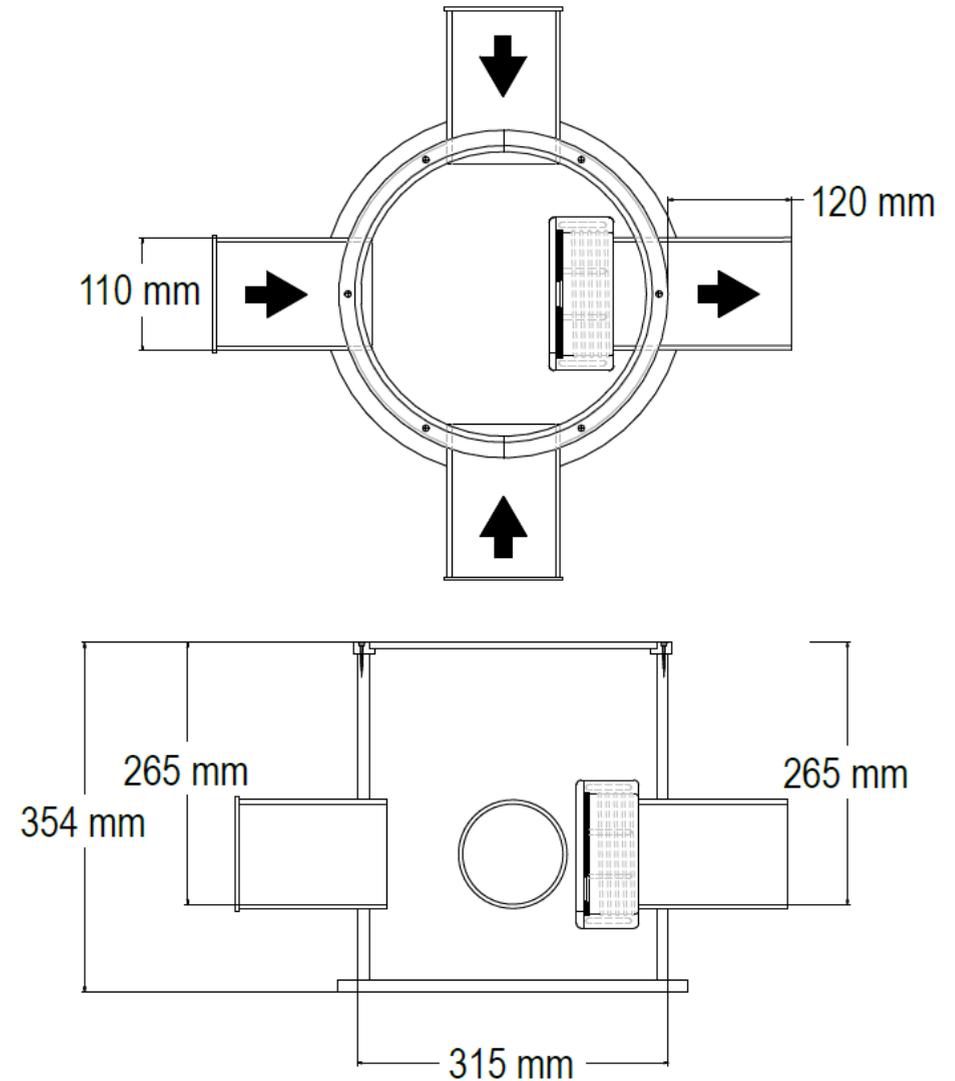
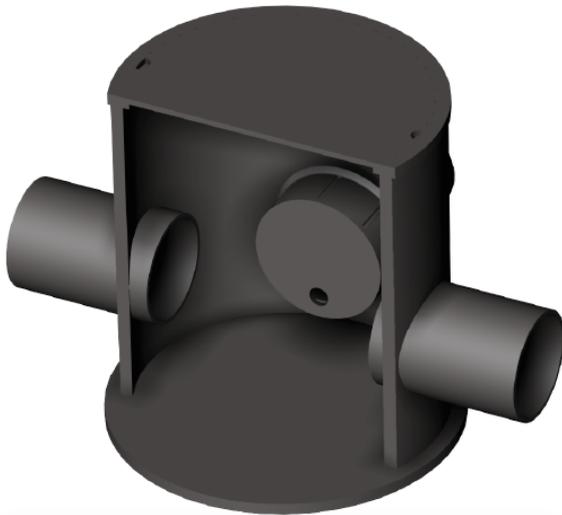
Flow Control Chambers

SUDS01001 Controflow 300 Series level Invert Screw Cap

A shallow flow control chamber with a removable, un-guarded circular orifice (to specified diameter), designed to manage prefiltered outflows from permeable paving.

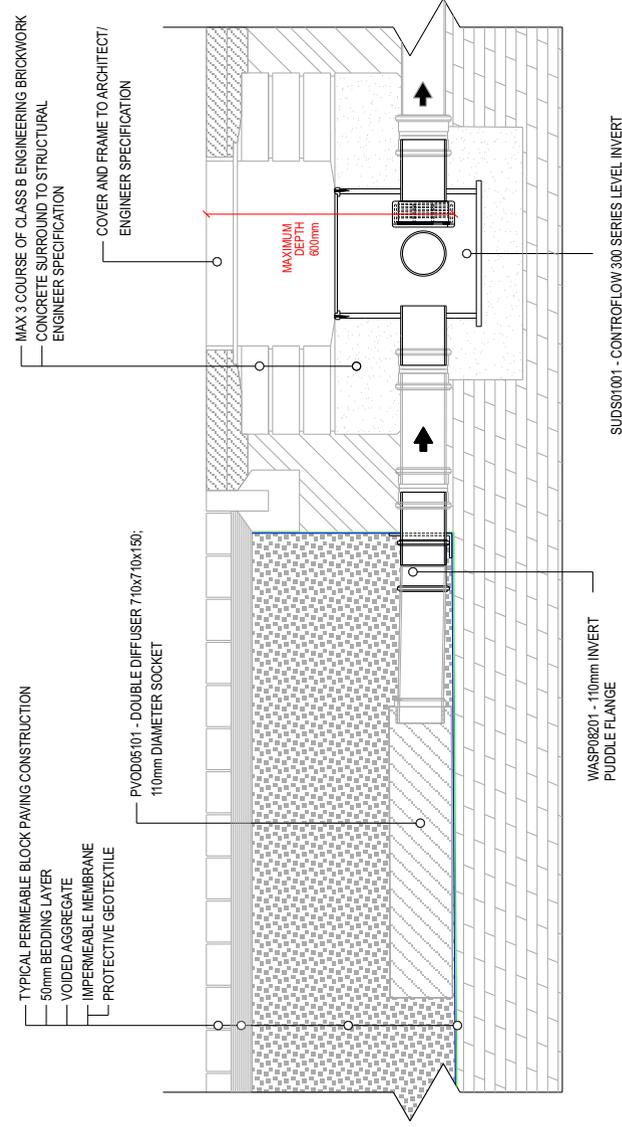
The chamber is suitable for a maximum depth of 600mm from finished ground level, to the orifice plate.

The chamber's small size and low cost make it ideal for managing flows between permeable paving compartments. Three 110mm diameter inlet pipe connection stubs offer a flexible layout. Supplied with a temporary protective site cover (permanent cover and frame not included).

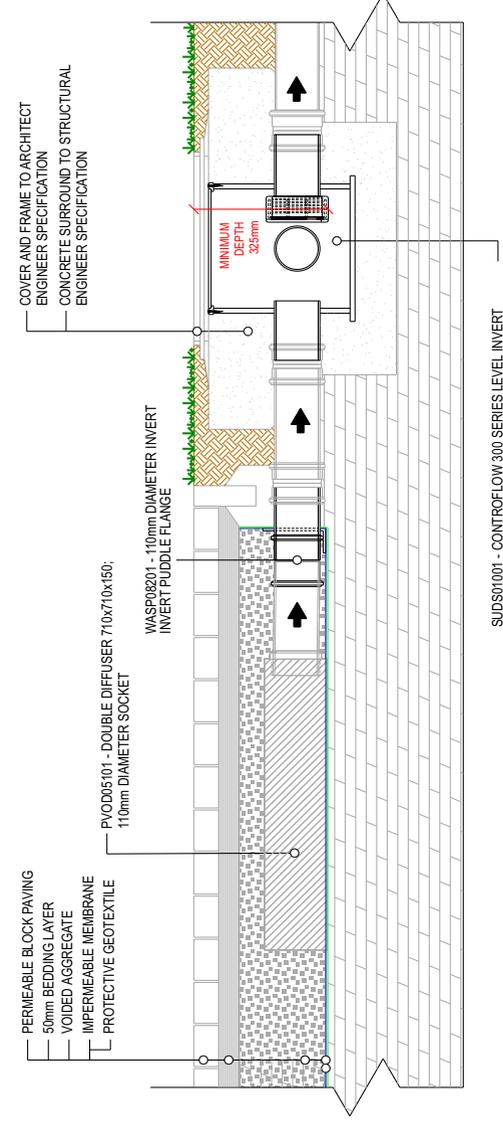




SUDS01001 - CONTROFLOW 300 SERIES LEVEL INVERT MAXIMUM DEPTH APPLICATION



SUDS01001 - CONTROFLOW 300 SERIES LEVEL INVERT MINIMUM APPLICATION





Filter Chambers

Downpipe Filter Chamber for use within Voided Sub-base

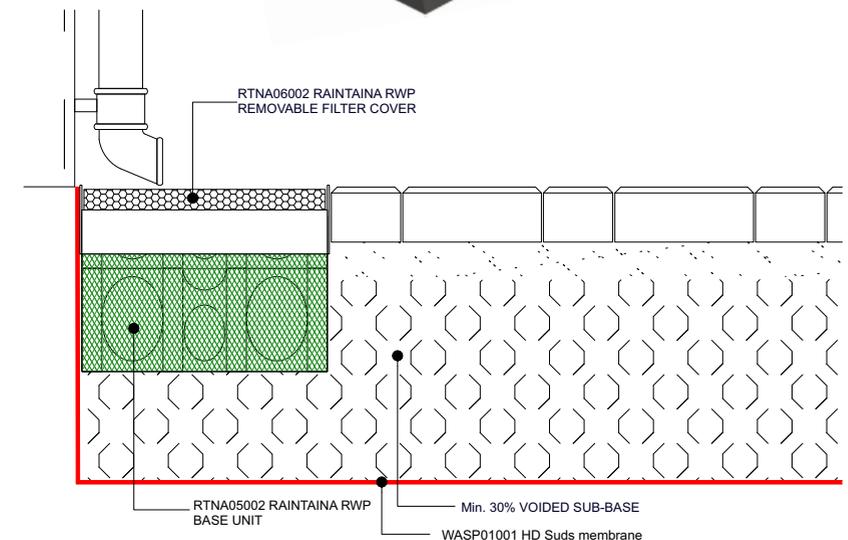
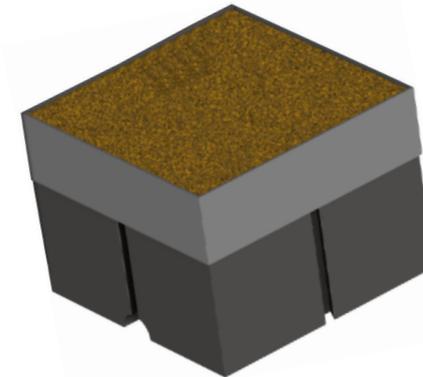
RTNA05002 Raintaina RWP Base Unit Diffuser with Mesh Surround
RTNA06002 Raintaina RWP Filter Cover Bronze Aggregate

Raintaina Erosion Pad Filter System is a self-flushing downpipe erosion pad and filter chamber. Downpipes discharge directly onto the permeable cover which effectively prevents detritus, such as leaves, moss and feathers, from entering a permeable pavement. The permeable cover is formed from resin bound gravel and removable for easy maintenance

Raintaina Erosion Pad Filter System provides the following benefits:

- Downpipe discharges directly onto the top of the SEL Raintaina Erosion Pad Filter System.
- Self-flushing; removes leaves, moss, feathers and other debris at ground level potentially avoiding overtopping of gutters.
- Provides a treatment phase, which is especially beneficial where planning conditions seek one treatment phase for roof run-off.
- Efficient filtration and silt separation.
- Prevents silt and debris entering the permeable paving system.
- Units situated under each individual downpipe to minimise the risk of system failure.
- Units positioned within the permeable paving system.
- Suitable for pedestrian areas with filter cover available in a variety of finishes.

RTNA05002 Raintaina Erosion Pad
Filter Chamber with RTNA06002
Raintaina Removeable Filter Lid





Filter Chambers

Downpipe Filter Chamber with Pipework Connection

RTNA05001 Raintaina RWP Base Unit

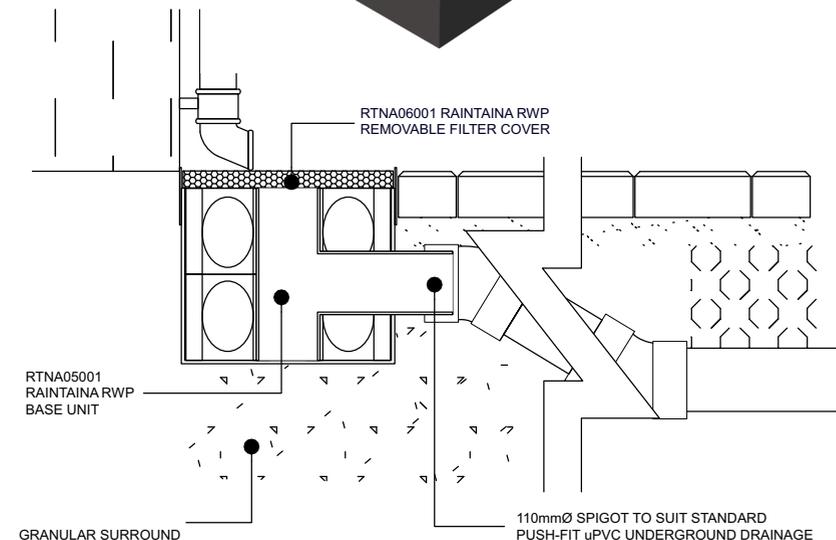
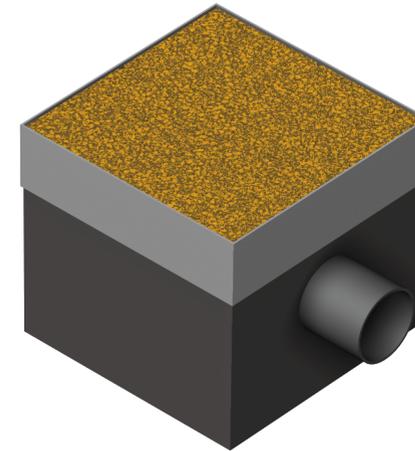
RTNA06001 Raintaina RWP Filter Cover Bronze Aggregate

Raintaina RWP Filter System is a self-flushing downpipe filter chamber. Downpipes discharge directly onto the permeable cover which effectively prevents detritus, such as leaves, moss and feathers, from entering a permeable pavement or pipe collection network. The permeable cover is formed from resin bound gravel and removable for easy maintenance.

The SEL Raintaina RWP Filter System provides the following benefits:

- Downpipe discharges directly onto the top of the SEL Raintaina RWP Filter System.
- Self-flushing; removes leaves, moss, feathers and other debris at ground level potentially avoiding overtopping of gutters.
- Provides a treatment phase, which is especially beneficial where planning conditions seek one treatment phase for roof run-off.
- Efficient filtration and silt separation.
- Prevents silt and debris entering the underground drainage system.
- Units situated under each individual downpipe to minimise the risk of system failure.
- Units for use outside of permeable paving system.
- Suitable for pedestrian areas with filter cover available in a variety of finishes.

RTNA05001 Raintaina Filter Chamber
with RTNA06001 Raintaina Removeable Filter Lid





Filter Chambers

Purpose-built high density polyethylene (HDPE) pre-fabricated catchpits are ideal for stormwater drainage systems.

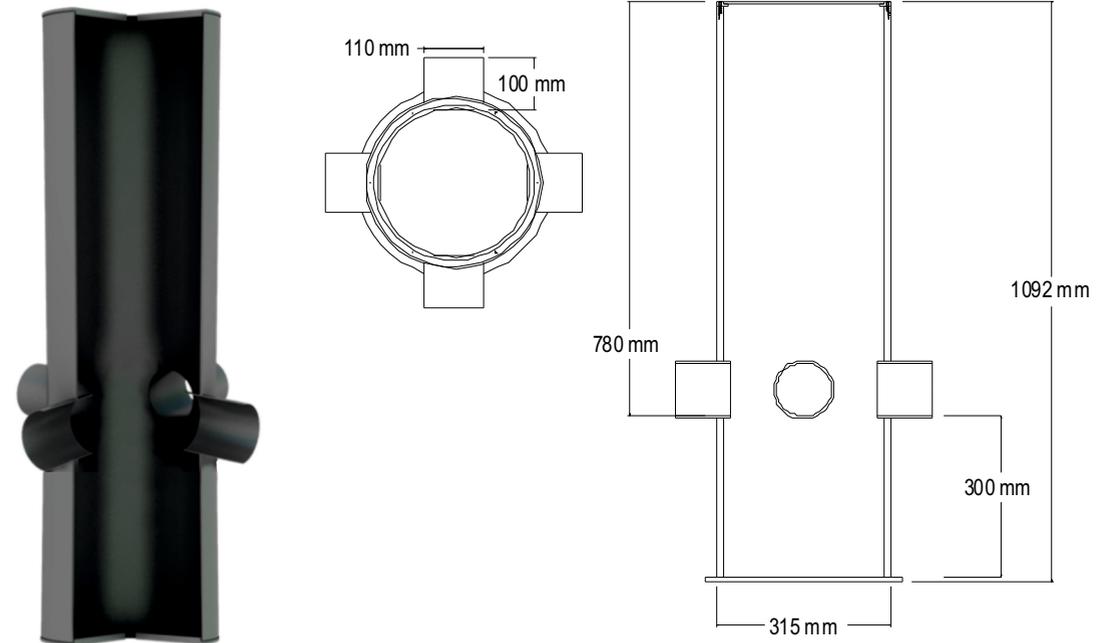
WASP Catchpits are designed to separate silt and other particles, helping to improve the quality of water before it is reintroduced into the environment.

They can be integrated into any drainage system requiring 'in line' silt and debris separation prior to attenuation or infiltration.

WASP Catchpits provide the following benefits:

- Provide a treatment phase, which is especially beneficial where planning conditions seek one treatment phase for runoff.
- Efficient filtration and silt separation.
- Prevents silt and debris entering an attenuation or infiltration system to minimise the risk of system failure.
- Have a 300mm deep collection sump for silt / debris deposition to enable easy removal at regular maintenance intervals.
- No moving parts.
- Spigots sized to suit standard PVCu pushfit pipework.

WASP04301 315mmØ Chamber, 3 x 110mm Ø inlets, 1 x 110mm Ø outlet



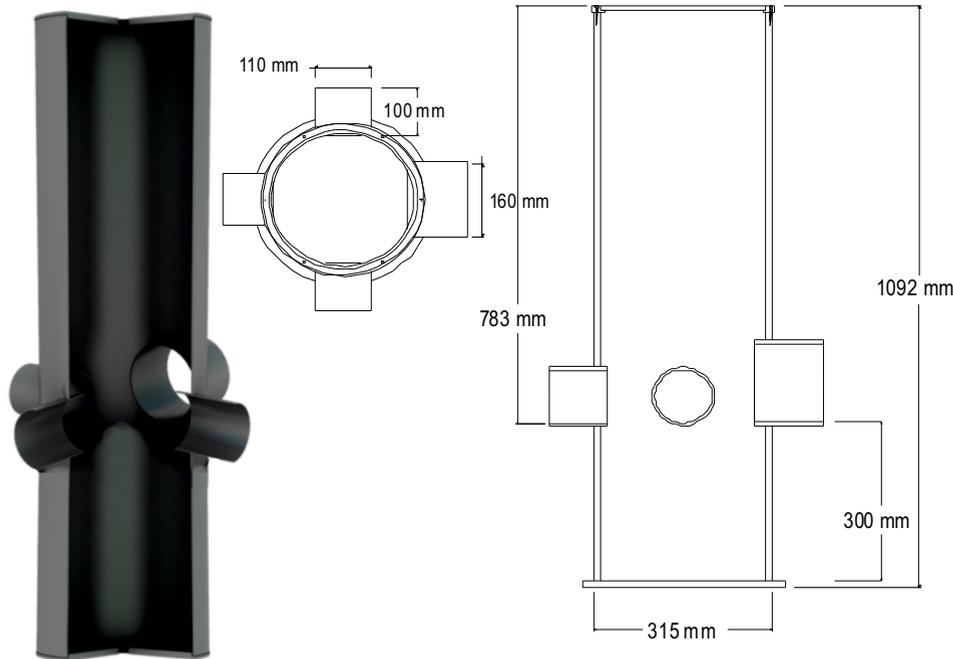
The WASP04301 has a diameter of 315mm and an overall nominal height of 1092mm. The polyethylene chamber can be easily reduced on site to suit required invert levels.

Each chamber has 4 number 110mm diameter pipe spigots to suit standard PVC-u push fit drainage pipework. Each spigot can be used to form either an inlet or outlet.

The WASP04301 chamber has a 300mm deep sump to accommodate the deposition of silt and debris in the collected rainwater for later removal under a regular maintenance regime.



WASP04310 315mmØ Chamber, 3 x 110mm Ø inlets, 1 x 160mm Ø outlet

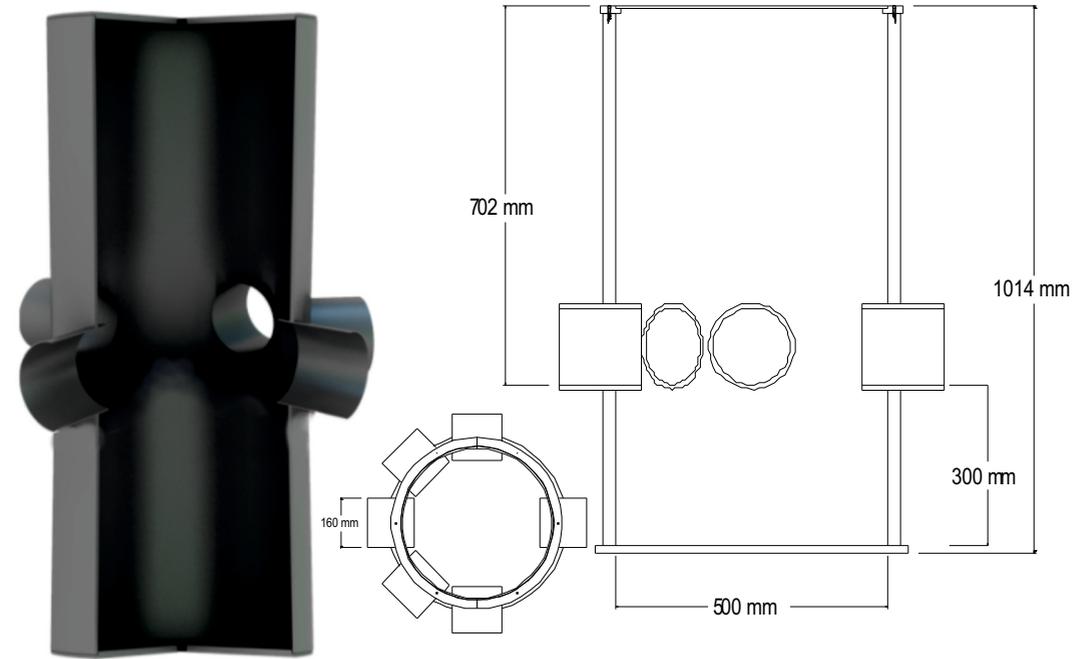


The WASP04310 has a diameter of 315mm and an overall nominal height of 1092mm. The polyethylene chamber can be easily reduced on site to suit required invert levels.

Each chamber has 3 number 110mm diameter inlet pipe spigots and 1 number 160mm diameter outlet pipe spigot to suit standard PVC-u push fit drainage pipework.

The WASP04310 chamber has a 300mm deep sump to accommodate the deposition of silt and debris in the collected rainwater for later removal under a regular maintenance regime.

WASP04510 500mmØ Chamber, 5 x 160mm Ø inlets, 1 x 160mm Ø outlet



The WASP04510 has a diameter of 500mm and an overall nominal height of 1014mm. The polyethylene chamber can be easily reduced on site to suit required invert levels.

Each chamber has 5 x 160mm diameter inlet pipe spigots and 1 x 160mm diameter outlet pipe spigot to suit standard PVC-u push fit drainage pipework. The inlet/outlets can be reduced to 110mm diameter by incorporating level invert reducers as required.

The WASP04510 chamber has a 300mm deep sump to accommodate the deposition of silt and debris in the collected rainwater for later removal under a regular maintenance regime.

SEL SOURCE AT



How to Achieve Storage Within a Permeable Pavement on a Sloping Site

If a permeable pavement is required on a sloping site and is being utilised for infiltration, then it must be designed to prevent water from infiltrating solely at the lowest point.

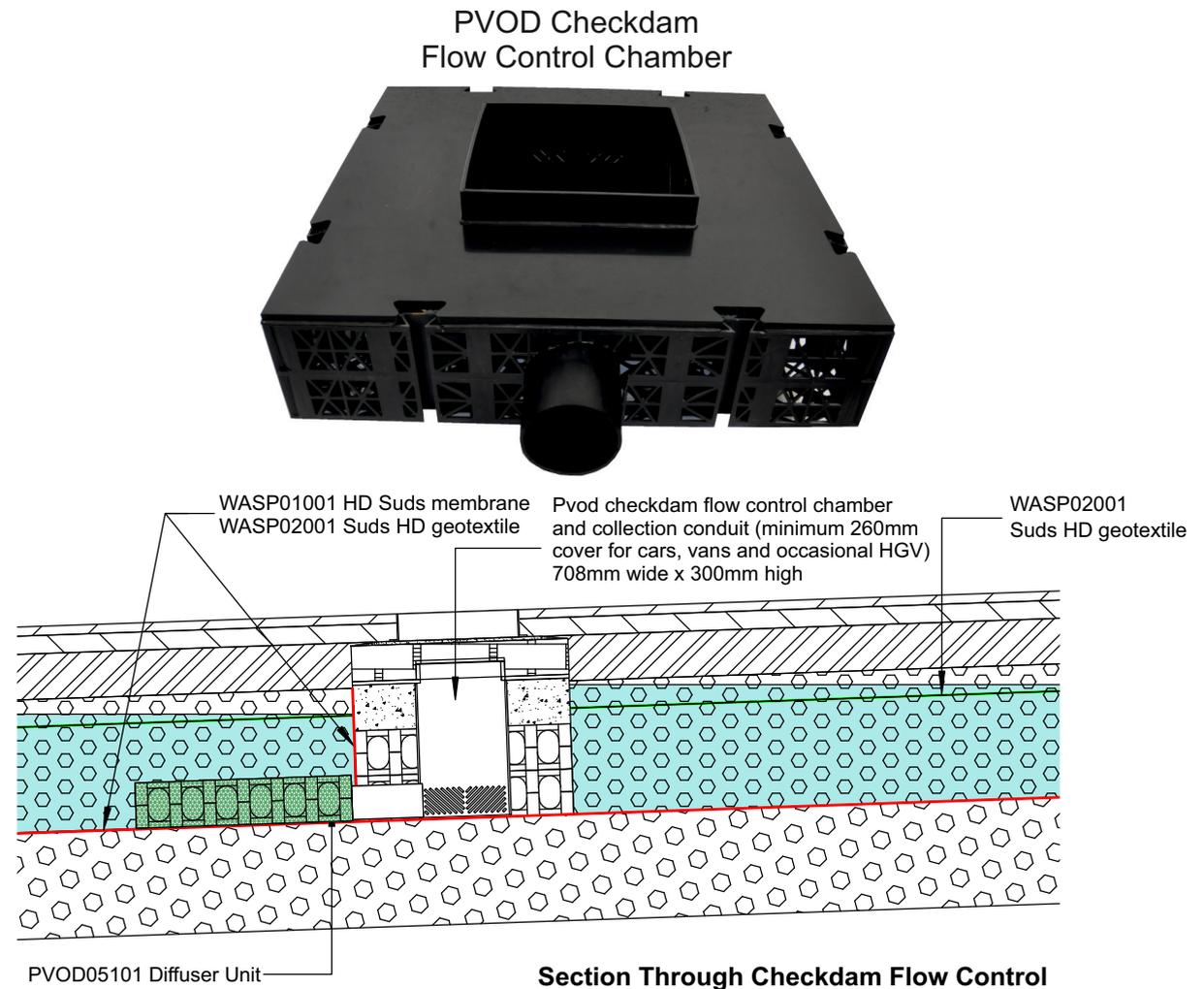
If the permeable pavement is being utilised for attenuation then the slope will reduce the available storage in the voided sub-base.

The SEL Checkdam system can provide a solution for both situations.

SEL recommend the creation of terraced areas separated using the SEL Checkdam system.

Developed from our existing range of components to suit podium deck drainage, the SEL Checkdam arrangement comprises the PVOD Flow Control Unit with Permavoid®. These are combined together to construct effective checkdams within permeable pavements on sloping sites.

HD Suds membrane is installed below and to the vertical face of the checkdam leaving a flexible apron which is then heat sealed to the main attenuation liner to form a water tight seal.



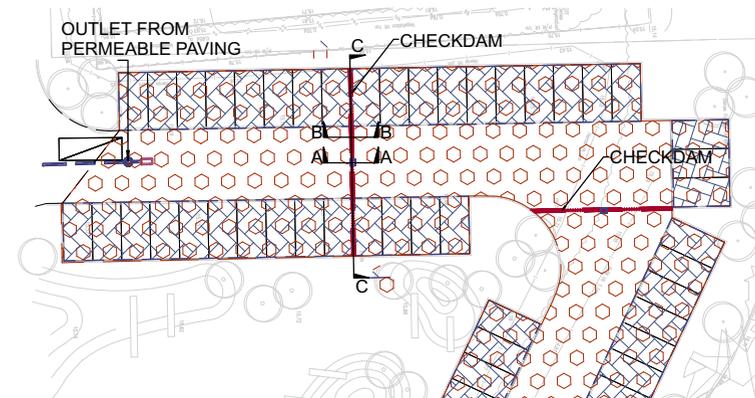
SEL SOURCE AT



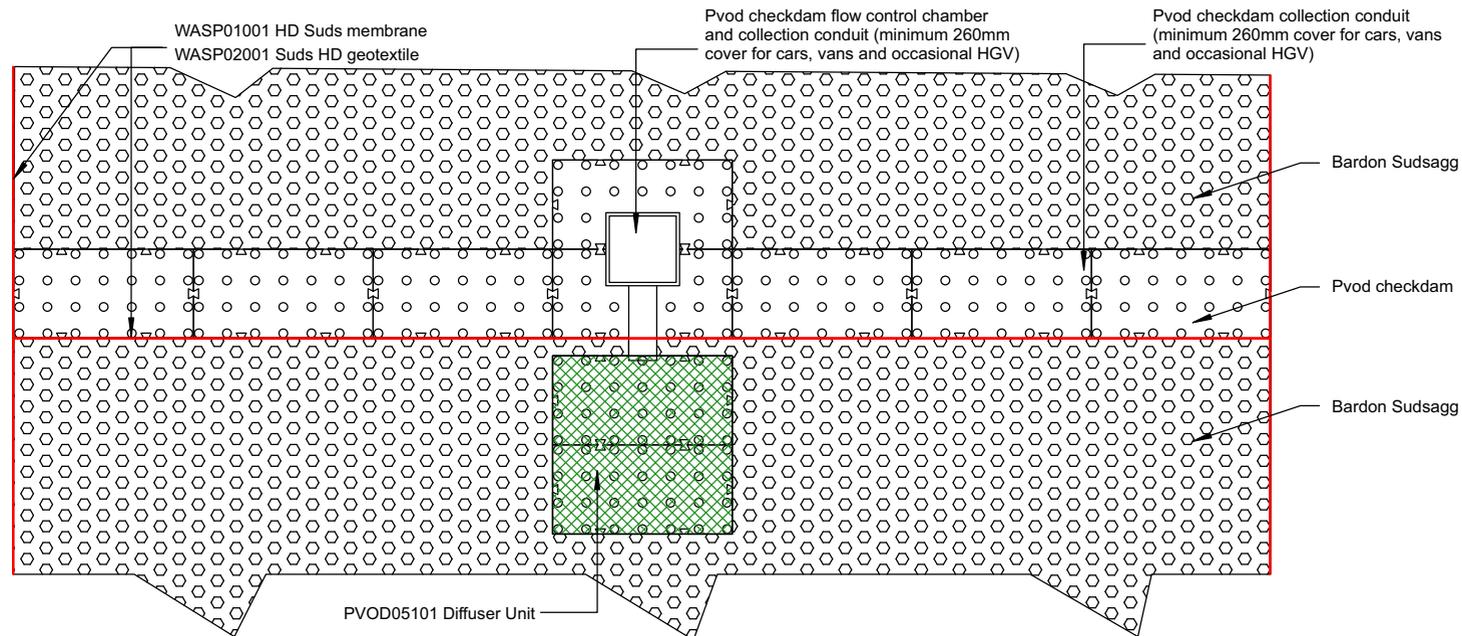
The Permavoid® units act as a collection conduit and are installed across the full width of the slope. These allow surface water to flow towards a PVOD flow control unit.

The surface water is passed forward through an orifice and dispersed into the on-going voided sub-base using a diffuser unit.

The flow rate and centre spacing of the checkdams can be modelled to suit site specific conditions.



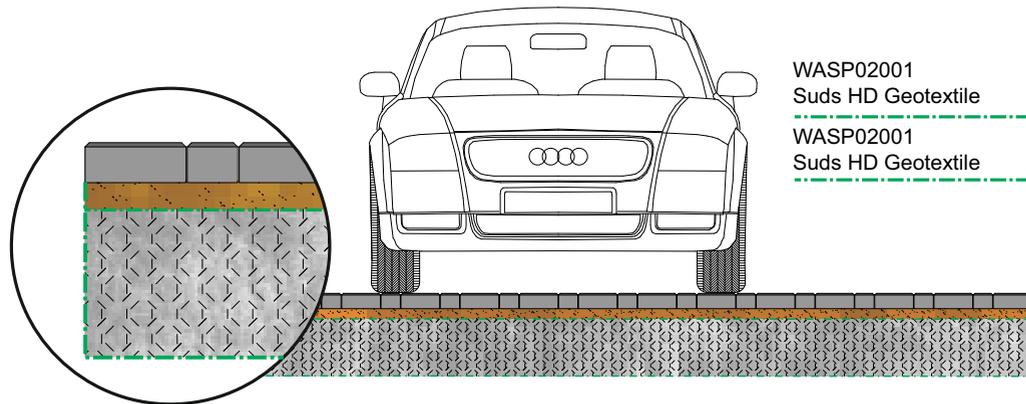
PLAN VIEW





Effective encapsulation of a Permeable Pavement for Infiltration

Standard Infiltration

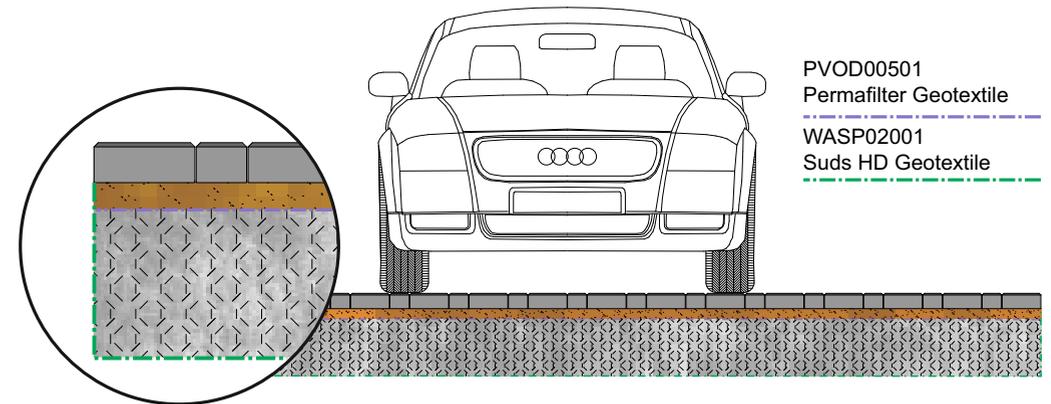


WASP02001 Suds HD Geotextile is a heavy duty, non-woven, needle-punched polypropylene geotextile which is suitable for infiltration (or membrane protection in attenuated areas). When used in a standard infiltration application Suds HD Geotextile is laid to the base and sides of the voided sub-base aggregate and also used as a separation layer between the permeable surfacing bedding layer and voided sub-base.

WASP02001 Suds HD Geotextile provides the following benefits:-

- Zero breakthrough head.
- High permeability.
- Good resistance to elongation.
- Excellent protection to WASP01001HD Suds membrane (when used in an attenuation application).

Infiltration with enhanced hydrocarbon treatment



PVOD00501 Permafilter Oil Trapping Geotextile is a non-woven, dimpled, needle-punched geotextile that has been specifically designed to provide enhanced hydrocarbon pollution treatment. In an enhanced infiltration application, Suds HD Geotextile is laid to the base and sides of the voided sub-base aggregate with Permafilter oil trapping geotextile used as a separation layer between the permeable surfacing bedding layer and voided sub-base.

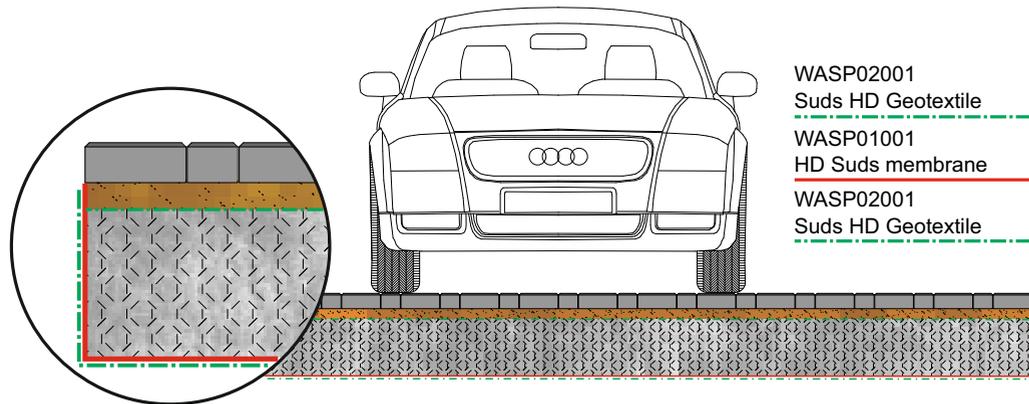
PVOD00501 Permafilter Oil Trapping Geotextile provides the following benefits:-

- Enhanced hydrocarbon pollution treatment.
- Capable of retaining oil contamination ranging from daily car drip losses to catastrophic events.
- Entrapped hydrocarbons are biodegraded by naturally occurring micro-organisms, providing a self-cleansing action.



Effective encapsulation of a Permeable Pavement for Attenuation

Standard Attenuation

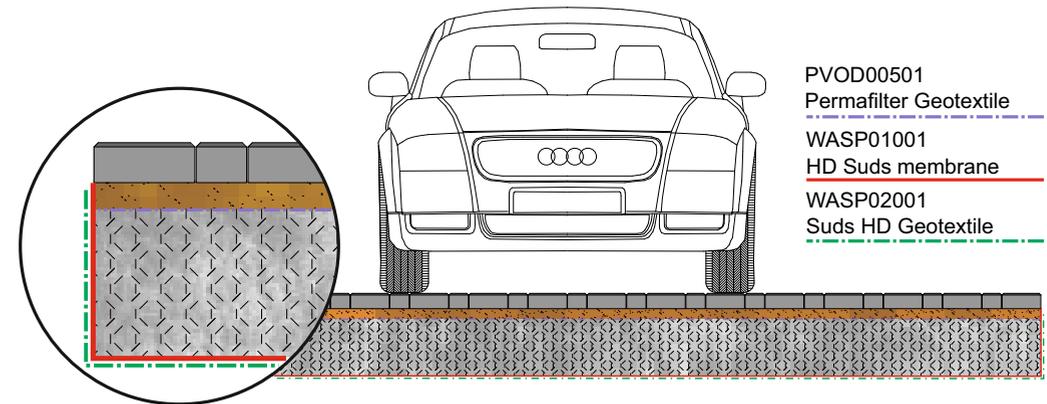


WASP01001 HD Suds membrane is suitable for lining areas beneath permeable pavements that are being utilised for attenuation. HD Suds Membrane is protected with a layer of Suds HD Geotextile, which is also used as a separation layer between the permeable surfacing bedding layer and voided sub-base.

WASP01001 HD Suds membrane provides the following benefits:

- High resistance to puncture.
- Fully weldable.
- Good elongation characteristics.
- Range of watertight pipe outlets available.

Attenuation with enhanced hydrocarbon treatment



PVOD00501 Permafilter Oil Trapping Geotextile is a non-woven, dimpled, needle-punched geotextile that has been specifically designed to provide enhanced hydrocarbon pollution treatment. In an enhanced attenuation application, Suds HD Geotextile is laid to the base and sides of the voided sub-base aggregate with Permafilter oil trapping geotextile used as a separation layer between the permeable surfacing bedding layer and voided sub-base.

PVOD00501 Permafilter Oil Trapping Geotextile provides the following benefits:-

- Enhanced hydrocarbon pollution treatment.
- Capable of retaining oil contamination ranging from daily car drip losses to catastrophic events.
- Entrapped hydrocarbons are biodegraded by naturally occurring micro-organisms, providing a self-cleansing action.



Effective encapsulation of an Attenuation System

Standard Attenuation

SEL recognises the importance of ensuring the watertight integrity of attenuation systems and more so where it is essential that runoff is fully contained within an underground storage system (e.g. where there is a potential of contaminants leaching into a protected aquifer or watercourse).

SEL recommend the use of welded membranes and that all joints are sealed using hot air welding methods. This should be carried out as part of an on-site CQA system where joint integrity is also tested. The jointing should be carried out by an experienced and fully trained membrane installer.

To ensure the integrity of the impermeable membrane a protection geotextile should be used on the outer surface of the liner to provide protection from following trades during backfilling.

SEL offer a membrane welder installation service

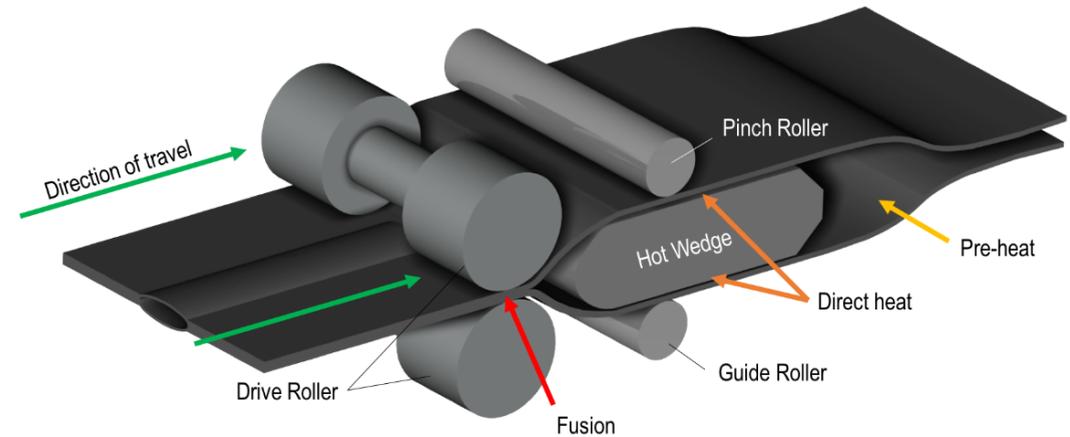


Illustration of a twin wedge weld. Lapped membrane edges are pre-heated by the hot wedge. Pre-heating the membrane primes the materials and helps to form a stronger weld. As the welder tracks along, pre-heated sections are then exposed to direct heat from the hot wedge. Pinch rollers help to ensure the material has constant contact with the hot wedge for an even heat distribution.

Finally, the membrane edges are fused together by the drive rollers, forming a twin seal. The welded seam created by a hot air wedge welder is composed of a primary seam and a secondary track that creates an unwelded channel.

This unwelded channel allows the completed weld to be tested by inflating the sealed channel with air to a predetermined pressure usually 1 bar for 5 minutes duration and observing the stability of the pressurised channel over time.

SEL SOURCE AT



WASP01001 Weld Grade HD SuDS Membrane been specifically developed and tested for use within underground storm water attenuation systems.

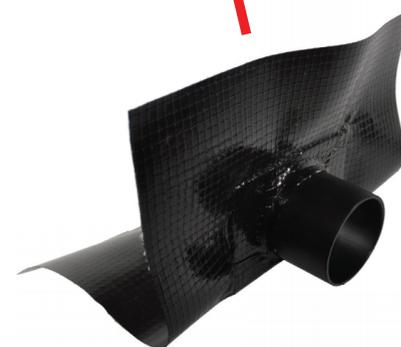
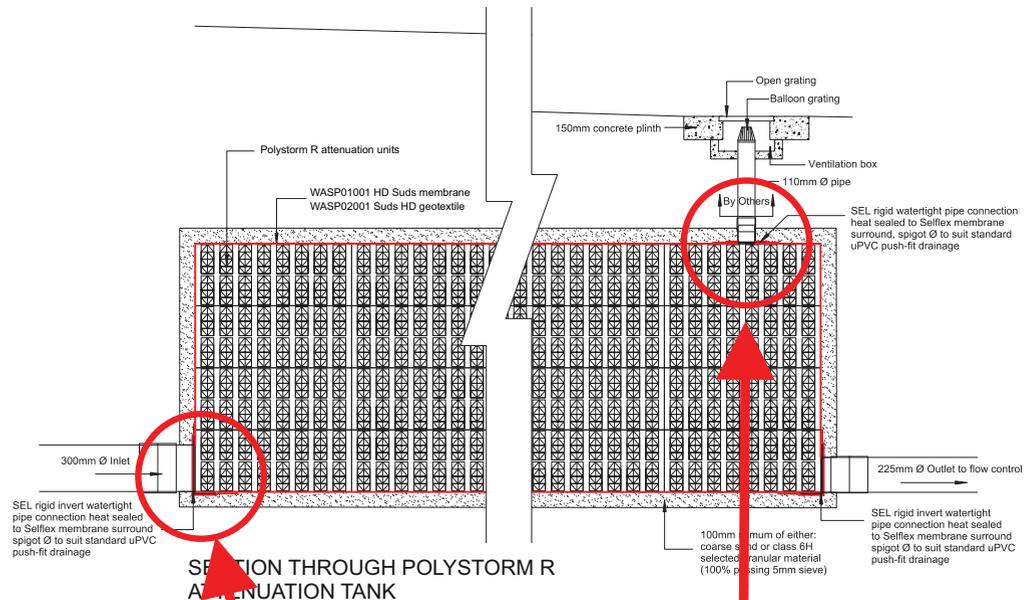
It is an impermeable flexible weldable liner with good elongation properties providing excellent installation characteristics for forming an impermeable barrier within permeable paving attenuation applications.

Adjacent panels are heat sealed together to form a single homogeneous watertight sheet. Rolls are sized to allow for easy and swift installation on site. Use of a geotextile protection layer is recommended for all installations.

To compliment the watertightness of the liner SEL have a range of watertight pipe connections. These are available in a range of diameters to suit standard underground drainage sizes and come in 2 types 'invert' and 'flat'.

Invert pipe connections are for use on the outlet and installed at the base of an attenuation tank. In fact these can be used anywhere where a pipe connection is required close to the edge of a tank.

Flat pipe connections are for use where a connection is required within the flat surface of a tank side. For instance where a connection for an air vent is required on the top surface.



PVOD03101 110mmØ invert membrane sealed tank adaptor
OR
PVOD03102 160mmØ invert membrane sealed tank adaptor



PVOD03201 110mmØ flat membrane sealed tank adaptor
OR
PVOD03202 160mmØ flat membrane sealed tank adaptor



Controflow® Chamber



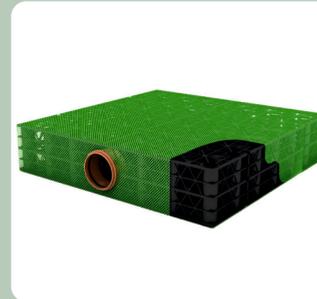
Product Code: SUDS02008
Controflow 500 Series
110Ø Stubs Stepped Invert Rodable

Controflow® Chamber



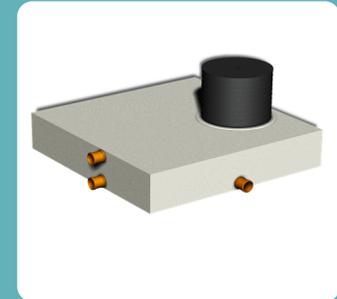
Product Code: SUDS02005
Controflow 500 Series
Universal Level Invert

RWP Diffuser Unit



Product Code: PVOD05101
Diffuser Unit
710x710x150mm, 110Ø socket

Raintaina 1.6 FC



Product Code: RTNA01001
Raintaina 1.6 FC
2.0m x 2.0m x 0.4m

Permavoid



Product Code: PVOD00001
Permavoid Unit
710mm x 355mm x 150mm

Attenuation Crate



Product Code: WASP00001
Attenuation Crate
1.0m x 0.5m x 0.4m

HD Suds Membrane



Product Code: WASP01001
Weld Grade HD Suds Membrane
1.7m x 50m Roll

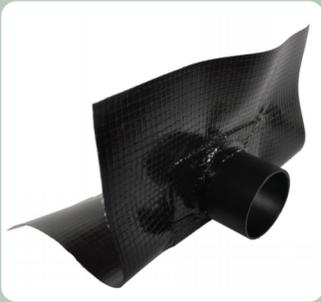
Suds HD Geotextile



Product Code: WASP02001
Suds HD Geotextile
2.0m x 50m Roll



Invert Tank Adapter



Product Code: PVOD03101 110mmØ
or PVOD03102 160mmØ

Flat Tank Adapter



Product Code: PVOD03101 110mmØ
or PVOD03102 160mmØ

Benefits of SEL Source AT

- It's simple
- Satisfies the planning requirement for SuDs, source control and treatment.
- Ideal for within curtilage drainage solutions.
- Full range of attenuation solutions for small and large sites.
- Optimises the storage within voided sub-base.
- Enables use of permeable paving on brownfield sites or sites that are unable to infiltrate.
- Enables use of sub-base storage below an impermeable pavement.
- Allows connection from roof.
- Provides bespoke silt catchpit chambers.
- Allows use of permeable paving on sloping sites.
- Simplifies and speeds up construction.
- Can be installed at any time during a construction programme.
- Reduces volume of imported stone.
- Reduces volume of excavation and muck off site.
- Allows use of small diameter pipe at shallower depths.
- Cost-effective shallow, low flow, flow controls.
- Often eliminates pumping.
- Reduces excavation depths for drainage system.
- Can be used with permeable surfaces and impermeable surfaces.

SEL at Your Service



- SEL can help with your permeable paving design.
- Free design review service.
- Check catchment areas and levels.
- Calculate attenuation volumes.
- Optimise depths of voided sub-base required.
- Model the flow control requirements.
- Size the orifice diameters.
- Provide CAD details for incorporation into drawings.
- Undertake CAD layouts.
- Provide 3rd party detailed designs.

This brochure summaries the core products within the SEL Source AT range and will satisfy most schemes. There are other ancillary components and flow control chambers available and in extreme circumstances special one-off solutions would be developed. Please contact SEL to discuss your requirements.

SEL SOURCE AT



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Web: www.selsource.co.uk

www.selsource.co.uk

Technical Services

To support architects, engineers and contractors in designing and installing SEL Source AT systems, our design services department offers computer aided scheme details and advice on installation.

SEL reserves the right to change or modify the design of products and specifications as their policy is one of continued research and improvement.

The information contained in this publication is believed to be correct at the date of publication, but it should be understood that between publications there may be changes in pertinent standards or regulations affecting the accuracy of the information contained therein.

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Several of the products shown in this brochure are subject to patent and/or registered design - please contact SEL for further details.

Other Services

Virtual Curtain Gas Migration Barrier
Commercial SuDS
Attenuation Tanks
Gas Protection
SEL Sports Rooftop Sports
MUGA & Sports Pitches
Cloud Water Control
Modular Paving

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SEL

SuDS for Housing

Attenuation