Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	30	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.400	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+40
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.195

Time from:	(mins) to:	Area (ha)	Time from:	(mins) to:	Area (ha)
0	4	0.100	4	8	0.095

Tank/Pond Details

Invert Level (m) 68.300 Ground Level (m) 69.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.00	151.5	0.60	265.0	1.20	285.9	1.80	285.9	2.40	285.9
0.10	169.0	0.70	285.9	1.30	285.9	1.90	285.9	2.50	285.9
0.20	187.0	0.80	285.9	1.40	285.9	2.00	285.9		
0.30	205.6	0.90	285.9	1.50	285.9	2.10	285.9		
0.40	224.8	1.00	285.9	1.60	285.9	2.20	285.9		
0.50	244.6	1.10	285.9	1.70	285.9	2.30	285.9		

Hydro-Brake Outflow Control

Design Head (m) 0.450 Hydro-Brake Type MD5 Invert Level (m) 68.250
Design Flow (l/s) 5.0 Diameter (mm) 108

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.3	0.80	6.3	2.00	10.0	4.00	14.1	7.00	18.7
0.20	4.8	1.00	7.1	2.20	10.5	4.50	15.0	7.50	19.3
0.30	4.8	1.20	7.7	2.40	10.9	5.00	15.8	8.00	20.0
0.40	4.9	1.40	8.4	2.60	11.4	5.50	16.6	8.50	20.6
0.50	5.1	1.60	8.9	3.00	12.2	6.00	17.3	9.00	21.2
0.60	5.5	1.80	9.5	3.50	13.2	6.50	18.0	9.50	21.8

Summary of Results for 100 year Return Period (+40%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	4.8	4.8	68.5618	0.2617	45.7	O K
30 Summer	4.8	4.8	68.6228	0.3227	58.2	O K
60 Summer	4.9	4.9	68.6683	0.3682	67.9	O K
120 Summer	5.0	5.0	68.6843	0.3842	71.5	O K
180 Summer	4.9	4.9	68.6783	0.3782	70.2	O K
240 Summer	4.9	4.9	68.6678	0.3677	67.8	O K
360 Summer	4.9	4.9	68.6438	0.3437	62.6	O K
480 Summer	4.8	4.8	68.6198	0.3197	57.6	O K
600 Summer	4.8	4.8	68.5968	0.2967	52.8	O K
720 Summer	4.8	4.8	68.5753	0.2752	48.4	O K
960 Summer	4.8	4.8	68.5343	0.2342	40.3	O K
1440 Summer	4.8	4.8	68.4673	0.1672	27.8	O K
2160 Summer	4.2	4.2	68.4123	0.1123	18.1	O K
2880 Summer	3.7	3.7	68.3773	0.0773	12.2	O K
4320 Summer	3.0	3.0	68.3413	0.0412	6.4	O K
5760 Summer	2.4	2.4	68.3243	0.0242	3.7	O K
7200 Summer	2.0	2.0	68.3128	0.0128	2.0	O K
8640 Summer	1.8	1.8	68.3048	0.0048	0.7	O K
10080 Summer	1.6	1.6	68.3000	0.0000	0.0	O K
15 Winter	4.8	4.8	68.5918	0.2917	51.7	O K
30 Winter	4.9	4.9	68.6598	0.3597	66.1	O K
60 Winter	5.0	5.0	68.7123	0.4122	77.8	O K
120 Winter	5.1	5.1	68.7358	0.4357	83.1	O K
180 Winter	5.1	5.1	68.7273	0.4272	81.2	O K
240 Winter	5.0	5.0	68.7148	0.4147	78.3	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	98.68	21
30 Summer	64.79	35
60 Summer	40.51	62
120 Summer	24.46	116
180 Summer	17.96	144
240 Summer	14.34	176
360 Summer	10.42	244
480 Summer	8.30	312
600 Summer	6.96	380
720 Summer	6.02	444
960 Summer	4.78	572
1440 Summer	3.46	808
2160 Summer	2.49	1164
2880 Summer	1.98	1524
4320 Summer	1.42	2208
5760 Summer	1.12	2944
7200 Summer	0.94	3672
8640 Summer	0.81	4408
10080 Summer	0.71	0
15 Winter	98.68	21
30 Winter	64.79	35
60 Winter	40.51	62
120 Winter	24.46	118
180 Winter	17.96	164
240 Winter	14.34	188

Summary of Results for 100 year Return Period (+40%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
360 Winter	5.0	5.0	68.6838	0.3837	71.3	O K
480 Winter	4.9	4.9	68.6503	0.3502	64.0	O K
600 Winter	4.8	4.8	68.6158	0.3157	56.8	O K
720 Winter	4.8	4.8	68.5828	0.2827	49.9	O K
960 Winter	4.8	4.8	68.5218	0.2217	37.9	O K
1440 Winter	4.6	4.6	68.4373	0.1373	22.5	O K
2160 Winter	3.7	3.7	68.3768	0.0768	12.1	O K
2880 Winter	3.1	3.1	68.3448	0.0447	7.0	O K
4320 Winter	2.3	2.3	68.3193	0.0192	3.0	O K
5760 Winter	1.8	1.8	68.3053	0.0053	0.8	O K
7200 Winter	1.5	1.5	68.3000	0.0000	0.0	O K
8640 Winter	1.3	1.3	68.3000	0.0000	0.0	O K
10080 Winter	1.1	1.1	68.3000	0.0000	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Winter	10.42	266
480 Winter	8.30	340
600 Winter	6.96	410
720 Winter	6.02	478
960 Winter	4.78	606
1440 Winter	3.46	826
2160 Winter	2.49	1188
2880 Winter	1.98	1508
4320 Winter	1.42	2248
5760 Winter	1.12	2944
7200 Winter	0.94	0
8640 Winter	0.81	0
10080 Winter	0.71	0

Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	100	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.400	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+40
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.195

Time from:	**(mins) to:**	**Area (ha)**	**Time from:**	**(mins) to:**	**Area (ha)**
0	4	0.100	4	8	0.095

Tank/Pond Details

Invert Level (m) 68.300 Ground Level (m) 69.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.00	151.5	0.60	265.0	1.20	285.9	1.80	285.9	2.40	285.9
0.10	169.0	0.70	285.9	1.30	285.9	1.90	285.9	2.50	285.9
0.20	187.0	0.80	285.9	1.40	285.9	2.00	285.9		
0.30	205.6	0.90	285.9	1.50	285.9	2.10	285.9		
0.40	224.8	1.00	285.9	1.60	285.9	2.20	285.9		
0.50	244.6	1.10	285.9	1.70	285.9	2.30	285.9		

Hydro-Brake Outflow Control

Design Head (m) 0.450 Hydro-Brake Type MD5 Invert Level (m) 68.250
Design Flow (l/s) 5.0 Diameter (mm) 108

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.3	0.80	6.3	2.00	10.0	4.00	14.1	7.00	18.7
0.20	4.8	1.00	7.1	2.20	10.5	4.50	15.0	7.50	19.3
0.30	4.8	1.20	7.7	2.40	10.9	5.00	15.8	8.00	20.0
0.40	4.9	1.40	8.4	2.60	11.4	5.50	16.6	8.50	20.6
0.50	5.1	1.60	8.9	3.00	12.2	6.00	17.3	9.00	21.2
0.60	5.5	1.80	9.5	3.50	13.2	6.50	18.0	9.50	21.8

Appendix G – Green Field Site Run off Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Gavin Bayes
Site name:	Simmingdish Lane
Site location:	Bicester

Site Details

Latitude:	51.90578° N
Longitude:	1.12872° W
Reference:	1354178030
Date:	Nov 08 2021 11:51

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

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.195

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm):	620	620
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.03	0.03
1 in 1 year (l/s):	0.02	0.02
1 in 30 years (l/s):	0.07	0.07
1 in 100 year (l/s):	0.09	0.09
1 in 200 years (l/s):	0.11	0.11

Appendix H – Typical Product Data

Conder® OIL/WATER SEPARATORS

THE PARTNER OF CHOICE

PREMIER TECH AQUA

40 years OF PASSION

Premier Tech Aqua's range of Conder Oil Separators are for installation on surface water drainage systems and are designed to prevent hydrocarbons (e.g. diesel, petrol, engine oil) from mixing with surface water and entering our drainage systems.

Pollution prevention is a critical part of sustainable drainage systems and statutory regulations are in force to control the discharge of hydrocarbons, with severe penalties imposed for non-compliance.

Compliance

Premier Tech Aqua's range of Conder Oil Separators full conform to both the Environment Agency's latest PPG guidelines and European standard BSEN-858-1-2 and are proven to effectively separate oil and water. Under test, the Conder Bypass performed to less than 1 mg/L and in doing so guarantees minimal environmental impact and ensures public safety.

Classes of Separators

There are two classes of separators which are defined by performance.

Class 1	Class 2*
Class 1 Separators are designed to achieve a concentration of less than 5 mg/L of oil under standard test conditions. These conditions are required for discharges to surface water drains and the water environment.	Class 2 Separators are designed to achieve a concentration of less than 100 mg/L oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies, such as discharges to the foul sewer.

*Class 2 available in forecourt separators only.

Selecting the Right Conder Separator

Premier Tech Aqua offers a full range of Separators for various uses and applications:

- Bypass Separator
- Full Retention Separator
- Forecourt Separator
- Wash Down and Silt Separators

If you're unsure of what type of Conder Oil Separator you require, please use the chart below to help you identify the most suitable product for your project.

The guidance given is for the use of separators in surface water drainage systems that discharge to rivers and soakways.

Is there a risk of oil contaminating the drainage from the site?

YES	YES	YES	YES	NO
Risk of infrequent light contamination and potential for small spills only e.g. car park.	Risk of regular contamination of surface water run off with oil and/or risk of larger spills e.g. vehicle maintenance area, goods vehicle parking or vehicle manoeuvring.	Risk of regular Drainage will also contain dissolved oils, detergents or degreasers such as vehicle wash water and trade effluents e.g. industrial sites.	Fuel oils are delivered to and dispensed on site e.g. retail fuel forecourts.	Very low risk of oil contamination e.g. roofwater.
YES				YES
Source control SUDS must be considered and incorporated where suitable.				Separator not required.
IF NOT SUITABLE	YES	YES	YES	
By-pass separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Full retention separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Trade effluents must be directed to the foul sewer. It may need to pass through a separator before discharge to sewer to remove.	Full retention forecourt separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Clean water should not be passed through the separator unless the size of the unit is increased accordingly.
The use of SUDS should be considered at all sites and they should be incorporated where suitable. SUDS can be used to polish the effluent from these separators before it enters the environment.				Source control SUDS should be considered where possible.

Separator Alarms

All oil separators are required by legislation to be fitted with an oil level alarm system with recommendations that the alarm is installed, tested, commissioned and regularly serviced by a qualified technician.

The alarm indicates when the separator is in need of immediate maintenance in order for it to continue to work effectively. Premier Tech Aqua can offer a full technical and service package for a variety of alarm options.

Conder Bypass Separators

Premier Tech Aqua's range of Conder Bypass Separators are used to fully treat all flows generated by rainfall rates of up to 6.5 mm/hr. Conder Bypass Separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where only small spillages occur and the risk of spillage is small.

Typical Applications

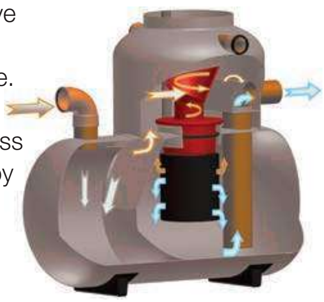
- Car parks
- Roadways and major trunk roads
- Light industrial and goods yards

Features and Benefits

- Innovative design
- Compact and easy to handle/install
- Fully compliant to the Environment Agency's PPG3 guidelines
- Low product and install costs
- Full BSI certification
- Exceeds industry standards
- Easy to service
- Fully tested and verified with a range from CNSB 3 to CNSB 1000 (Class 1)

Performance

Conder Bypass Separators have been designed to treat all flow up to the designed nominal size. Any flow in excess of the nominal size is allowed to bypass the separation chamber, thereby keeping the separated and trapped oil safe.



How it Works

Step 1

During the early part of a rain storm, which is a time of high oil contamination, all of the contaminated water flow passes through the sediment collection chamber and enters the separation chamber through a patented oil skimming and filter device.

Step 2

All of the oil then proceeds to the separation chamber where it is separated to the Class 1 standard of 5 mg/L and safely trapped.

Step 3

As the rainstorm builds up to its maximum and the level of oil contamination reduces significantly, the nominal size flow continues to pass through the separation chamber and any excess flow of virtually clean water is allowed to bypass directly to the outlet.

Specifications

Larger models up to CNSB 1000 are available.

Area Drained (m^2)	Tank Code including Silt	Length including Silt (mm)	Silt Capacity (L)	Oil Storage Capacity (L)	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)	Access (mm)
1667	CNSB3s/21	1400	300	45	1026	2200	1730	1680	750
2500	CNSB4.5s/21	1785	450	67.5	1026	1875	1270	1220	600
3333	CNSB6s/21	1975	600	90	1026	1875	1270	1220	600
4444	CNSB8s/21	2165	800	120	1026	1875	1270	1220	600
5555	CNSB10s/21	2485	1000	150	1026	1875	1270	1220	600
8333	CNSB15s/21	2670	1500	225	1210	2150	1450	1400	600
11111	CNSB20s/21	3115	2000	300	1210	2150	1450	1400	600
13889	CNSB25s/21	3555	2500	375	1210	2150	1450	1400	600
16667	CNSB30s/21	3470	3000	450	1510	2690	1770	1720	750
22222	CNSB40s/21	4040	4000	600	1510	2690	1770	1720	750
27778	CNSB50s/21	4655	5000	750	1510	2690	1770	1720	750
33333	CNSB60s/21	4415	6000	900	1880	3300	2025	1975	2 x 600
44444	CNSB80s/21	5225	8000	1200	1880	3300	2025	1975	2 x 600
55556	CNSB100s/21	6010	10,000	1500	1880	3300	2025	1975	2 x 600

Note: It is a requirement of PPG3 that you have a silt capacity either in your tank or in an upstream catch pit.

Conder Full Retention Separators

Premier Tech Aqua's range of Conder Full Retention Separators are designed to treat the full flow that can be delivered by a drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65 mm/hr. Full Retention Separators are used where there is a risk of regular contamination with oil and a foreseeable risk of significant spillages.

Typical Applications

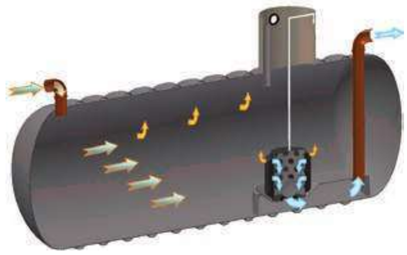
- Sites with a high-risk of oil contamination
- Fuel storage depots
- Refuelling facilities
- Petrol forecourts
- Vehicle maintenance areas/workshops
- Where discharge is to a sensitive environment

Features and Benefits

- All surface water is treated
- Automatic closure device (ACD) fitted as standard

Performance

All Conder Full Retention Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.



How it Works

Step 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

Step 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

Step 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Larger models available upon request.

Area Drained (m^2)	Tank code Incl. Silt	Length including Silt (mm)	Slit Capacity (L)	Oil Storage Capacity	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
222	CNS4s/11	2319	400	40	1026	1655	1295	1245
333	CNS6s/11	3414	600	60	1026	1655	1295	1245
444	CNS8s/11	3197	800	80	1210	1855	1480	1430
556	CNS10s/11	3957	1000	100	1210	1855	1480	1430
833	CNS15s/11	3870	1500	150	1510	2180	1780	1730
1111	CNS20s/11	5060	2000	200	1510	2180	1780	1730
1667	CNS30s/11	5369	3000	300	1880	2560	2030	1980
2222	CNS40s/11	7059	4000	400	1880	2560	2030	1980
2778	CNS50s/11	4080	5000	500	2600	3315	2730	2680
3333	CNS60s/11	4805	6000	600	2600	3315	2730	2680
3889	CNS70s/11	5529	7000	700	2600	3315	2730	2680
4444	CNS80s/11	6254	8000	800	2600	3315	2730	2680
5556	CNS100s/11	6751	10,000	1,000	2600	3315	2730	2680

Note: It is a requirement of PPG3 that you have a silt capacity either in your tank or in an upstream catch pit.

Conder Forecourt Separators

Conder Forecourt Separators have been designed for specific use in petrol filling stations and other similar applications. The size of this separator has been specifically increased in order to retain the possible loss of the contents from one compartment of a road tanker, which could be up to 7,600 litres.

Forecourt Separators are an essential infrastructure requirement for all forecourts so as to ensure compliance with both health and safety and environmental legislation.

Typical Applications

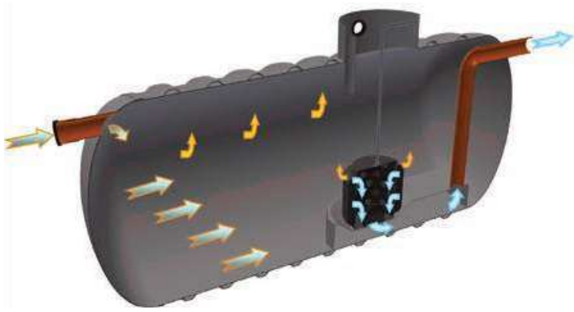
- Petrol forecourts
- Refuelling facilities
- Fuel storage depot

Features and Benefits

- All surface water is treated
- Available in Class 1 and Class 2
- Automatic Closure Device (ACD) fitted as standard
- Includes 2000L silt capacity

Performance

All Conder Forecourt Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.



How it Works

Step 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

Step 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

Step 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Tank Code	Volume (L)	Length (mm)	Diameter (mm)	Height (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Access (mm)
ANO/11*	10,000	4,250	1,800	2,100	1,600	1,550	750
ANT/12**	10,000	4,250	1,800	2,100	1,600	1,550	750
LNO/11***	10,000	4,250	1,800	2,100	1,600	1,550	750

*Class 1 Forecourt Separator suitable for discharging to surface water drains

**Class 2 Forecourt Separator suitable for discharging to foul drains only

***Class 1 Forecourt Separator suitable for installation in granular materials

Conder Washdown and Silt Separators

Premier Tech Aqua's range of Conder Washdown and Silt Separators are for use in areas such as car washes, pressure wash facilities or other cleaning facilities and must be discharged to the foul water drainage system in accordance with PPG13.

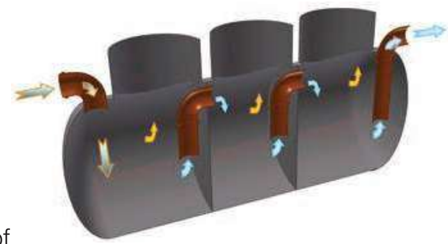
Typical Applications

- Car wash facilities
- Tool hire depots
- Pressure washer facilities

Features and Benefits

- Available in 1,2 and 3 stage options
- Efficient silt and hydrocarbon removal

Performance



The Environment Agency's PPG13 requires that discharge from pressure washers must discharge to a foul drainage system. Where there is no foul drainage available, the effluent must be contained within a sealed drainage system or catchpit for disposal by a licenced waste contractor.

Silt build-up is the primary concern with washdown facilities and so our range of Conder Washdown and Silt Separators are used to remove the silt and will allow some separation of hydrocarbons.

Detergents that are used in wash down areas will break down and disperse hydrocarbons (hindering the separation process). Therefore, it is important to remember the main function of wash down separators is to remove silt.

How it Works

Step 1

Contaminated wash down water enters the unit where the heavier solids, silts and settle to the bottom of the tank.

Step 2

The lighter liquids, hydrocarbons, will rise to the surface and be retained within the tank.

Step 3

Treated water will exit the separator via the dipped outlet.

Specifications

Although it is recognised that single stage separators give the most efficient separation, 2 and 3 chamber Conder Washdown and Silt Separators are available on request.

Tank Code	Capacity (L)	Silt Storage	Diameter (mm)	Length (mm)	Access Diameter (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
CWS2/12	2,000	1,000	1,000	2,713	600	1,290	1,240
CWS3/12	3,000	1,500	1,200	2,853	600	1,475	1,425
CWS4/12	4,000	2,000	1,200	3,737	600	1,475	1,425
CWS6/12	6,000	3,000	1,500	3,636	600	1,775	1,725
CWS8/12	8,000	4,000	1,800	3,443	600	2,030	1,980
CWS10/12	10,000	5,000	1,800	4,250	600	2,030	1,980

Conder FST Silt Trap

Large quantities of silt can be associated with washdown areas. The Conder FST range of silt traps is ideal for easy removal of silt either manually or by a waste disposal contractor.

The FST range of silt traps are available with varying grades of covers from B125 up to E600 to allow installation in all types of vehicle or plant washdown facilities.

Conder Alarm Systems

All separators must be fitted with an alarm in order to provide visual and audible warning when the level of oil reaches 90% of its storage volume, as required by The Environment Agency's PPG3.

The alarm system will then be triggered to indicate that the separator is in need of immediate emptying, in order to continue effective operation.

Features and Benefits

- Option for installation at a remote supervisory point
- Audible and visual
- Eliminates unnecessary waste management visits
- Easy installation
- Audible, visual and text message alert alarm systems available

Mains Powered System

Mains powered alarm systems are best suited to new build situations or sites where installation of the necessary cabling and ducting is straight forward and economical. The probe located in the separator will, when surrounded by floating hydrocarbons, activate an alarm condition on the remote panel to advise that the unit requires emptying.

Solar Powered System (Flashing Beacon)

This option requires no mains power supply or any significant cabling or ducting, making it extremely economical for large sites and retro fitting alarms to existing oil separators. A High Intensity Beacon will flash when a problem is detected.

Solar GSM Alarm

The Solar GSM Alarm sends a status report on your separator to a mobile phone number of your choice. The status of the GSM Alarm can also be tested at any time by simply sending a pre-recorded text message via your directed mobile phone, for additional peace of mind.

Peripherals

Coalescing Filters

The Conder Coalescing Filter is designed to separate residual oil in already separated oil/water and ensures a discharge quality of less than 5 mg/L of oil in water.

Features and Benefits

- Handle for easy removal and cleaning
- Flashing beacons (with option of siren kit)
- Kiosks
- Probe brackets
- Bas 1000 intrinsically safe junction box
- High level probe
- Silt level probe
- Oil level probe

Servicing

The Environmental Agency's PPG3 guidelines stipulate that every 6 months, and in accordance with manufacturer's instructions, experienced personnel should carry out maintenance to both the separator and alarm.

Premier Tech Aqua and our service partners can offer a full technical and service package including separator and alarm installation, commissioning, oil and silt removal and route service contracts.

SPEL Grease Separators are designed for use wherever it is necessary to separate greases and oils of vegetable and animal origin from wastewater, such as in trade or industrial plants/establishments

The units have two chambers, the first chamber is to remove and capture sludge, a sludge trap and the second chamber to separate out the grease.
SPEL Grease separators are available from 2,000litre to 10,000litre depending on the specific site requirements.

Example sites

- Commercial kitchens and large catering establishments, e.g. in inns, hotels, motorways service stations, canteens; grilling, roasting and frying facilities
- Food distribution points (with returnable crockery)
- Butcher's shops, with or without slaughtering facilities
- Meat and sausage factories, with or without slaughtering facilities
- Abattoirs; poultry slaughterers; tripe preparation plants; animal rendering plants; bone and glue boiling plants; soap factories
- Oil mills and vegetable oil refineries
- Margarine factories
- Pickling plants
- Fast-food preparation plants
- Chip and crisp producers
- Peanut roasting plants

Hotel, fast-food outlet site

To establish the size of unit for a typical hotel, restaurant or fast food outlet site the following information is required to calculate the model most suited.

- Number of meals
- Maximum waste water flow in litres
- Average waste water volume per day in m3
- Opening hours
- Average duration of operation each day
- Quantity of meat products per day

For other sites SPEL can advise the data required to establish the correct model size required.

Wastewater containing a considerable proportion of grease in a non-separable form (i.e. emulsified) from applications such as dairy, cheese making and fish processing, or from distribution points having only dish washing facilities, or from "wet waste compactors", will only be effectively treated in a SPEL Grease Separator under certain conditions. The wastewater may require further treatment.

Installation

Installation shall be in accordance with the Installation Instructions supplied with each mode.
They are for gravity flows and the upstream pipeline should be installed at a gradient of 2% (1:50) to prevent accumulation of grease.

The pipelines connected to the SPEL Grease Separator shall be adequately ventilated. Vent connections are provided for this purpose. A stack vent, if required, should be installed according The Building Regulations.

Temperature of the wastewater at the point of connection to the public sewer may be governed by the local authority.

Inspection and servicing

SPEL Grease Separators are designed to be simply and efficiently de-sludged using a suction tanker. Far simpler to removing baskets etc by hand.
They should be inspected weekly or monthly and emptied in accordance with operational experience.
The retained solids in the SPEL Grease Separator should be removed, the unit thoroughly flushed with clean water and refilled with clean water

SPEL Automatic Alarm Monitoring System

GA-1 USER INTERFACE FEATURES

1. LED indicator for mains
2. LED indicator for alarm
3. LED indicator for fault
4. Alarm Reset/Test push button
5. Connector for GA-SG1 sensor
6. Relay output for monitoring and control purposes
7. Supply voltage

For total protection and peace of mind it is essential to install a SPEL GA-1 Automatic Alarm Monitoring System

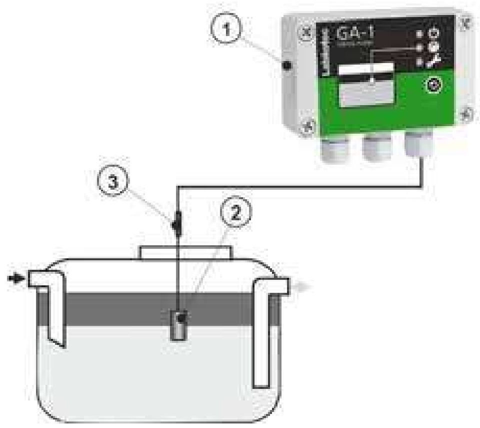
The GA-1 unit is an alarm device for monitoring the thickness of the grease layer accumulating in a grease separator.

The system consists of GA-1 control unit, GA-SG1 sensor and a cable joint.

SPEL GA-1 control unit features

The GA-SG1 sensor is installed into the grease separator and it supervises thickness of grease layer.

The LED indicators, push button and interfaces of the SPEL GA-1 control unit as above.



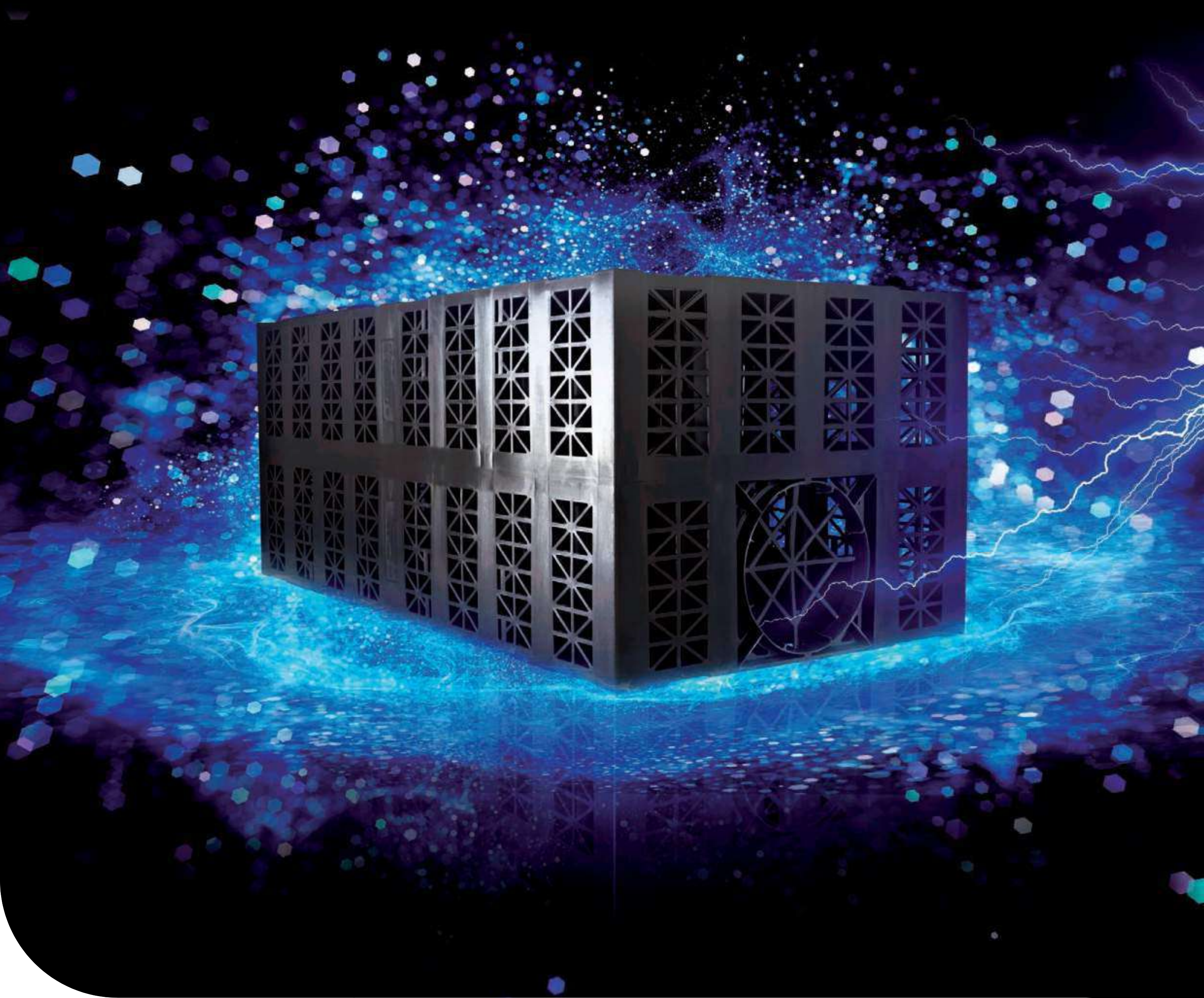
SYSTEM COMPONENTS:

1. GA-1 control unit
2. GA-SG1 sensor (grease alarm) with fixed cable
3. Cable joint

WATER MANAGEMENT

AquaCell systems

Product and installation manual



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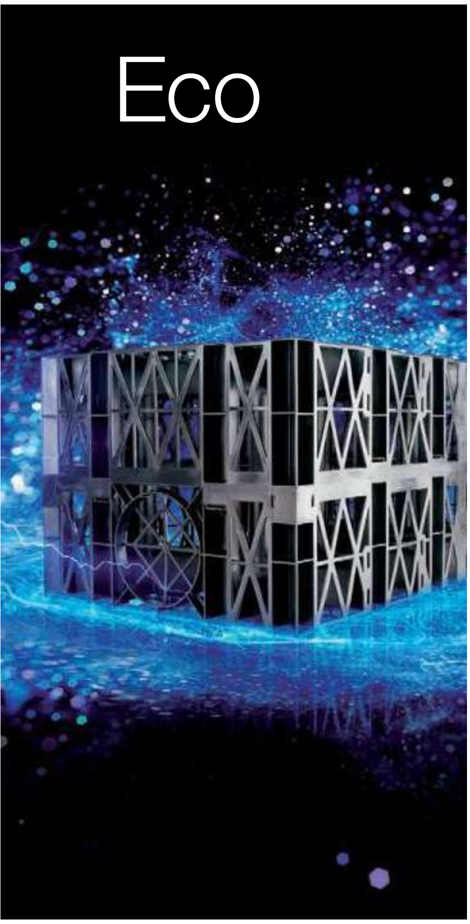
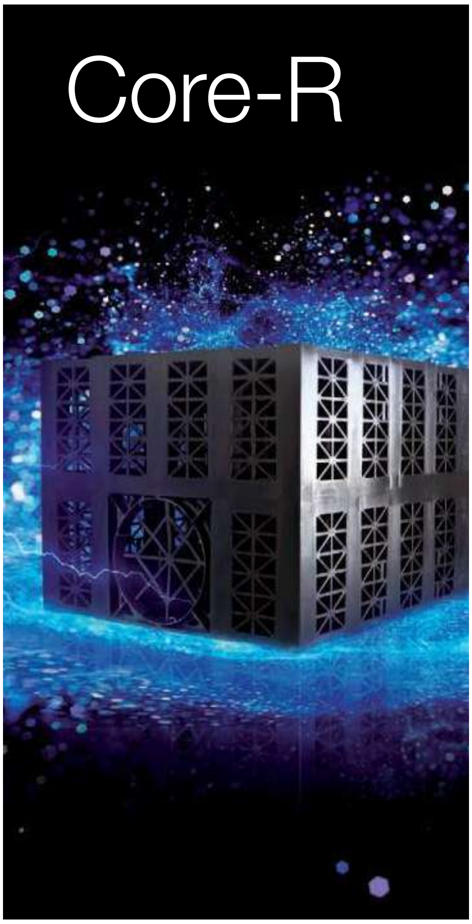




Introduction to SuDS

Continuing urban development, a changing climate and the consequences of increased rainfall are all increasingly prominent issues on the political and environmental agenda and all drive the need to actively manage excessive rainfall across new and existing developments through the use of Sustainable Drainage Systems (SuDS).
Designed correctly drainage systems can assist in delivering sustainable development whilst improving the spaces where we live, work and play.
The SuDS approach to managing water takes account not just of how water quantity is managed but also considers how improvements to water quality can be delivered as well as the creation of habitats promoting biodiversity and amenity for the community.
Good SuDS aim to mimic nature and manage rainfall close to where it falls. They are designed to move and attenuate water within the development before it is released into water courses. Water is stored within the development where is allowed to infiltrate into the ground or is released at a controlled rate to prevent issues downstream.
The CIRIA SuDS Manual gives guidance on all areas of SuDS and focuses on the cost-effective planning, design, construction, operation and maintenance of SuDS.

Which SuDS components are best?

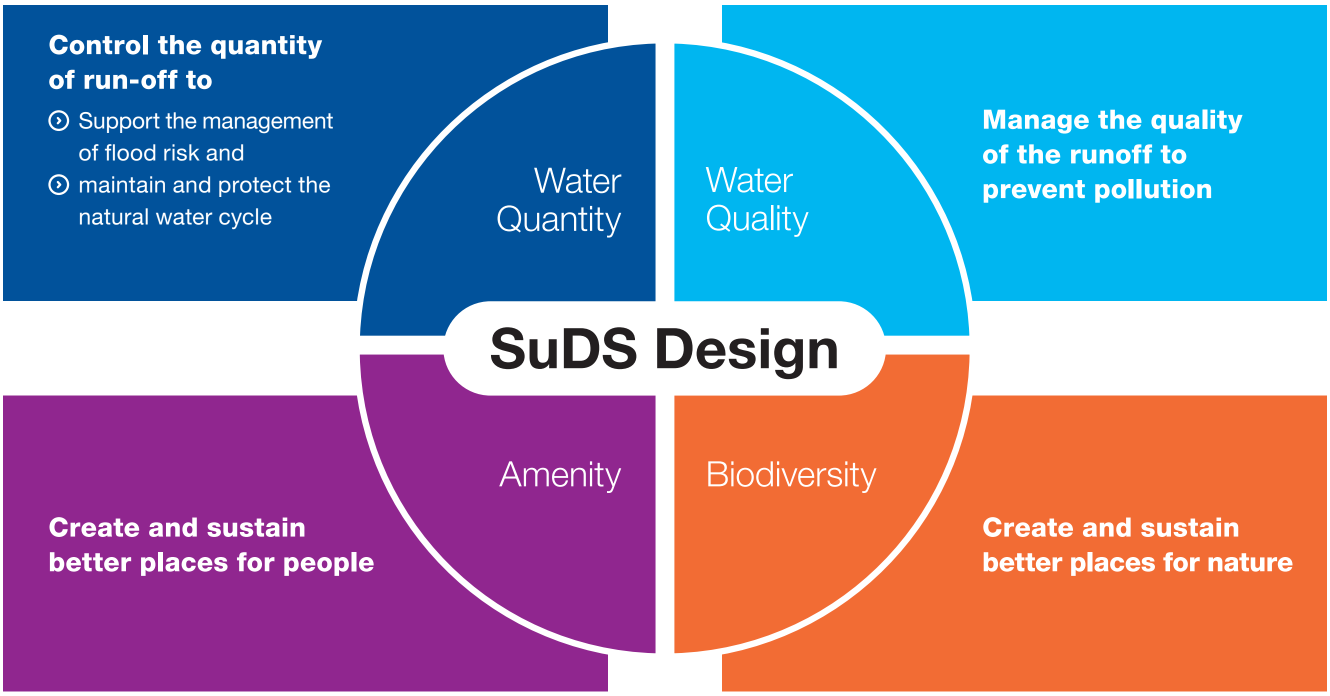
SuDS should help maximise amenity and biodiversity, whilst also delivering key objectives to manage flood risk and water quality For any given site, SuDS should be considered as sequence of components designed to efficiently drain surface water whilst minimising pollution.
Selection of which SuDS components is best for each development is dependent on the site specific requirements.

How can Wavin help with SuDS projects?

Wavin is well qualified to advise on how to comply with current and emerging regulation. We can aid specifiers, developers and contractors in responding to legislative demands as they pertain to flooding, sewage, urban drainage and sustainable resources use.
In particular, the proven qualities and performance of AquaCell systems not only support the achievement of SuDS, they can also help reinforce and enhance planning applications and enable development to proceed.

CIRIA SuDS Design

Source: The SuDS Manual (CIRIA)



Keeping you on top of legislation

Flood and Water Management Act 2010

The Flood and Water Management Act was designed to reduce the risk of flooding and its consequences by providing for better, more comprehensive and co-ordinated water management, embracing groundwater, surface water and coastal erosion risk. Schedule 3 of the act gives DEFRA responsibility for establishing national standards for sustainable drainage and empowers local authorities to manage local flood risk by adopting and maintaining sustainable drainage schemes. In January 2019 Schedule 3 was implemented by the Welsh Government. This legislation effectively makes the use of SuDS mandatory on new developments with the aim of reducing flood risk and improving water quality. The new standards for Wales support the ‘four pillars’ of SuDS.

Sewers for Adoption

In England the framework for the delivery of SuDS in the absence of Schedule 3 is through a revision to Sewers for Adoption to include some SuDS components as adoptable by the Water and Sewage Companies. The document, currently with Ofwat for approval, is expected to be introduced early 2020. When it comes into force it will be the only guide to the standards that sewers must meet if they are to be adoptable by WaSCs in England. The new document will, for the first time, offer guidance on SuDS components (although not all) that can be adopted by Water and Sewerage Companies with standards on the flood risk performance that is expected.

The Water Environment and Water Services (WEWS) (Scotland) Act 2003

In Scotland WEWS makes Scottish Water responsible for SuDS that deal with the run-off from roofs and any paved ground surface within the property boundary. In order to deliver this SuDS need to be designed to Scottish Water’s specifications as set out in their manual, Sewers for Scotland v4.0. In addition, the law makes the use of SuDS obligatory when dealing with surface water drainage from all new developments.

The EU Water Framework Directive

Nearly half the EU population lives in ‘water-stressed’ countries, caused by high extraction from freshwater sources, and demand is growing all the time. The EU Water Framework Directive introduces a new legislative approach designed to better manage and protect water resources, based not on national orpolitical boundaries but on the natural catchment of river basins.

Building Regulation Part H (Drainage and Waste Disposal)

Building Regulation Part H embraces the guidelines for drainage and waste disposal that must be met in the UK. Although Part H extends to rainwater drainage and solid waste storage, waste drainage issues are to the fore. The Building Regulations are designed to ensure that all foul water is properly disposed of to maintain a decent level of sanitation, promoting both personal and environmental health. The regulations also highlight the importance of pollution prevention, working sewage infrastructure and sewage maintenance. With regards to stormwater, Building Regulations Approved Document H3 stipulates that adequate provision should be made for rainwater to be carried from the roof of a building to either a soakaway, water course or sewer.

National Planning Policy Framework

Section 14 of the National Planning Policy Framework sets out policy to ensure that flood risk is taken into account at all stages of the planning process and that inappropriate development in areas at risk of flooding is avoided. The policy directs development away from areas of highest risk and where new development is, exceptionally necessary in such areas, aims to make it safe without creating an increase in flood risk elsewhere and, where possible, reduce flood risk overall. It also states developments should only be allowed in an area of flood risk if it incorporates sustainable drainage systems, unless there is clear evidence that these would be inappropriate.




Overview

The AquaCell range of geocellular systems are a fully tried and tested, BBA approved, modular technique for managing excessive rainfall.

Applications

The AquaCell range can be used as either a temporary storage tank or as a soakaway, and is suitable for applications including:

- Landscaped areas
- Parks
- Domestic gardens
- Residential developments
- Car parks & roads
- Industrial/commercial areas






The AquaCell range

There are three types of AquaCell unit. Each can be used as a standalone system or different unit types can be mixed and matched together in layers to value engineer the most cost effective solution.

All AquaCell units have identical dimensions (1m x 0.5m x 0.4m), but they are manufactured to perform differently. The type of unit, or combination of units required will depend on factors such as the load application, overall installation depth and site conditions.

Features and benefits

The following are applicable to all AquaCell units:

- BBA Approved – certificate No. 03/4018
- Modular, lightweight and versatile
- Easy to handle and quick to install
- Proven clip and peg connection system
- 95% void (each unit holds 190 litres of water)
- Can be brick-bonded for extra stability
- Units can be mixed and matched together for optimum performance
- Full range of ancillaries
- Can be used as integral part of a SuDS scheme

Environmental benefits

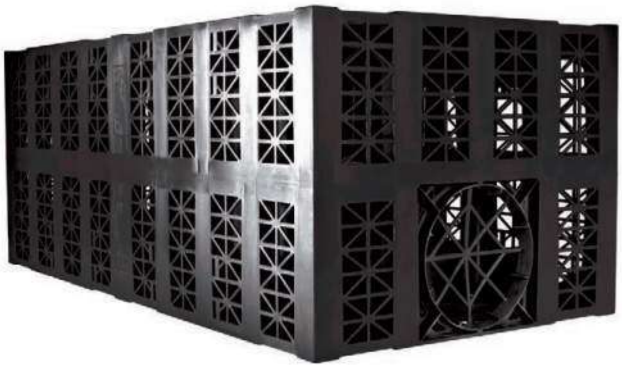
In addition, the AquaCell range can also offer the following environmental benefits:

- Reduced flooding risk
- Controlled release of stormwater into watercourses or, where permitted, existing sewer systems
- Recharging of local groundwater (if infiltration/soakaway application)
- Aerobic purification to improve water run-off quality
- Sustainable, cost effective management of the water environment

Eco

Eco is manufactured from specially reformulated, recycled material and has been designed for shallow, non-trafficked, landscape applications.

Core-R



Core-R has been designed for use in deep applications, subject to both regular and heavy traffic loadings, such as cars and HGV's.

Plus-R

Plus-R has been designed primarily for use in applications where inspectability is required, and is suitable for use in all applications from landscaped areas to heavily trafficked areas including HGV.

AquaCell Configurator Tool

Optimise tank and soakaway designs with the AquaCell Configurator Tool

The AquaCell Configurator tool aids and speeds the efficient design of stormwater tank or soakaway solutions. The tool guides users through a step-by-step specification process and, based on responses, will recommend the optimum design, based on the loadings, depths and site conditions of each project.

The tool generates a PDF of the design for easy download and can store the data online for future reference. To start using the tool or to learn more visit: **myportal.wavin.co.uk/tools**

AquaCell Eco

Application

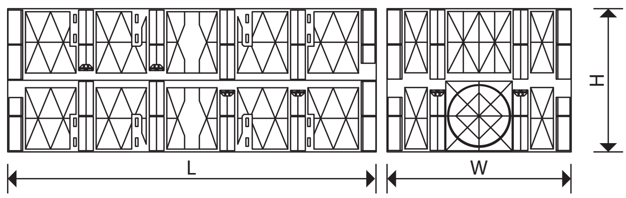
AquaCell Eco is manufactured from specially reformulated, recycled material and has been specifically designed for shallow, non-trafficked, landscaped applications. AquaCell Eco is **NOT** suitable for locations subject to high water tables.

AquaCell Eco is typically suitable for installations to a maximum depth of 2.68 metres, to the base of the units from ground level, with a minimum cover depth of 0.3 metres, (CIRIA's recommendation, is to allow a cover depth of 0.5 metres in applications where a ride on mower may be used).

Any installation using AquaCell Eco must **NOT** be subjected to additional loading at any time. Trafficking by construction plant on site, including mechanical equipment, must be avoided.

If trafficking of the buried tank by construction plant or, other vehicles is unavoidable, the installation should be constructed using AquaCell Core-R units (see page 9).

The width of an AquaCell Eco installation should not exceed 12 metres to allow for mechanical backfilling without loading. There is no limit to the length of the installation.

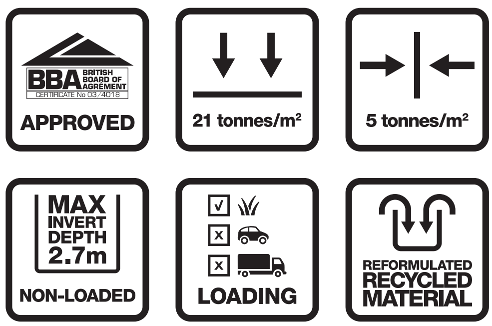


Material: Reformulated polypropylene

Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB025	500	400	1000

Features and benefits

- Manufactured from specially reformulated, recycled material
- Suitable for both soakaway and attenuation applications
- Proven vertical loading capacity of: 21.3 tonnes/m² (213kN/m²)
- Proven lateral loading capacity of: 5.2 tonnes/m² (52kN/m²)
- Integral "hand holds" for ease of carrying/handling
- BBA approved – Certificate No 03/4018



Maximum installation depths – to base of units (m)[1]

Typical soil type	Soil weight kN/m³	Angle of internal friction φ (degrees)[2, 3]	Landscaped areas
Over-consolidated stiff clay	20	24	1.53
Silty sandy clay	19	26	1.68
Loose sand and gravel	18	30	2.08
Medium dense sand and gravel	19	34	2.35
Dense sand and gravel	20	38	2.68

(1) These values relate to installations where the groundwater is a minimum of one metre below the base of the excavation.
(2) AquaCell Eco units should not be used where groundwater is present.
(3) 0.5m cover is required where a ride-on mower may be used.

Assumptions made:
- Ground surface is horizontal
- Shear planes or other weaknesses are not present within the structure of the soil.

Source: BBA

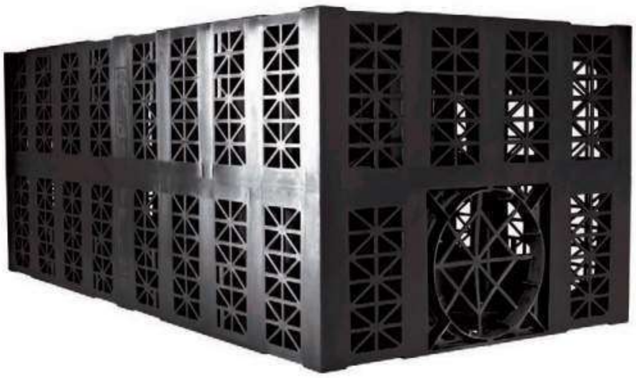
AquaCell Core-R

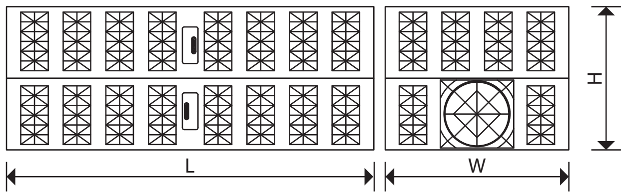
Application

AquaCell Core-R has been designed for use in deep applications, subject to regular and heavy traffic loadings, e.g. cars and HGV's. AquaCell Core-R can also be used for deep soakaways and landscaped applications.

Typically for use down to depths of 6.68m in landscaped areas (6.43m trafficked by cars) to the base of the units from ground level, in best soil conditions.

Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 1.11 metres is in place.





Features and benefits

- Suitable for regular and heavy traffic loadings
- Proven vertical loading capacity of: 66.9 tonnes/m² (669 kN/m²)
- Proven lateral loading capacity of: 12.3 tonnes/m² (123kN/m²)
- BBA approved – Certificate No 03/4018
- Ideal for all types of shallow and deep projects including major attenuation and infiltration schemes

Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB150	500	400	1000

Maximum installation depths – to base of units (m)[1]

Typical soil type	Soil weight kN/m³	Angle of internal friction φ (degrees)[2, 3]	Landscaped areas	Vehicle mass <9 tonnes[4, 5]	Vehicle mass <44 tonnes
Over-consolidated stiff clay	20	24	3.85	3.61	3.36
Silty sandy clay	19	26	4.35	4.09	3.83
Loose sand and gravel	18	30	5.34	5.06	4.78
Medium dense sand and gravel	19	34	5.94	5.68	5.41
Dense sand and gravel	20	38	6.68	6.43	6.18

(1) Without groundwater present below base of units – AquaCell Core-R may be used where groundwater is present, contact Wavin for technical advice.
(2) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.
(3) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
(4) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
(5) This category should be used when considering landscaped areas that may be trafficked by ride on mowers.

Assumptions made:
- Ground surface is horizontal
- Shear planes or other weaknesses are not present within the structure of the soil.

Source: BBA

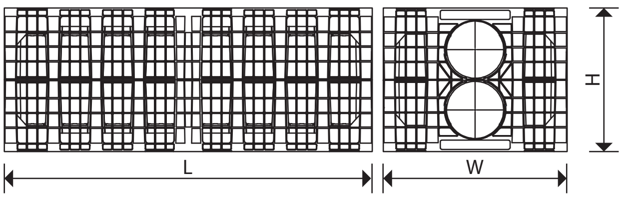
AquaCell Plus-R

Application

AquaCell Plus-R has been designed primarily for use in applications where inspection is required. It is suitable for use in all applications from landscaped areas to heavily trafficked areas (for vehicles up to 44 tonnes). The units can be used in combination with AquaCell Core-R (and Eco if there is at least one layer of Core-R in between the Plus-R and Eco layer).

Extra lateral loading capacity allows installation at greater depths. Integral inspection channels in each unit combine to create viewing channels for the full length of the installed structure.

Typically for use down to depths of 7.82m in landscaped areas (7.57m trafficked by cars and 7.3m trafficked by HGV's) to the base of the units from ground level, in best soil conditions. Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 1.30 metres is in place.

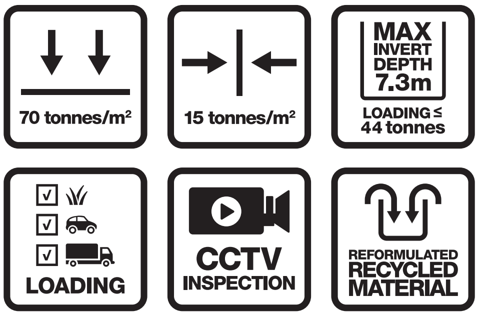


Material: Polypropylene

Nominal size (mm)	Part number	Dimensions (mm)		
		W	H	L
160	6LB200	500	400	1000

Features and benefits

- Suitable for extra deep installations
- Inspectable (supplied with end cap for use when an inspection channel is not required)
- Proven vertical loading capacity of: 70.2 tonnes/m^2 (702 kN/m^2)
- Proven lateral loading capacity of: 15.1 tonnes/m^2 (151 kN/m^2)



Maximum installation depths – to base of units (m)[1]

Typical soil type	Soil weight kN/m^3	Angle of internal friction φ (degrees)[2,3]	Landscaped areas	Vehicle mass <9 tonnes[4,5]	Vehicle mass <44 tonnes
Over-consolidated stiff clay	20	24	4.67	4.42	4.17
Silty sandy clay	19	26	5.03	4.78	4.53
Loose sand and gravel	18	30	5.86	5.61	5.36
Medium dense sand and gravel	19	34	6.87	6.62	6.37
Dense sand and gravel	20	38	7.82	7.57	7.30

(1) Without groundwater present below base of units – AquaCell Plus-R may be used where groundwater is present, contact Wavin for technical advice.
(2) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.
(3) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.
(4) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
(5) This category should be used when considering landscaped areas that may be trafficked by ride on mowers.

Assumptions made:
- Ground surface is horizontal
- Shear planes or other weaknesses are not present within the structure of the soil.

AquaCell Plus-R: for inspectability

By aligning AquaCell Plus-R units end-to-end, full length viewing channels can be created – allowing for CCTV inspection if required. These are created in the bottom layer of an AquaCell tank installation.

The units can be used in combination with AquaCell Core-R (and with Eco if there is at least one layer of AquaCell Core-R in between the Plus-R and Eco layer).

NOTE: For any AquaCell Plus-R units on the perimeter of a structure that are NOT required for inspection access, the open ends of the integral inspection tunnels should be fitted with the end caps provided.

Inspection chambers

An inspection chamber should precede the inlet pipework for the AquaCell structure.

A silt trap or hydro-dynamic separator prior to the inspection chamber is also recommended.

For on-line installations the following Chambers are recommended:
— Down to 3m Wavin Non-Entry Inspection Chambers
— Down to 5m Wavin Range 600 Inspection Chambers, or a traditional manhole*

**where inlet pipework is replaced by AquaCell units acting as flow conduit.*

For off-line installations:
— Manhole with in-built flow control

Recommendation: If installing any Wavin Non-Entry Inspection Chamber, deeper than 1.2 metres, ensure that the cover and frame includes a 350mm restrictor to prevent man entry.

Inspection and maintenance

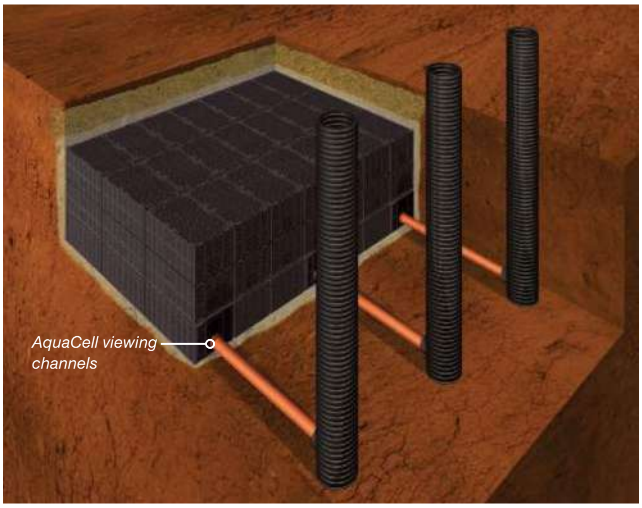
CCTV inspection at every inspection point is recommended:
— after every major storm
— at regular intervals according to the specific maintenance plan for the site

Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank.
It is important to prevent construction silt from entering the AquaCell structure.

Inspectability scenarios

AquaCell Plus-R viewing channel

Trafficked tank installation with inspection chambers



End cap for when an inspection channel is not required

Design guidance

Infiltration or attenuation?

The AquaCell range can be used either as:

- A soakaway whereby the units will be installed in suitable pervious soils so the units can be wrapped in a geotextile to allow infiltration of the stormwater into the surrounding ground, or
- As an attenuation tank in impervious ground (e.g. clay) where infiltration is not possible, here the units are encapsulated in a geomembrane (which is in turn wrapped in a protective geotextile layer) so that the structure can hold the stormwater temporarily until local drainage flows can accept it for normal disposal at a permissible outflow rate.

Large scale AquaCell Core-R storage tank

Domestic AquaCell Core-R soakaway

Site assessment

Ground conditions may be established as part of a geotechnical assessment. This may include tests for infiltration and ground water level.

If there is no confirmation that such assessments have been conducted, or resulting conclusions are unavailable, a trial pit will be required in accordance with BRE 365.

For further information and guidance, please contact the Wavin Technical Design Team.

Infiltration (soakaways)

According to the principals of SuDS, wherever possible stormwater should be drained back into the ground via a soakaway as the first priority. A site must meet BOTH of the following criteria for infiltration to be possible:

- The underlying soil surrounding the proposed installation is sufficiently permeable
- The seasonally high water table is a minimum of 1 metre below the base of the proposed installation

If either of these criteria is not met, or cannot be confirmed for any reason, a soakaway system may not be suitable for the application, in which case a storage tank must be used.

Attenuation (storage tanks)

A storage tank may be designed to be online or offline (see pages 26-31 for typical details). However, if the site is subject to groundwater or a high water table, it is important to ensure that the tank is not vulnerable to flotation. Sufficient weight from soil, or other covering placed over the AquaCell units, must be sufficient to counter any buoyancy uplift force from the rising groundwater level.

Important design considerations for geocellular structures

Rising rainfall levels and increased focus on SuDS compliance, have led to an increase in the use of modular units to create underground structures for infiltration or the temporary storage of stormwater.

However, not all currently available systems have the proven performance characteristics necessary to meet the wide range of complex underground geocellular applications.

The Wavin range of AquaCell units provide assured performance, since all strength and hydraulic capabilities have been verified by independent testing and all units are fully BBA approved.

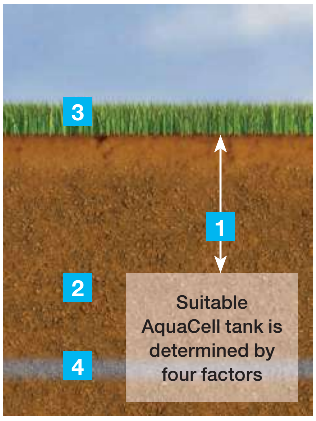
To guarantee the structural integrity of an engineered drainage system, any underground structure must be strong enough to support the loads to which it will be subjected without any unacceptable deflection.

The correct choice of geocellular unit must have appropriate proven top (vertical) and side (lateral) load bearing capacity and deflection characteristics to suit site conditions.

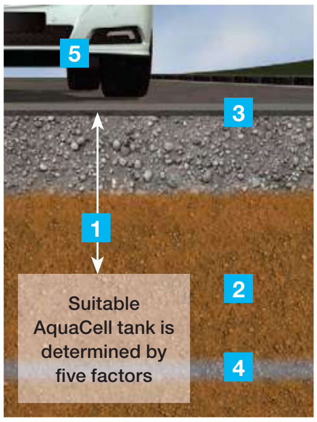
The five key site considerations to be noted when designing a geocellular structure are:

1. Depth of cover (See page 14)
2. Soil type
3. Surface finishing
4. Presence of groundwater
5. Type of traffic/loading

A: Non-trafficked



B: Trafficked



The combination of these 5 factors effectively means that the required characteristics of a geocellular structure to be installed under a trafficked location (for example) will be very different from that under a landscaped/low-loaded location.

Two typical examples are given below.

Example A: Landscaped/non-trafficked location and 0.3m cover depth. Typically requires minimum vertical strength of 17.5 tonnes/m²

Example B: Car park with occasional light delivery traffic and between 0.5 – 0.7m cover depth. Typically requires minimum vertical strength of 40 tonnes/m²

Design guidance

Hydraulic design

All AquaCell units have identical dimensions: 1m x 0.4m x 0.5m, have a nominal void ratio of 95% and each holds 190 litres of water. Hydraulic calculations are accordingly the same for AquaCell Eco, Core-R and Plus-R.

Structural design however, requires careful consideration of loading factors specific to each location – see CIRIA C680 or CIRIA C737 for further guidance (we recommend using the BPF Guide Designing Geocellular Drainage Systems to CIRIA Report C737 alongside.)

Structural design – installation and cover depths

Each AquaCell unit has been designed to have specific loading capacities (see pages 8-10) that define the maximum depth parameters for which they are suitable.

Minimum depth of cover varies according to whether or not the installation will be subject to trafficking by cars/HGVs.

However, in some situations, installations may have to be located with greater cover depths. Reasons may include:

- Deep-running drainage network
- Other buried services running above tank location
- Installation into banked/ sloping ground
- Upper layer of clay preventing infiltration

The table shows a summary of typical cover depths and installation depths as a guide.

Typical minimum cover depths and maximum installation depths

Location type	Minimum cover depths (m)		
	AquaCell Eco	AquaCell Core-R	AquaCell Plus-R
Landscaped/non-trafficked areas[2]	0.30	0.30	0.30
Car parks, vehicle mass up to 9 tonnes[1]	n/a	0.60	0.69
HA/HGV loading up to 60 tonnes	n/a	1.11	1.30
	Maximum installation depths (m)[3]		
Maximum depth to base of unit (Landscaped)	2.68	6.68	7.82
Maximum depth to base of unit – vehicle mass up to 9 tonnes	n/a	6.43	7.57
Maximum depth to base of unit – vehicle mass up to 44 tonnes	n/a	6.18	7.30

(1) For specific advice on cover depths for heavier loadings/HGV applications, contact Wavin Technical Design on 0844 856 5165.

(2) 0.30m is minimum depth for AquaCell in landscaped applications. 0.5m cover is recommended in applications where ride-on mowers may be used. If construction plant is to be used on site, extra protection may be needed.

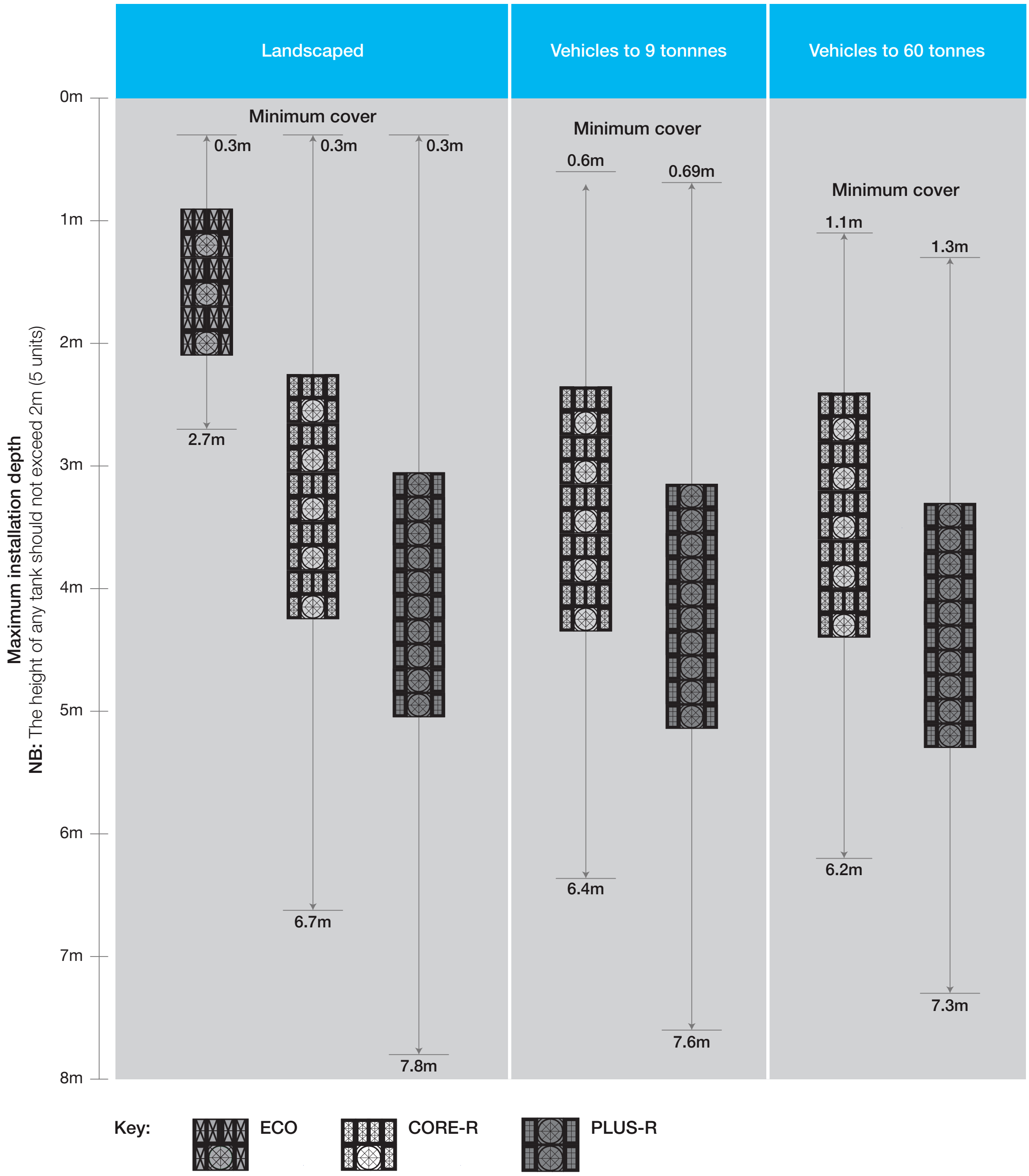
(3) Allowable maximum depth to base of bottom layer of units is dependent on soil type, angle of shearing resistance, loadings, and groundwater level. The above depths are based on 38° angle of shearing resistance and no groundwater.

In trafficked applications it is recommended that the height of any tank should not exceed 2m (5 units). If you require a tank that exceeds this, please contact Wavin Technical Design for guidance:

T: 0844 856 5165 E: technical.design@wavin.co.uk

Minimum cover and maximum installation depths to base of units from ground level, in best soil conditions

This chart shows how deep each unit can be used for different applications in best soil conditions.



Note: The AquaCell units can also be used in combination with each other, see page 16 for details.

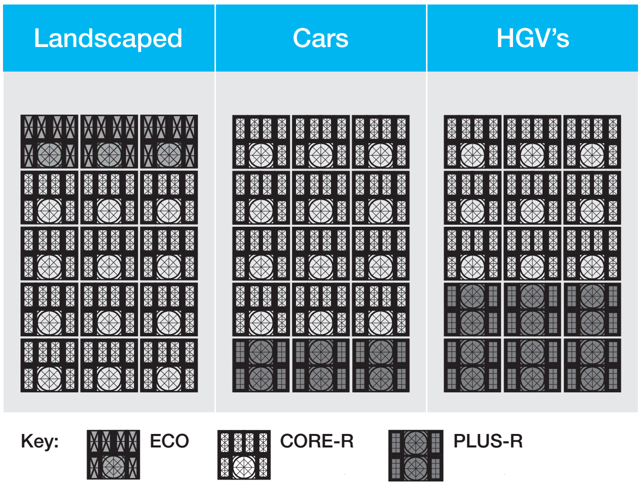
Design guidance

Mix and match

Although all AquaCell units have identical dimensions, and a high nominal void ratio of 95%, they are manufactured to perform at a range of depths, dependent on soil type, angle of shearing resistance, loading and ground water levels. For optimum performance the units can be mixed and matched (in layers) to value engineer the most effective design (in cost and performance terms) for each installation. For example, in a landscaped application if you needed to install a tank or soakaway that is deeper than 2.7m, you could install layers of AquaCell Core-R underneath the AquaCell Eco. See below illustrations showing examples of how the AquaCell units can be mix and matched together. For advice on how to optimise a tank or soakaway design using more than one type of AquaCell please contact Wavin Technical Design.

Note: AquaCell Eco cannot be used directly with AquaCell Plus-R therefore there must be a layer of AquaCell Core-R between them.

Typical examples of mix and match with AquaCell



Brick bonding – for extra stability

When assembling a geocellular structure that comprises two or more layers, it is recommended that AquaCell units are placed in a 'brick-bonded' configuration for extra stability.

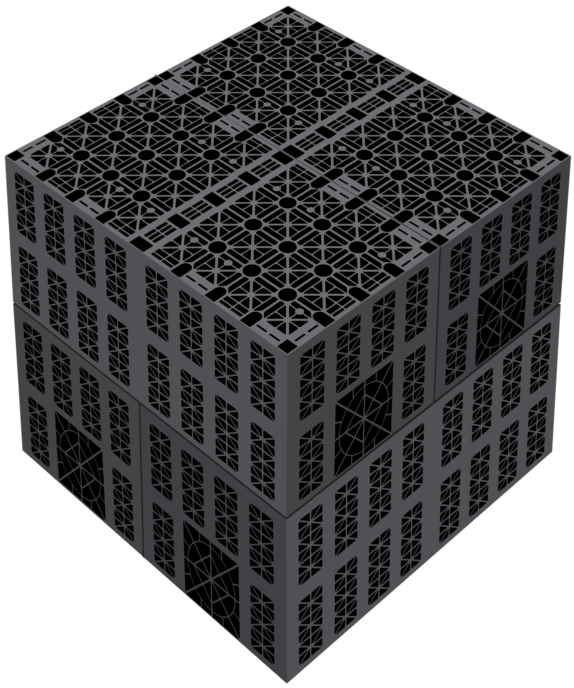
This helps minimise continuous vertical joints in the assembly, and gives the structure extra stability.

A significant advantage of AquaCell unit design is that brick bonding placement does not require extra connectors.

All three AquaCell units may be placed in this way, unless inspection channels and cleaning access are required using AquaCell Plus-R.

AquaCell Plus-R units incorporate integral inspection channels. These are designed for combined alignment to create viewing tunnels at the base of an assembled structure (see page 11).

Example of AquaCell being brick bonded



Installation guidance

AquaCell Core-R and Plus-R: Construction loads

Construction plant such as excavators can impose significant loads on any AquaCell unit. The following guidelines should be observed:

- Tracked excavators (not exceeding 21 tonnes weight) should be used to place fill over the AquaCell units when the geotextile or geomembrane wrapping has been completed
- At least 300mm of fill should be placed before the excavators or trucks delivering the backfill are allowed to traffic over the installed units
- Compaction plant used over the AquaCell units should not exceed 2300kg/metre width. This will allow the compaction of Type 1 sub-base in 150mm layers over the units in accordance with the Specification for Highways Works
- All other construction plant should be prevented from trafficking over the system once it is installed and surfacing completed, unless a site specific assessment demonstrates that it is acceptable
- In particular cranes should not be used over, or place their outriggers over the system

AquaCell Eco: Construction loads

As AquaCell Eco is designed for landscaped and non-loaded applications, certain precautions are recommended on site to prevent damage to the units through excess loading.

Manual assembly

Whilst assembling the tank, it may be necessary to walk on top of previously laid AquaCell units. Therefore care should be taken not to damage the edges of the units.

Backfilling

When backfilling AquaCell Eco installations:

- Machines placing the material must be located OFF the units
- Only light compaction should be applied to the material
- Backfill with suitable, stone-free, as-dug material
- First layer should be 300mm thick before using any compaction plant
- NO vibratory mechanism should be used for compacting this first layer
- Compaction plant must not exceed 2300kg per metre width

Construction traffic on site

Once backfilled, if construction plant (e.g. excavators or loaders) are likely to run over the installation, ensure that:

- MINIMUM protective cover should be 500mm well-compacted granular material
- Only tracked excavators can be used and MUST NOT weigh more than 14 tonnes.
- HGVs MUST NOT run over installed AquaCell Eco units

Manual assembly

All ancillaries and adaptors (see pages 34-37) can be used with either the AquaCell Eco, Core-R or Plus-R units, except the 225mm Flange Adaptor (6LB106) which must only be used with AquaCell Core-R or Plus-R.

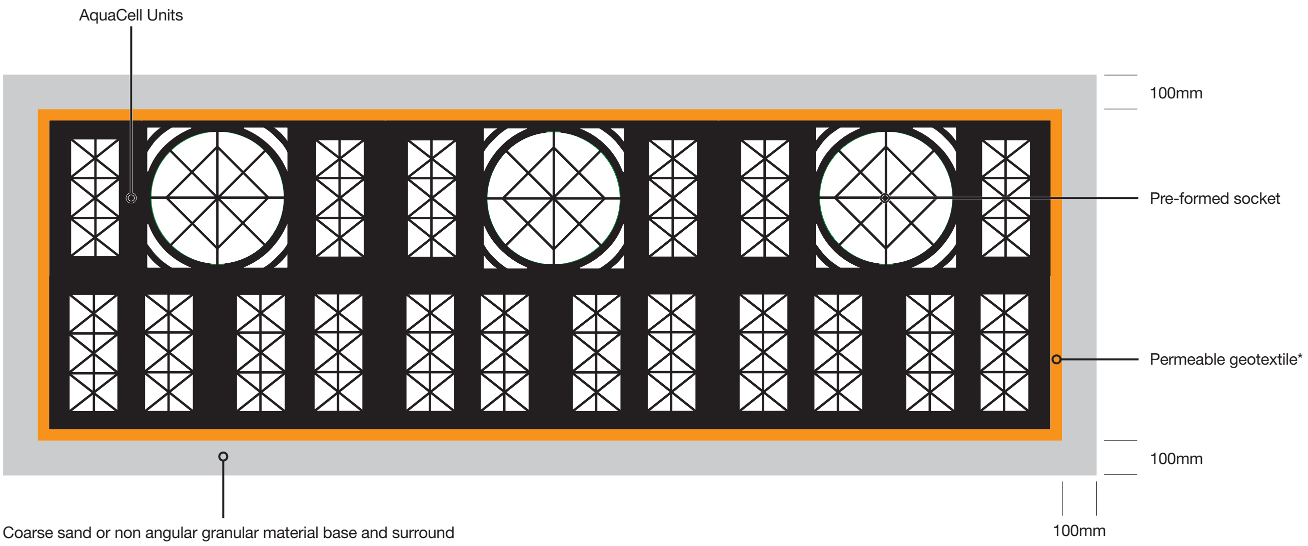
The 150mm Flange Adaptor (6LB104) should only be used when constructing an air vent on the top surface of an AquaCell Eco unit. The adaptor should not be used to connect inlet pipes to the side of an Eco unit.

Installation

Typical soakaway installation method

Typical installation procedure

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non angular granular material, level and compact.
3. Lay the geotextile* over the base and up the sides of the trench.
4. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below) – see page 16. For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
5. Fix the Adaptors to the AquaCell units as required and connect pipework.
6. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or one of the standard Silt Traps (6LB600, 6LB625, 6LB630) is installed prior to the inlet pipework – see page 24 for installation guidelines.
7. Wrap and overlap the geotextile covering the entire AquaCell structure.
8. Lay 100mm of coarse sand or non angular granular material between the trench walls and the AquaCell structure and compact.
9. Lay 100mm of coarse sand or non angular granular material over the geotextile and compact.
10. Backfill with suitable material.
11. Rainwater from roof areas may discharge directly into the soakaway but rainwater from carparks must discharge through a catchpit manhole and/or a petrol interceptor.



Example shows the use of AquaCell Eco. However, a soakaway can also be installed as shown using either of the other versions of AquaCell units (Core-R or Plus-R) as appropriate.

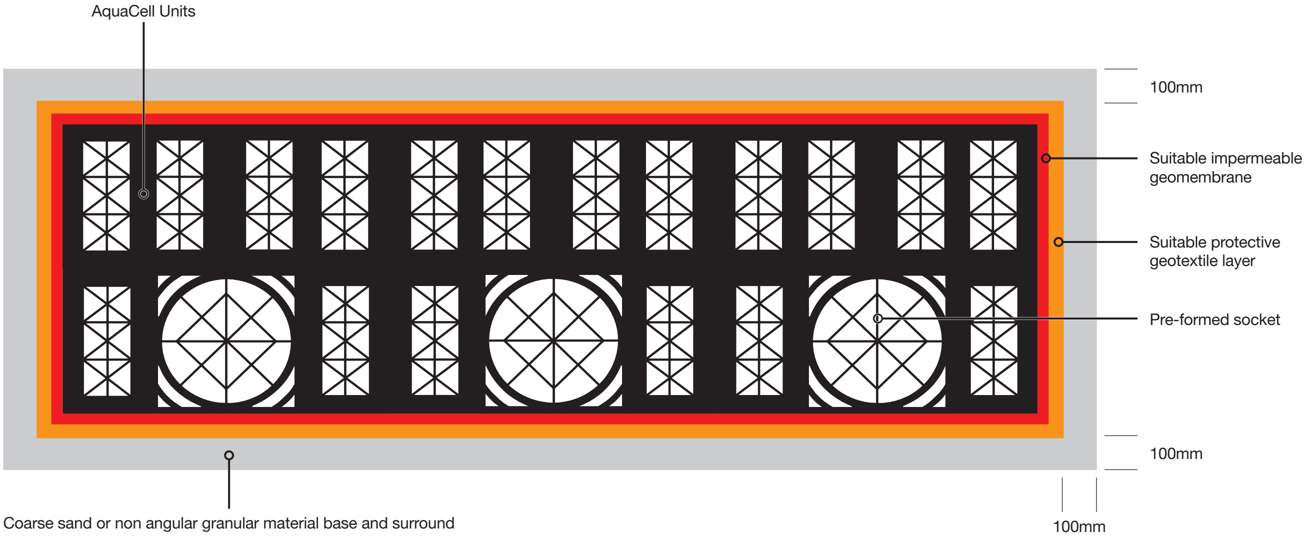
**The geotextile should be selected according to specific site conditions. Specialist advice should be sought if surrounding soil characteristics exhibit a high degree of fines/low infiltration capacity and/or there is a high risk of damage from ground contaminants.*

Typical storage tank installation method

Typical installation procedure

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non-angular granular material, level and compact.
3. Lay the geotextile[1] over the base and up the sides of the trench.
4. Lay the geomembrane[2] on top of the geotextile over the base and up the sides of the trench.
5. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below) – see page 16. For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
6. Wrap the geomembrane around the AquaCell structure and seal to manufacturers recommendations.*
7. If side connections into the AquaCell units is required, (other than the preformed socket), use the appropriate Flange Adaptor (6LB104 or 6LB106). Fix the flange adaptor to the unit using self-tapping screws. Drill a hole through the Flange Adaptor and connect the pipework. (6LB106 should not be used with AquaCell Eco).
8. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework – see page 20 for installation guidelines.
9. Wrap and overlap the geotextile covering the entire AquaCell structure, to protect the geomembrane.
10. Lay 100mm of coarse sand or non angular granular material between the trench walls and the AquaCell structure and compact.
11. Lay 100mm of coarse sand or non angular granular material over the geotextile/geomembrane and compact.
12. Backfill with suitable material.

NB: A storage tank must be vented, and it is recommended that one vent pipe, 110mm in diameter is provided per 7,500 square metres of impermeable catchment area on a site, see page 20 for design.



Example shows the use of AquaCell Core-R. However, a storage tank can also be installed as shown using any of the other versions of AquaCell units (Eco, Core-R or Plus-R) as appropriate.

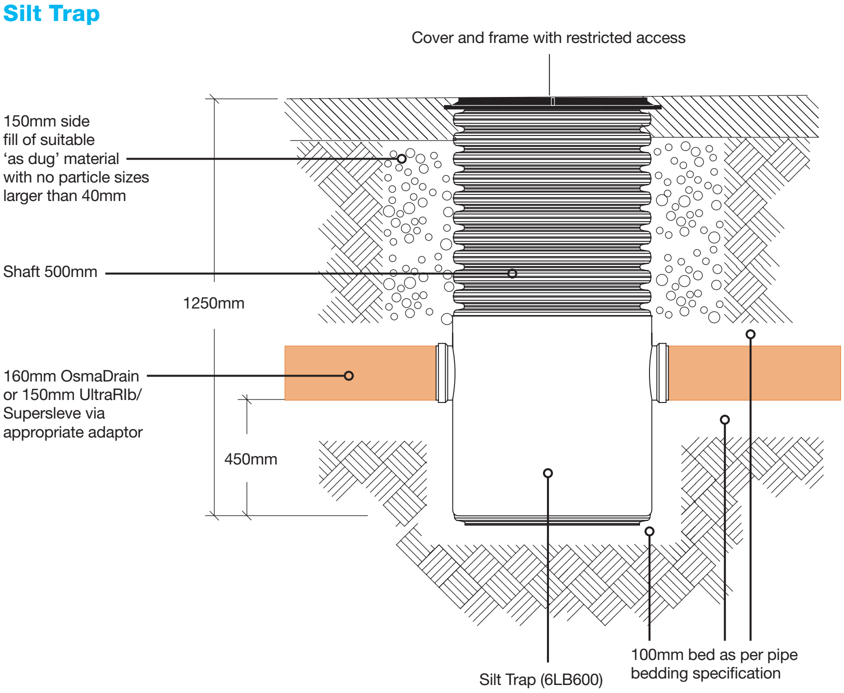
1. For protective geotextiles CIRIA C753 – The SuDS Manual recommends a geotextile of at least 2mm thick and 300gsm.

2. The geomembrane should be designed to survive the rigours of construction, this is typically at least 0.5mm thick. Joints should be sealed using proprietary welding techniques.

Installation

Silt Trap and Air Vent termination

Silt Trap

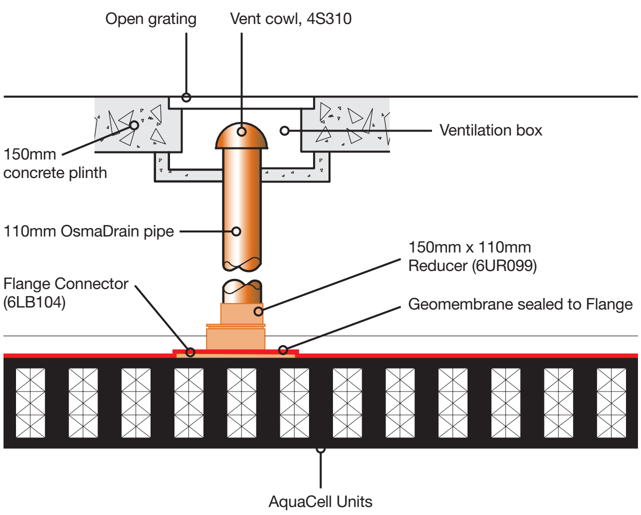


Typical installation procedure

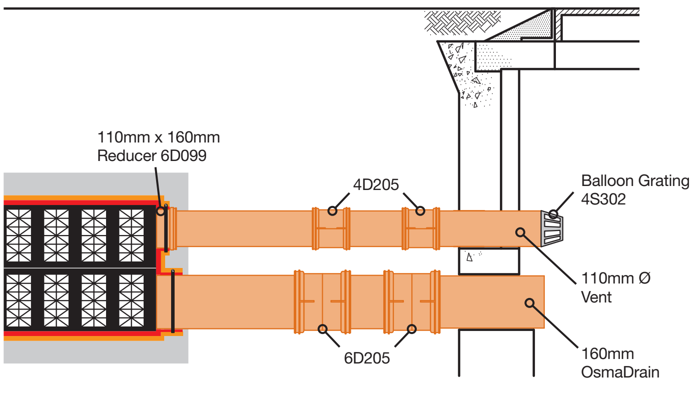
1. Place the Silt Trap (6LB600, 6LB625, 6LB630) on a minimum of 100mm bed as per pipe bedding specification. Ensure that the trap is as close to the AquaCell unit as possible and in a suitable position to allow pipework connection.
2. Connect the relevant pipework in accordance with standard pipe installation guidelines.
3. Surround the sides of the Silt Trap with 150mm of 'as dug' material, with no particle sizes larger than 40mm.
4. Fit relevant cover and frame.

NOTE: When surrounded by a concrete plinth (150mm x 150mm) the 4D920 Cover and Frame can be used in situations with a loading of up to 50kN (5 tonne).

Typical Air Vent design



Typical Air Vent through manhole



NOTE: It is recommended that all connections and air vent installations in storage applications (using geomembrane) are made using a Flange Adaptor.

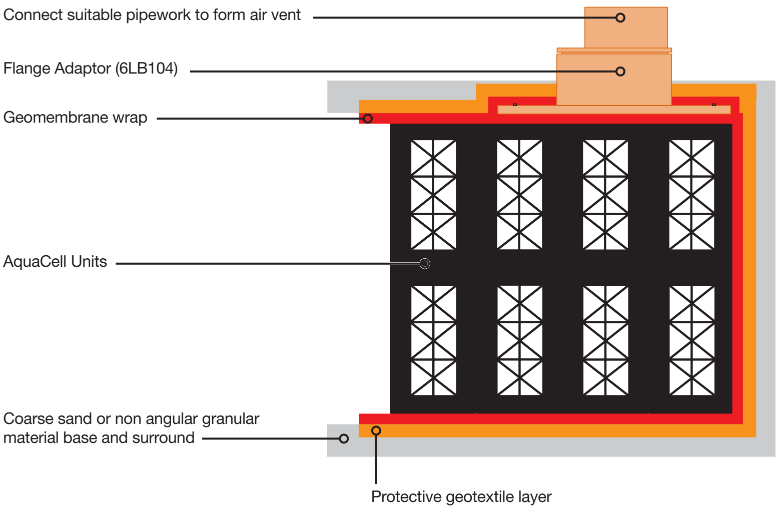
Adhesive or double sided tape should be used between the geomembrane and the flange plate to ensure a watertight seal.

NOTE: It is recommended that one vent pipe, 110mm in diameter, is provided per 7,500 square meters of impermeable catchment area on a site. Please contact Wavin Technical Design for further details.

Connections

Top connection for Air Vent

Connect into the top of the AquaCell unit, using Flange Adaptor.

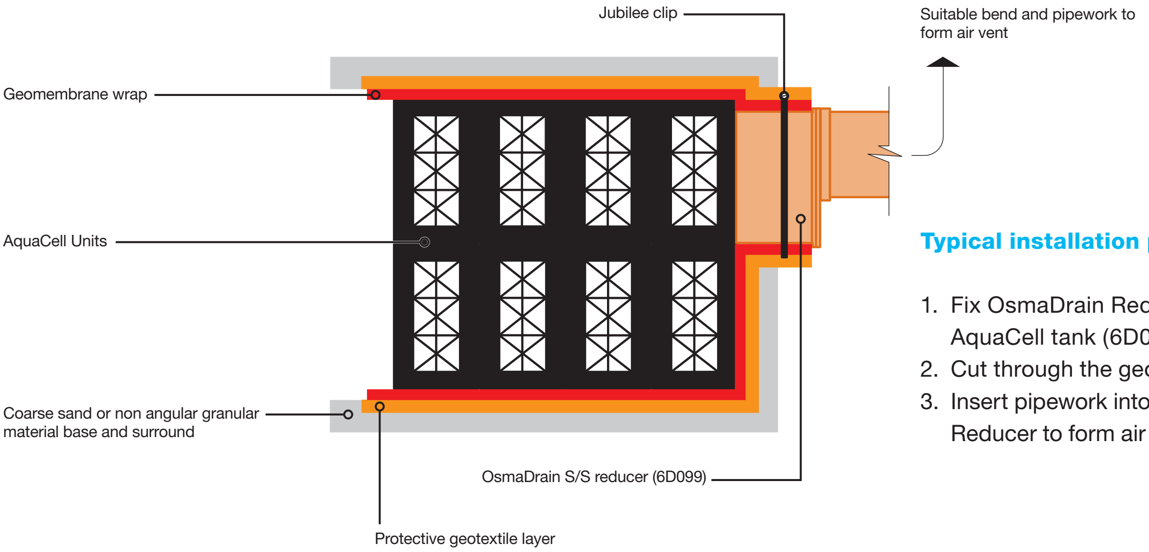


Typical installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor to form air vent.

Side connection for Air Vent

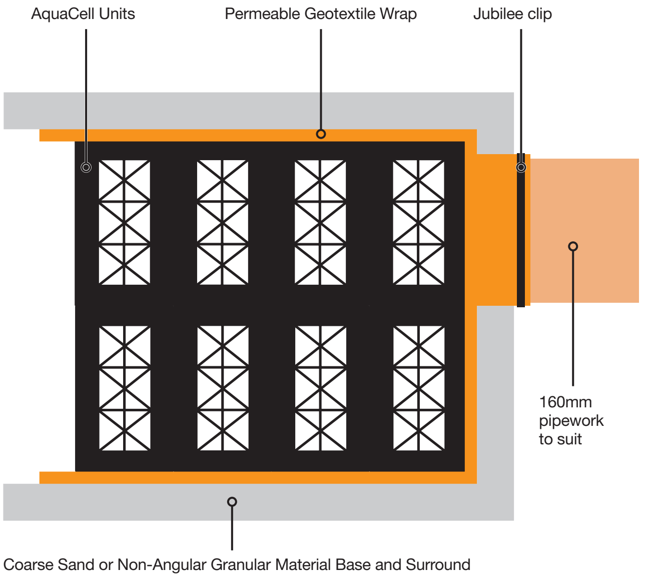
Connect into the side of the AquaCell tank unit using standard Reducer.



Typical installation procedure

1. Fix OsmaDrain Reducer to the AquaCell tank (6D099).
2. Cut through the geomembrane.
3. Insert pipework into OsmaDrain Reducer to form air vent.

Connections

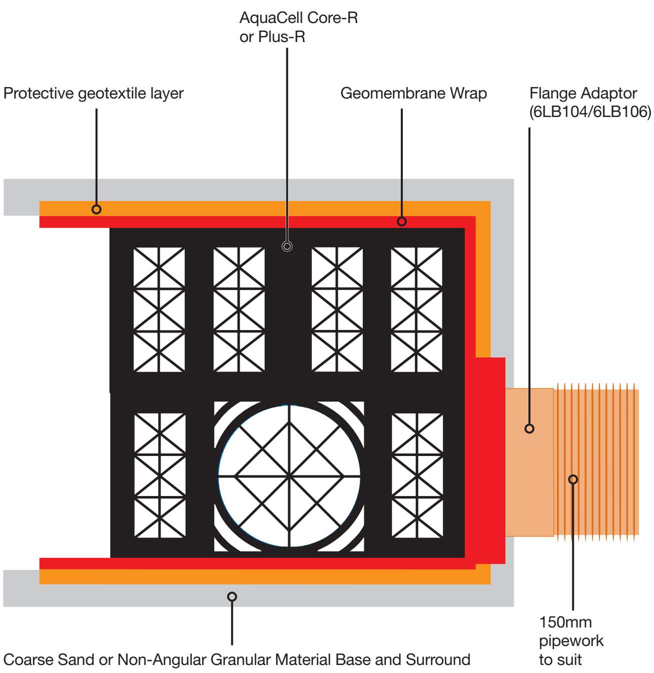


Connections to AquaCell units

Connection for soakaway application using either the pre-formed socket (as shown below) or standard adaptors into pre-formed socket*.

*NOTE: For pipework other than 160mm OsmaDrain, these adaptors can be used to connect to the following:

- 6TW141: TwinWall S/S Adaptor connects to 150mm TwinWall
- 6D099: OsmaDrain Adaptor connects to 110mm OsmaDrain
- 6UR141: UltraRib S/S Adaptor connects to 150mm UltraRib
- SA15/2: Double Spigot Adaptor connects 160mm OsmaDrain to 150mm Supersleve Clay



Connection for storage application using Flange Adaptor at points other than pre-formed socket, (for AquaCell Core-R or Plus-R).

Installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor.

*NOTE: When using the 6LB104: For pipework other than 150mm UltraRib these adaptors can be used to connect to the following:

- 6UR099: S/S Level Invert Reducer to 110mm OsmaDrain
- 6UR143: UltraRib 150mm Spigot Adaptor connects to 160mm OsmaDrain
- 6TW145: UltraRib 150mm Spigot Adaptor connects to 150mm Twinwall
- TA/2: UltraRib 150mm Spigot Adaptor connects to 150mm Supersleve Clay

When using the 6LB106: For pipework other than 225mm UltraRib these adaptors can be used to connect to the following:

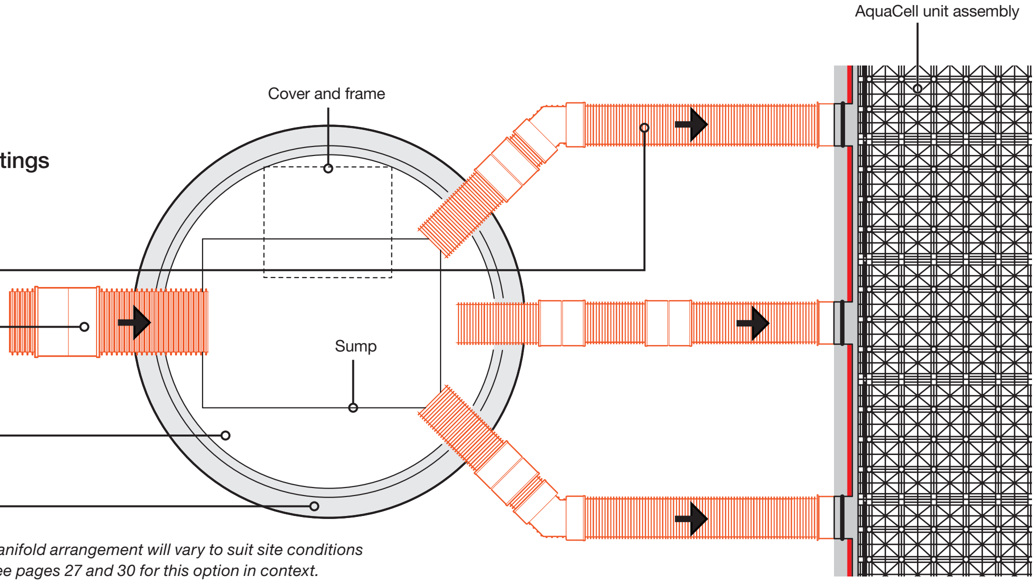
- 9TW145: UltraRib 225mm Spigot Adaptor connects to 225mm Twinwall
- TA/4: UltraRib 225mm Spigot Adaptor connects to 225mm Supersleve Clay

Connection configurations

The connections shown here in schematic form, are the typical options used to connect AquaCell units to control chambers. They provide a controlled feed into and out of the AquaCell units, and are used for either infiltration or attenuation schemes.

Manifold connection

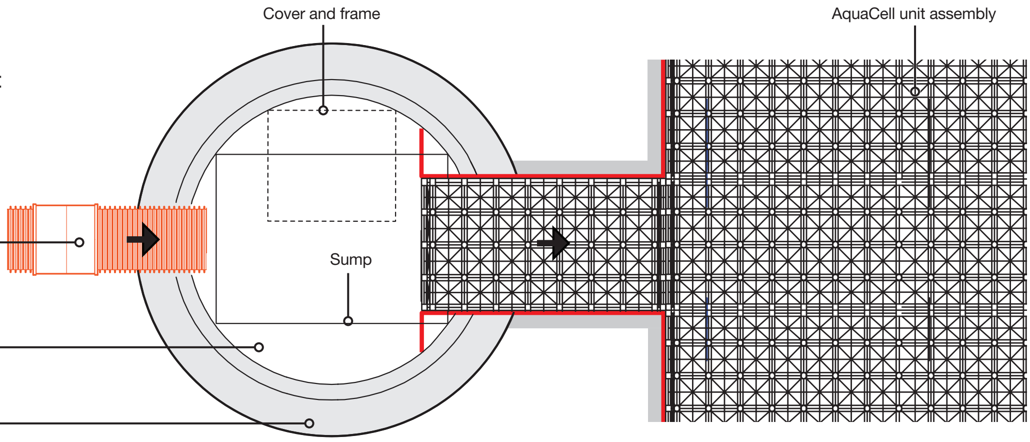
Using standard pipes and fittings



NOTE: The configuration of pipes in a manifold arrangement will vary to suit site conditions and aniticipated stormwater intensity. See pages 27 and 30 for this option in context.

Box connection

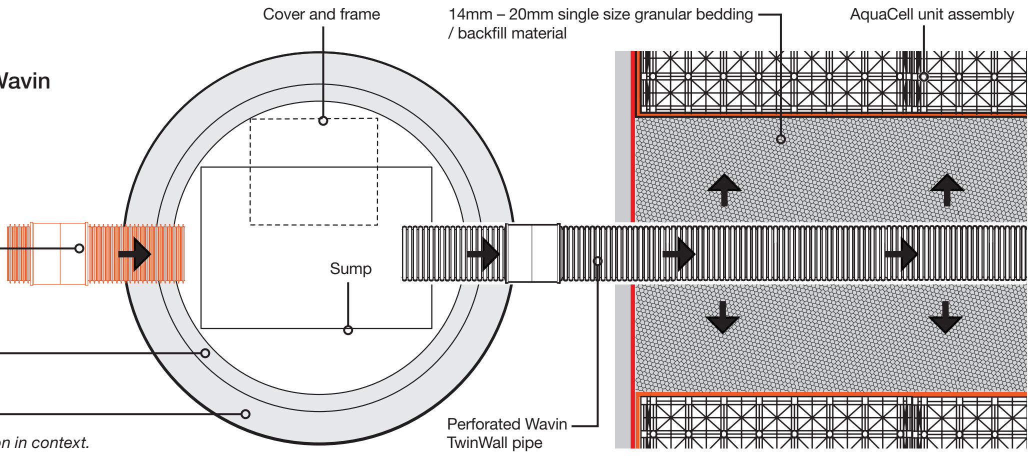
Using AquaCell units for fast water transfer



NOTE: See pages 26 and 29 for this option in context.

Central pipe connection

Using standard perforated Wavin TwinWall pipe and fittings

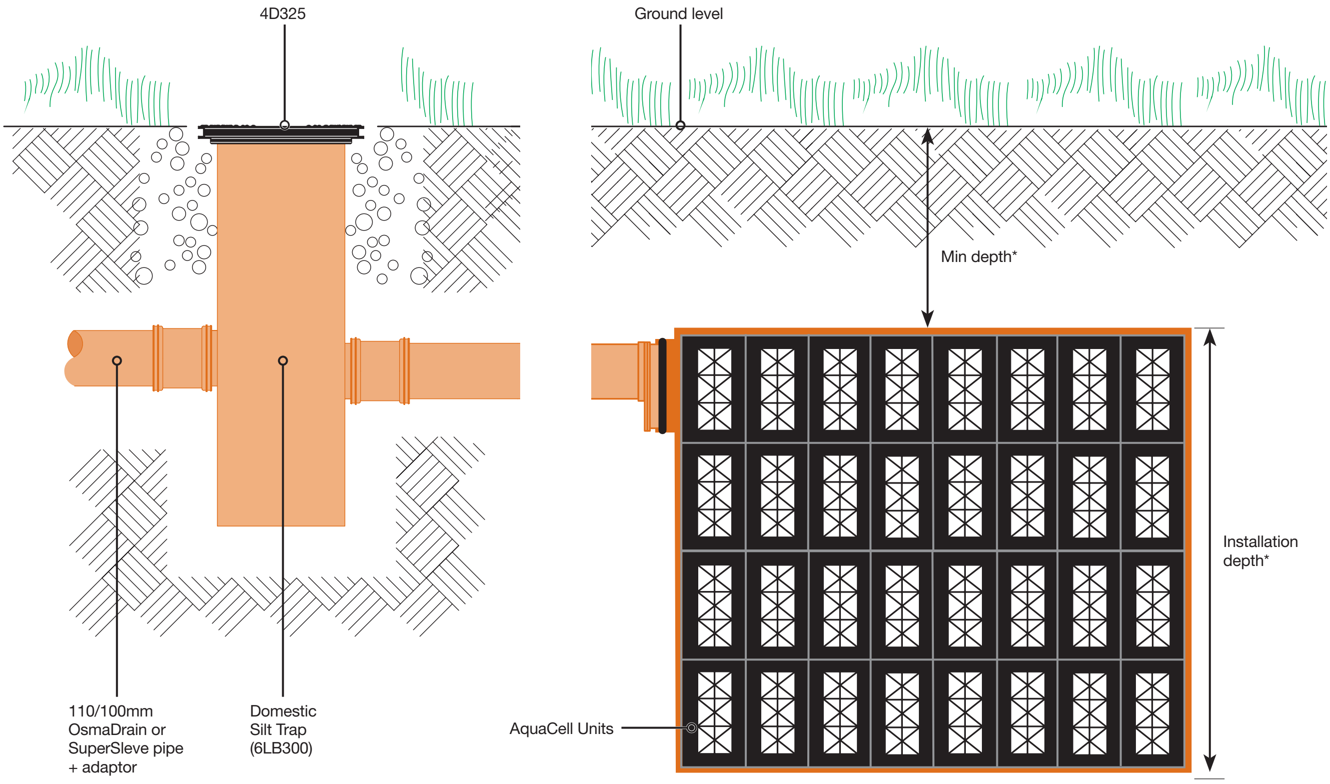


NOTE: See pages 28 and 31 for this option in context.

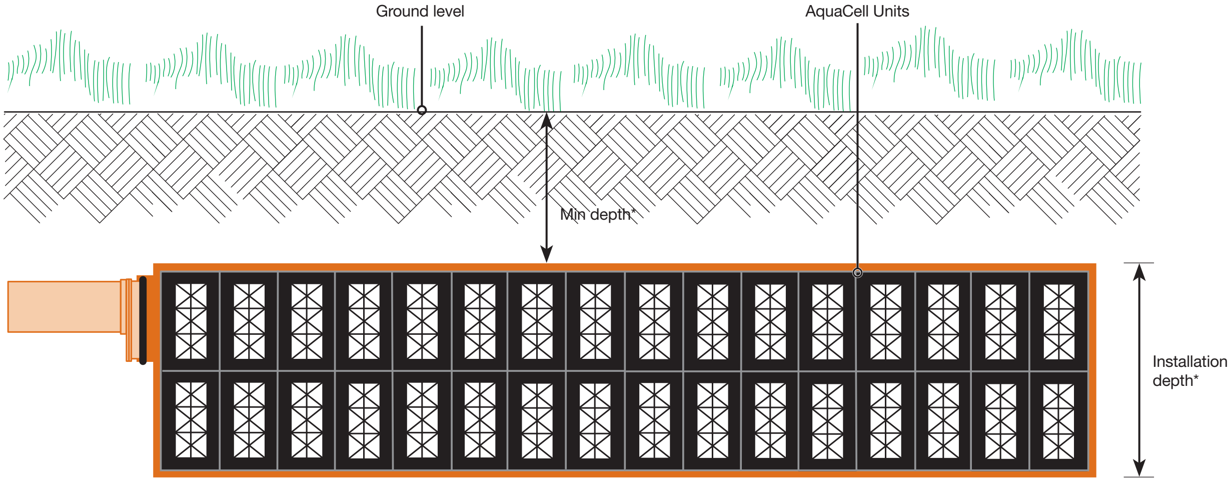
Soakaways

Soakaway – non-traffic loading

Soakaway

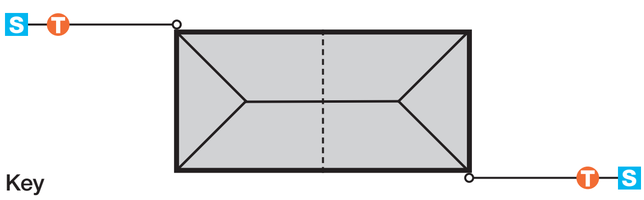


Trench soakaway



Notes

1. Soakaways should be sited at least 5m away from the building (Ref BS EN 752-4).
2. The exact size and shape of the soakaways are to be determined once all the necessary calculations have been produced.
   *For information regarding cover depths and installation depths, see page 15.



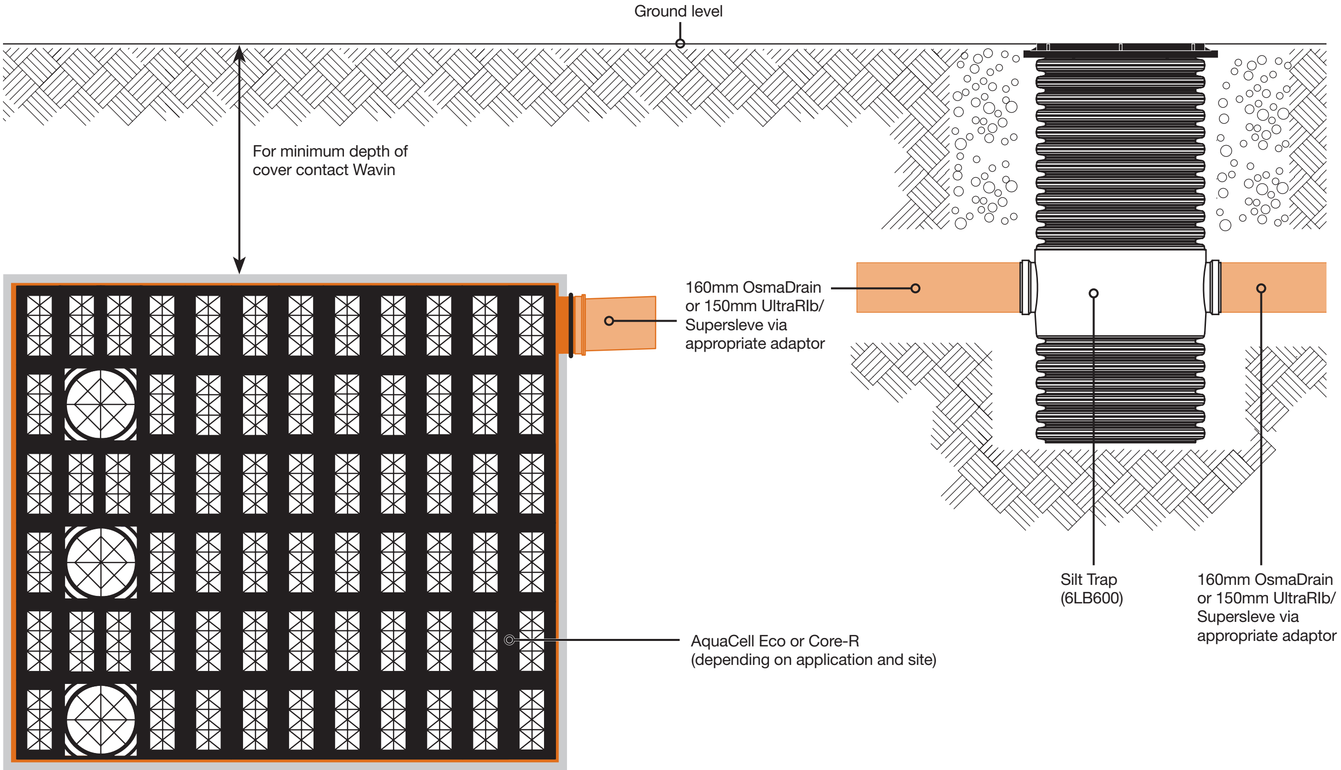
Key

S = AquaCell units soakaway (See note 2)

T = 250mm Dia Silt Trap

Soakaway – traffic loading

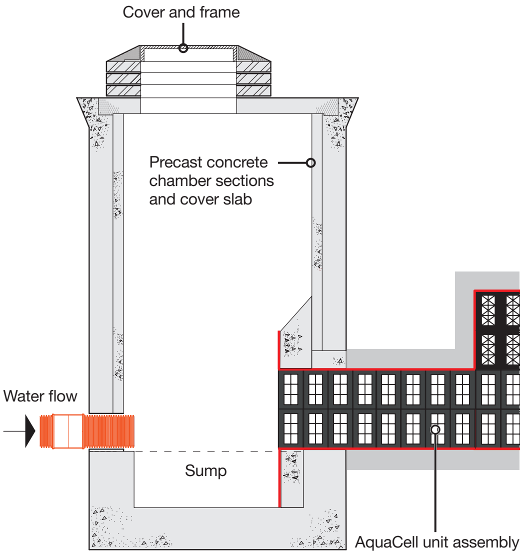
Soakaway



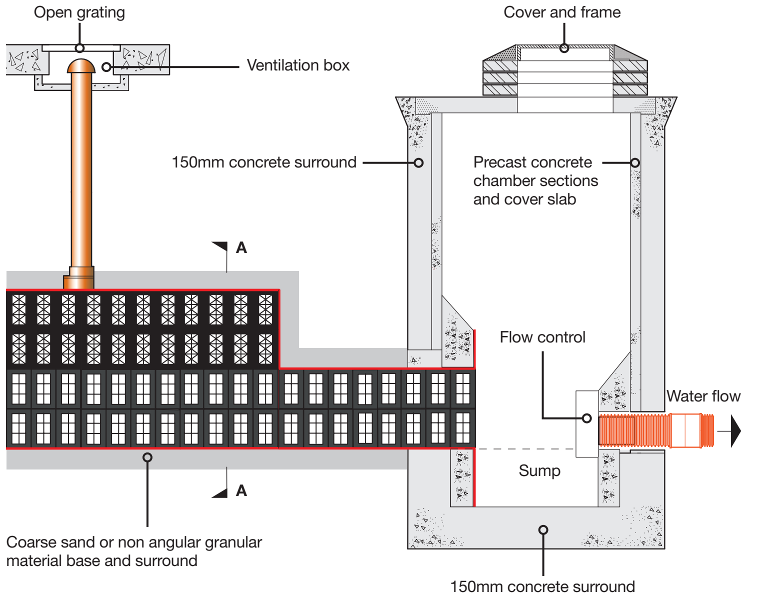
On-line storage

On-line storage – box feed

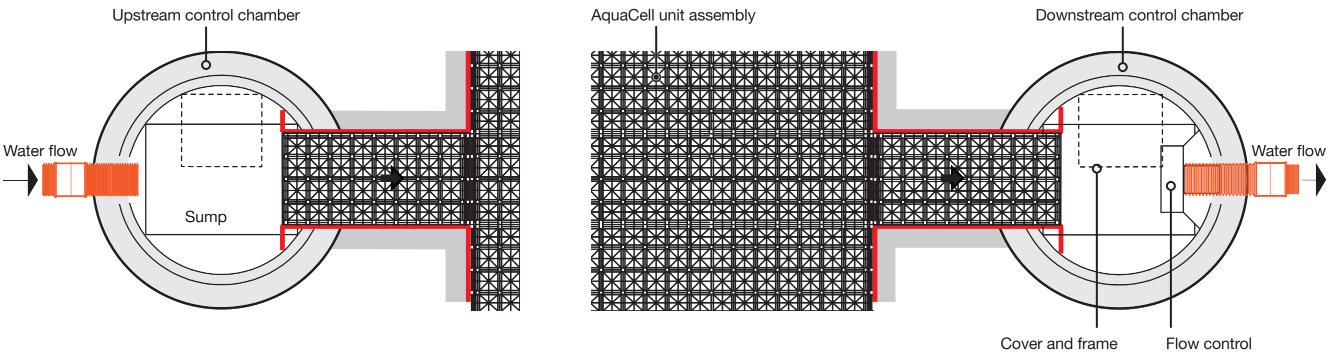
Long section



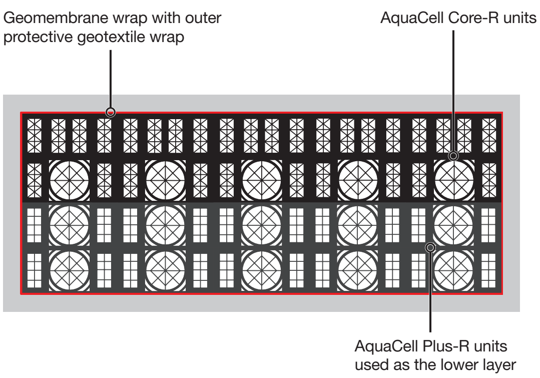
Typical vent detail



Plan



Cross section A-A



What happens to the water?

1. The water level in the upstream control chamber rises.
2. Then, during a storm event, the AquaCell storage assembly quickly fills with water via the AquaCell feed connection.
3. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and into the downstream control chamber.
4. The water then flows through the vortex flow control valve.