

Bond House 9-10,
Lower Bridge St, Dublin 8.
D08TH76
T: +353 1 9697881
E: Dublin@alantraynor.com
W: www.alantraynor.com

Unit 6, Belturbet Business Park,
Creeny, Belturbet, Co. Cavan.
T: +353 49 9522236
E: info@alantraynor.com
W: www.alantraynor.com



Alan Traynor Consulting Engineers Ltd.



Alan Traynor Consulting Engineers Ltd



Comhairle Contae an Chabháin
Cavan County Council

**PROPOSED DEVELOPMENT AT KINNYPOTTLE,
CAVAN TOWN, CO. CAVAN.**

Foul, Surface Water, Attenuation Calculation & Details

Storm sewer loadings for Development at Elm Grove, Cavan, Co.Cavan

DATA		STORM WATER FLOW Modified Rational Method					SEWER DESIGN Ks = 0.60										
SEWER REFERENCE		Roofs/yards Area A1		Impervious Area		Rainfall : I (mm/hr)	Storm Water Flow $Q=Ap^{1.49}C_r^{0.78}$ l/Sec	Size of drain (mm)	Gradient (1 in X)	Length (m)	Capacity (l/Sec)	Pipe full Velocity (m/Sec)	Actual Velocity (m/Sec)	Half full velocity (m/Sec)	Max Velocity (m/Sec)	Depth of flow (mm)	Reserve capacity (l/Sec)
From Manhole	To Manhole	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
S1	S3	0.000	0.016	0.016	0.016	50.00	2.02	225	75	17.193	60.05	1.51	0.70	1.51	1.71	28.13	58.03
S2	S3	0.008	0.016	0.024	0.024	50.00	3.04	225	200	15.250	36.57	0.92	0.56	0.92	1.04	43.95	33.53
S3	S4	0.016	0.069	0.085	0.125	50.00	15.81	225	75	46.974	60.05	1.51	1.28	1.51	1.71	78.66	44.24
S4	S5	0.015	0.009	0.024	0.149	50.00	18.85	225	75	12.030	60.05	1.51	1.34	1.51	1.71	86.57	41.21
S5	Sext	0.000	0.000	0.000	0.149	50.00	3.00	225	20	10.514	116.82	2.94	1.26	2.94	3.33	24.61	113.82

3.0 l/s achieved by means of a hydrobrake

Housing Development Elm Grove

Permeable Paving Design Sheet - Catchment Area 1

Discharge rate	1.00	Litres/Sec
Total Area of Paving	75	Sq. meters
Thickness of storage layer	0.4	Meters
Total catchment area	338	Sq. meters
Void ratio of stone	0.3	
Available storage	9	Cubic meters
Required Storage	8	Cubic meters

Duration	Return Period	Volume of water	Storage capacity	Outflow	Storage required
Mins	100	m3	m3	m3	m3
5	15.4	5.2	9	0.3	4.9
10	21.4	7.2	9	0.6	6.6
15	25.2	8.5	9	0.9	7.6
30	30.0	10.1	9	1.8	8.3
60	35.1	11.9	9	3.6	8.3
120	42.8	14.5	9	7.2	7.3
180	47.4	16.0	9	10.8	5.2
240	51.0	17.2	9	14.4	2.8
360	56.6	19.1	9	21.6	0.0
540	62.7	21.2	9	32.4	0.0
720	67.5	22.8	9	43.2	0.0
1080	74.9	25.3	9	64.8	0.0
1440	80.6	27.2	9	86.4	0.0
2880	89.0	30.1	9	172.8	0.0

Permeable Paving is designed for a 1:100 year storm return period

Housing Development Elm Grove

Permeable Paving Design Sheet - Catchment Area 2

Discharge rate	1.00	Litres/Sec
Total Area of Paving	65.8	Sq. meters
Thickness of storage layer	0.3	Meters
Total catchment area	150	Sq. meters
Void ratio of stone	0.3	
Available storage	6	Cubic meters
Required Storage	3	Cubic meters

Duration	Return Period	Volume of water	Storage capacity	Outflow	Storage required
Mins	100	m3	m3	m3	m3
5	15.4	2.3	6	0.3	2.0
10	21.4	3.2	6	0.6	2.6
15	25.2	3.8	6	0.9	2.9
30	30.0	4.5	6	1.8	2.7
60	35.1	5.3	6	3.6	1.7
120	42.8	6.4	6	7.2	0.0
180	47.4	7.1	6	10.8	0.0
240	51.0	7.7	6	14.4	0.0
360	56.6	8.5	6	21.6	0.0
540	62.7	9.4	6	32.4	0.0
720	67.5	10.1	6	43.2	0.0
1080	74.9	11.2	6	64.8	0.0
1440	80.6	12.1	6	86.4	0.0
2880	89.0	13.4	6	172.8	0.0

Permeable Paving is designed for a 1:100 year storm return period

Housing Development Elm Grove

Permeable Paving Design Sheet - Catchment Area 3

Discharge rate	1.00	Litres/Sec
Total Area of Paving	58.5	Sq. meters
Thickness of storage layer	0.3	Meters
Total catchment area	125.5	Sq. meters
Void ratio of stone	0.3	
Available storage	5	Cubic meters
Required Storage	2	Cubic meters

Duration	Return Period	Volume of water	Storage capacity	Outflow	Storage required
Mins	100	m3	m3	m3	m3
5	15.4	1.9	5	0.3	1.6
10	21.4	2.7	5	0.6	2.1
15	25.2	3.2	5	0.9	2.3
30	30.0	3.8	5	1.8	2.0
60	35.1	4.4	5	3.6	0.8
120	42.8	5.4	5	7.2	0.0
180	47.4	5.9	5	10.8	0.0
240	51.0	6.4	5	14.4	0.0
360	56.6	7.1	5	21.6	0.0
540	62.7	7.9	5	32.4	0.0
720	67.5	8.5	5	43.2	0.0
1080	74.9	9.4	5	64.8	0.0
1440	80.6	10.1	5	86.4	0.0
2880	89.0	11.2	5	172.8	0.0

Permeable Paving is designed for a 1:100 year storm return period



Section: **Attenuation tank**

GENERAL DATA

site location: **Ireland**
 60 min rainfall depth of 5 year return period 'R' [mm] = **15**
 M5-60 to M5-2d rainfall ratio 'r' = **0.40**
 proposed discharge rate 'v₁' [litre/s] = **3.00**
 proposed discharge rate 'v₂' [litre/s] = **3.00**
 allowance for climate change: **10%**

SUMMARY OF CALCULATIONS

required storage volume for discharge rate 'v₁' = **28.39** m³
 required storage volume for discharge rate 'v₂' = **42.54** m³

AREA DATA

	impermeability [%]	effective area [m ²]
impermeable area 'A ₁ ' [m ²] = 1490	100.00	1490
landscaping and/or green roof area 'A ₂ ' [m ²] = 0	90.00	0
other partially permeable area 'A ₃ ' [m ²] = 0	100.00	0
AREA DRAINED TO ATTENUATION TANK =		1490 m²

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v₁

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M20-D			M30-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.37	6.10	1.17	7.90	11.77	1.36	9.70	14.45	1.45	10.90	16.24	0.90	15.34
10	0.52	8.40	1.18	11.00	16.39	1.38	13.50	20.12	1.47	15.20	22.65	1.80	20.85
15	0.63	9.90	1.19	12.90	19.22	1.39	15.90	23.69	1.49	17.90	26.67	2.70	23.97
30	0.80	12.70	1.20	15.90	23.69	1.39	19.40	28.91	1.49	21.70	32.33	5.40	26.93
60	1.00	16.20	1.20	19.70	29.35	1.39	23.70	35.31	1.49	26.30	39.19	10.80	28.39
120	1.21	20.80	1.19	24.20	36.06	1.38	28.90	43.06	1.47	32.00	47.68	21.60	26.08
240	1.45	26.50	1.18	29.90	44.55	1.37	35.30	52.60	1.46	38.80	57.81	43.20	14.61
360	1.60	30.60	1.18	33.80	50.36	1.36	39.70	59.15	1.44	43.50	64.82	64.80	0.02
600	1.79	36.40	1.17	39.30	58.56	1.35	45.90	68.39	1.42	50.10	74.65	108.00	0.00
1440	2.24	39.20	1.17	51.50	76.74	1.34	59.20	88.21	1.42	64.10	95.51	259.20	0.00

* Z2 is a growth factor from M5 rainfalls

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v₂

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M30-D			M100-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.37	6.10	1.17	7.90	11.77	1.45	10.90	16.24	1.88	15.40	22.95	0.90	22.05
10	0.52	8.40	1.18	11.00	16.39	1.47	15.20	22.65	1.93	21.40	31.89	1.80	30.09
15	0.63	9.90	1.19	12.90	19.22	1.49	17.90	26.67	1.97	25.20	37.55	2.70	34.85
30	0.80	12.70	1.20	15.90	23.69	1.49	21.70	32.33	1.98	30.00	44.70	5.40	39.30
60	1.00	16.20	1.20	19.70	29.35	1.49	26.30	39.19	1.97	35.80	53.34	10.80	42.54
120	1.21	20.80	1.19	24.20	36.06	1.47	32.00	47.68	1.92	42.80	63.77	21.60	42.17
240	1.45	26.50	1.18	29.90	44.55	1.46	38.80	57.81	1.88	51.00	75.99	43.20	32.79
360	1.60	30.60	1.18	33.80	50.36	1.44	43.50	64.82	1.85	56.60	84.33	64.80	19.53
600	1.79	36.40	1.17	39.30	58.56	1.42	50.10	74.65	1.80	64.30	95.81	108.00	0.00
1440	2.24	39.20	1.17	51.50	76.74	1.42	64.10	95.51	1.78	80.60	120.09	259.20	0.00

* Z2 is a growth factor from M5 rainfalls

RUNOFF ESTIMATION METHODS

EQUATION - $QBAR = 0.00108 * (AREA)^{0.89} * (SAAR)^{1.17} * (SOIL)^{2.17}$

AREA	3890	m ²
SAAR	954	mm
SOIL	0.4	index

QBAR	0.00324	m ³ /s
------	---------	-------------------

Outflow **3.24** l/s

Outflow **8.34** l/s/ha

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 242139, Northing: 305260,

DURATION	Interval															
	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	2.6	3.7	4.3	5.2	5.8	6.3	7.9	9.7	10.9	12.6	14.2	15.4	17.2	18.7	19.9	N/A
10 mins	3.6	5.1	6.0	7.2	8.1	8.8	11.0	13.5	15.2	17.6	19.8	21.4	24.0	26.0	27.7	N/A
15 mins	4.2	6.0	7.0	8.5	9.5	10.3	12.9	15.9	17.9	20.7	23.2	25.2	28.2	30.6	32.6	N/A
30 mins	5.5	7.7	8.9	10.7	11.9	12.9	15.9	19.4	21.7	24.9	27.8	30.0	33.5	36.1	38.3	N/A
1 hours	7.2	9.9	11.3	13.5	14.9	16.0	19.7	23.7	26.3	30.0	33.3	35.8	39.7	42.7	45.1	N/A
2 hours	9.3	12.7	14.4	17.0	18.7	20.0	24.2	28.9	32.0	36.2	39.9	42.8	47.1	50.4	53.2	N/A
3 hours	10.9	14.6	16.6	19.4	21.3	22.8	27.4	32.5	35.8	40.4	44.4	47.4	52.0	55.6	58.5	N/A
4 hours	12.2	16.2	18.3	21.4	23.4	25.0	29.9	35.3	38.8	43.6	47.8	51.0	55.9	59.6	62.6	N/A
6 hours	14.2	18.8	21.1	24.5	26.7	28.4	33.8	39.7	43.5	48.6	53.1	56.6	61.8	65.7	69.0	N/A
12 hours	16.6	21.7	24.3	28.0	30.5	32.3	38.2	44.6	48.7	54.3	59.1	62.7	68.3	72.5	75.9	N/A
18 hours	18.6	24.1	26.8	30.8	33.5	35.5	41.7	48.5	52.8	58.6	63.7	67.5	73.3	77.7	81.3	N/A
24 hours	21.7	27.8	30.9	35.3	38.2	40.4	47.2	54.5	59.1	65.4	70.8	74.9	81.0	85.7	89.5	N/A
2 days	24.2	30.8	34.1	38.9	41.9	44.3	51.5	59.2	64.1	70.7	76.4	80.6	87.0	91.9	95.8	109.1
3 days	30.4	37.7	41.3	46.4	49.6	52.1	59.6	67.5	72.5	79.1	84.7	89.0	95.2	100.0	103.8	116.5
4 days	35.7	43.6	47.5	52.9	56.3	58.9	66.8	75.0	80.1	86.9	92.7	97.0	103.3	108.1	111.9	124.6
6 days	40.6	49.0	53.1	58.8	62.4	65.1	73.4	81.9	87.1	94.1	100.0	104.4	110.8	115.7	119.5	132.4
8 days	49.4	58.8	63.3	69.6	73.5	76.4	85.3	94.3	99.9	107.2	113.4	117.9	124.6	129.6	133.6	146.8
10 days	57.6	67.8	72.7	79.4	83.5	86.7	96.1	105.6	111.4	119.1	125.5	130.2	137.2	142.3	146.4	159.9
12 days	65.3	76.3	81.4	88.5	93.0	96.2	106.1	116.1	122.2	130.2	136.8	141.7	148.9	154.2	158.4	172.2
16 days	72.7	84.3	89.8	97.3	101.9	105.4	115.7	126.1	132.4	140.7	147.5	152.5	159.9	165.3	169.7	183.8
20 days	86.9	99.7	105.7	113.8	118.9	122.6	133.7	144.8	151.5	160.3	167.5	172.8	180.6	186.2	190.8	205.5
25 days	100.5	114.4	120.8	129.5	134.9	138.9	150.7	162.5	169.5	178.7	186.3	191.8	199.8	205.7	210.4	225.7
25 days	117.0	132.0	139.0	148.4	154.1	158.4	170.9	183.4	190.8	200.5	208.4	214.2	222.6	228.8	233.6	249.4

NOTES:
N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

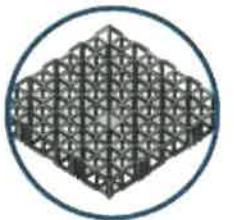
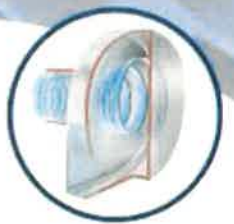


Modular Geo-Void Systems

Total Water Management

ESS EcoCell

Ecological Tank Systems



ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Environmental Sustainable Solutions

Welcome to Environmental Sustainable Solutions; specialist suppliers and designers of geocomposites and water re-use systems. Environmental Sustainable Solutions can help you achieve innovative results for all your requirements:-

- Ⓞ Stormwater Management
- Ⓞ Gas Barrier Protection
- Ⓞ Stormwater Attenuation
- Ⓞ Contaminated Land Development
- Ⓞ Stormwater Drainage
- Ⓞ Ground Stabilisation
- Ⓞ Rainwater Recycling Management
- Ⓞ Structural Waterproofing
- Ⓞ Gas Venting Systems
- Ⓞ Damp-proofing projects

Over the last 12 years Environmental Sustainable Solutions, and associated companies, have designed and installed thousands of water recycling, drainage and attenuation tank systems for schools, car parks, retail parks, offices and sports arenas throughout Ireland, UK, Europe and the Middle East.

Our wide range of environmental protection products, surface water drainage modules and modular water storage tank systems provides maximum design flexibility for engineers and architects working on even the most demanding of storm water storage and recycling projects.

Stormwater Management And Design

Stormwater is the phrase used to describe the excess rainwater that flows from rooftops, roads, car parks and other buildings. This water can contain many pollutants picked up from roofs and highways. In extreme weather conditions sudden heavy downpours of rain can cause major environmental disasters. Using our Rainmanager products; stormwater can not only safely be removed, but it can be stored and recycled for commercial and domestic use.

How it works

- ESS Attenuation Tank

Stormwater enters the attenuation tank via the inlet manhole, which incorporates a silt collection sump and a galvanised leaf collection basket. Water passes through the tank and exits through the outlet manhole, which contains an AquaBrake flow control device.

This flow control device regulates the release rate of water from the tank, and in so doing, enables the tank to fill. As a result of water entering the tank at a greater rate than it can exit, the void space then fills with water. While the tank fills, air is vented from the tank.

The Inlet/Outlet pipe will act as a flushing channel. This perforated pipe is wrapped completely in High Flow Filtering Geotextile, which prevents silt entering the block area. As the tank continues to empty at a pre-determined rate, air re-enters the tank via the same air vent system. The roof of the completed tank must be lower than the lowest gully trap on site.

Benefits

- Ⓞ 100% sealed tank
- Ⓞ Full installation service provided
- Ⓞ 12 years experience as market leader
- Ⓞ Quick installation – reduce site access delays
- Ⓞ Increased land usage – tanks are sub surface
- Ⓞ Economical – generally more cost efficient than any other equivalent sealed tank
- Ⓞ Cost effective – reduced costs for excavation and disposal of material
- Ⓞ Modular – easy to create any shape
- Ⓞ Strong – designed to support shear loading
- Ⓞ Lightweight – no cranes required
- Ⓞ Determinate volume – one cubic metre of matrix tank modules contain 950 litres of water, whereas stone fill will only provide 300 litres of storage per cubic metre.

Soakaway

The soakaway is normally best built as a long narrow structure.

The inlet pipe comes in at roof level and faces downwards so that the water can percolate into the tank.

The blocks are wrapped in Geotextile, to protect them and also to keep clay from filling up the void.

An air vent pipe is installed on the highest point with a cowl on top or vented back to an inlet manhole.

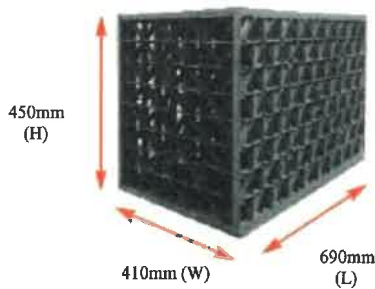
There is no outlet from a soakaway, therefore no flow control unit is required.

Protecting the Environment

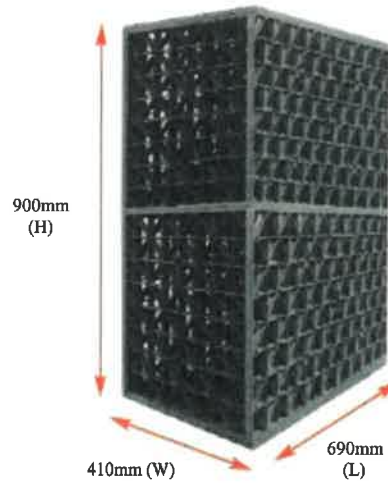
Stormwater Storage Tank

SUITABLE FOR USE UNDER:

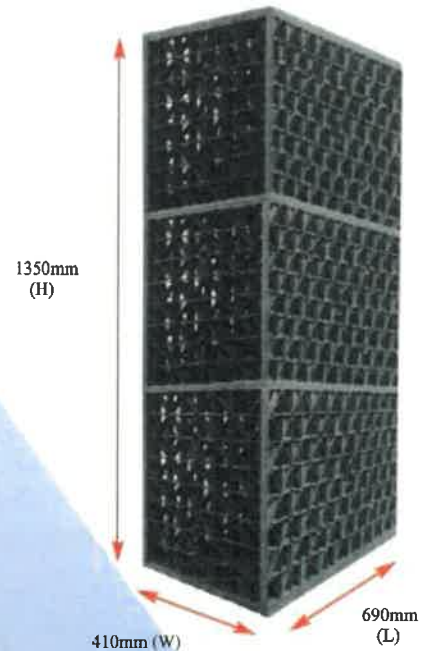
- Roadways
- Car parks
- Green areas



Single
8 Modules/m³
Flowrate - 2300 l/min



Double
4 Modules/m³
Flowrate - 4600 l/min



Triple
2.6 Modules/m³
Flowrate - 6900 l/min

Notes:

Blocks must be positioned in the correct orientation.
See opposite above

SPECIFICATION (SINGLE)

Weight (maximum)	9.17kg
Crush Strength (up to)	400kN/m ²
Lateral Strength	80kN/m ²
Minimum Cover (green areas)	500mm
(trafficked areas)	650mm
Maximum Cover	3m
Material	Polypropylene
Void Ratio (Internal)	>95%

Design Requirements:

- Tank storage capacity (m³)
- Depth restrictions
- Location (Road, Car Park, Green Area)
- Design constraints on site

A set of loading calculations specific to the site requirement will be done by ESS and submitted on all tanks

DESIGN CRITERIA

The attenuation tank is constructed using matrix module blocks. These blocks can take passing loads of up to 40 tonnes/m². The void ratio of each block is 95%. The blocks are made from polypropylene.

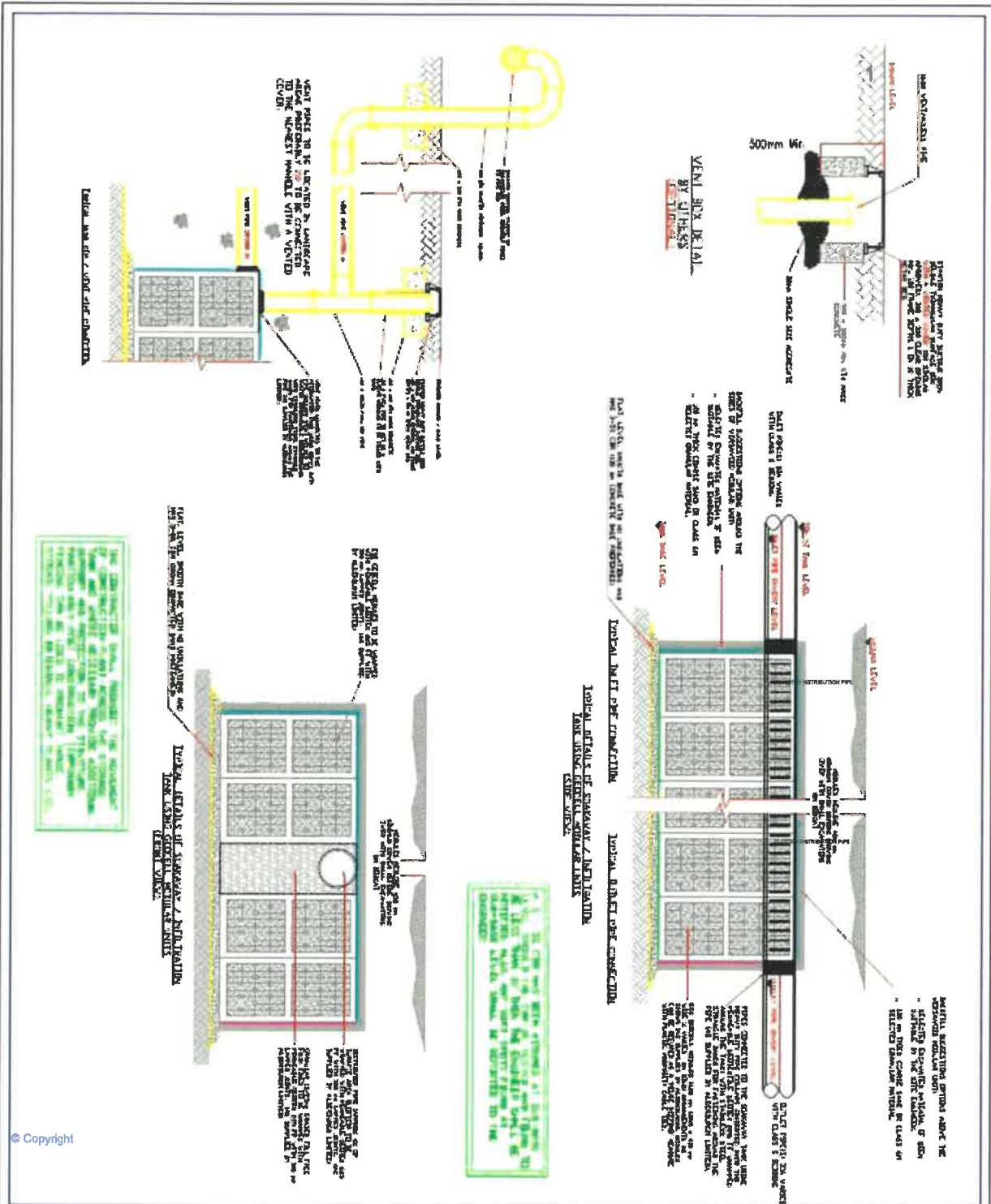
The tank is sealed with a layer of Tuflex membrane, which is fully welded together to form a 100% seal. All pipe penetrations are fully sealed to the membrane. The Tuflex membrane is protected by a layer of heavy duty protection geotextile, to prevent damage from construction or backfilling. A number of air extraction vents/flushing points are placed in the roof of the tank.

Note:

It is vital that the underground tanks are fully sealed, otherwise ground water and silt particles may enter the void space and use up capacity. Preferably, the base of the tank should be 500mm above the ground water level. Otherwise ground water relief measures should be implemented.

Infiltration System

Typical arrangement using ESS Ecological Tank System for water quality

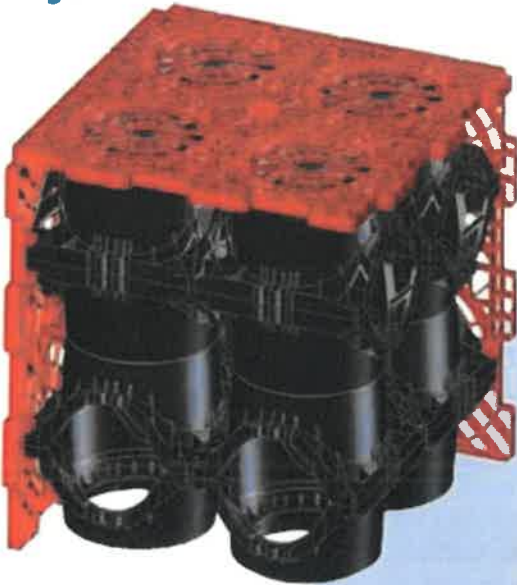


<p>1. All other... 2. ... 3. ... 4. ... 5. ... 6. ... 7. ... 8. ... 9. ... 10. ...</p>	<p>11. ... 12. ... 13. ... 14. ... 15. ... 16. ... 17. ... 18. ... 19. ... 20. ...</p>	<p>21. ... 22. ... 23. ... 24. ... 25. ... 26. ... 27. ... 28. ... 29. ... 30. ...</p>	<p>31. ... 32. ... 33. ... 34. ... 35. ... 36. ... 37. ... 38. ... 39. ... 40. ...</p>	<p>41. ... 42. ... 43. ... 44. ... 45. ... 46. ... 47. ... 48. ... 49. ... 50. ...</p>
--	--	--	--	--

Infiltration Swales & Underground Channels

Please refer to separate data sheets for the following products

Modular VersaVoid System



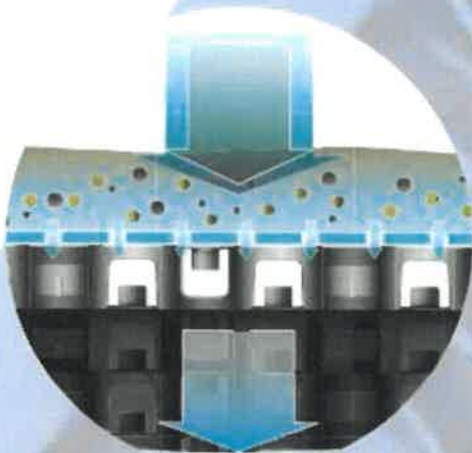
Benefits

- Ⓒ **Quick**
Reduce site access delays
- Ⓒ **Lightweight**
No cranes required
- Ⓒ **Strong**
Designed for maximum anticipated loads
- Ⓒ **Maintenance Free Tank**
All debris and sediment is pre-filtered
- Ⓒ **Determinate Volume**
One cubic metre of Tank modules contain 950 litres of water
- Ⓒ **Cost Effective**
Reduces excavation and disposal by up to 5 x compared with conventional soak wells
- Ⓒ **High Infiltration**
98% void surface area
- Ⓒ **Totally Modular**
For greatest flexibility designed to cope. Units start at 300mm deep

for shallow inverts to 3050mm+ deep in 250mm increments.

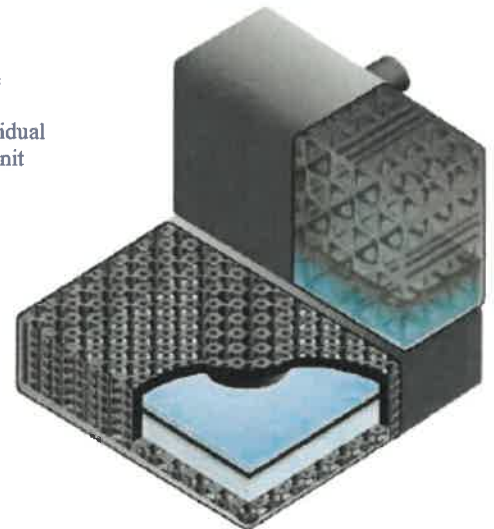
- Ⓒ **Designed by Engineers for Engineers** – to specify with confidence.
- Ⓒ **Designing out Problems** with such systems (access, maintenance, loading etc.)
- Ⓒ **Designing in Answers** to design requirements.
- Ⓒ **Total 3D Access**
For total maintenance with total confidence.
- Ⓒ **Structurally Designed** with built in safety factor to carry all loads with complete confidence.
16 clear vertical access chambers per m2.
- Ⓒ **Total Void Creation**
With the greatest strength from any modular systems.

Oil Filtration

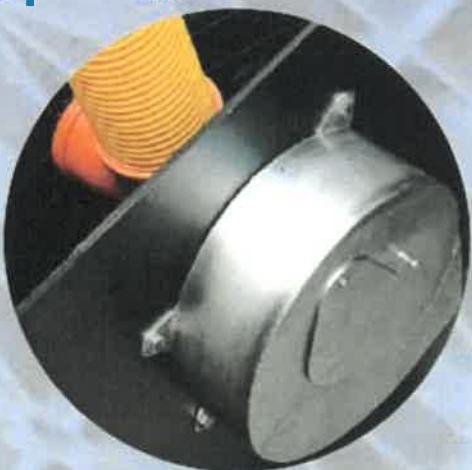


Benefits

- Ⓒ Source control designed to handle catastrophic spillages
- Ⓒ Capture, filter and break down residual hydrocarbons - all in one compact unit
- Ⓒ Self-maintaining ecosystems decompose hydrocarbon compounds and clean filters
- Ⓒ Load bearing, modular components provide up to 200t/m² loading capacity

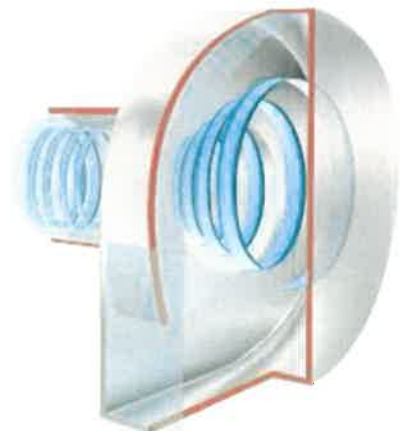


Aquabrake



Benefits

- Ⓒ **Cost Savings**
Can reduce upstream storage requirements by up to 30%.
- Ⓒ **Durability**
Corrosion resistant stainless steel.
- Ⓒ **No energy requirements**
Self-activating solution with no moving parts.
- Ⓒ **Clog Resistant**
AquaBrake design prevents blockages likely to occur in traditional orifices.
- Ⓒ **Flexible Design**
Several options for attachment available.



The ESS CombiSwale

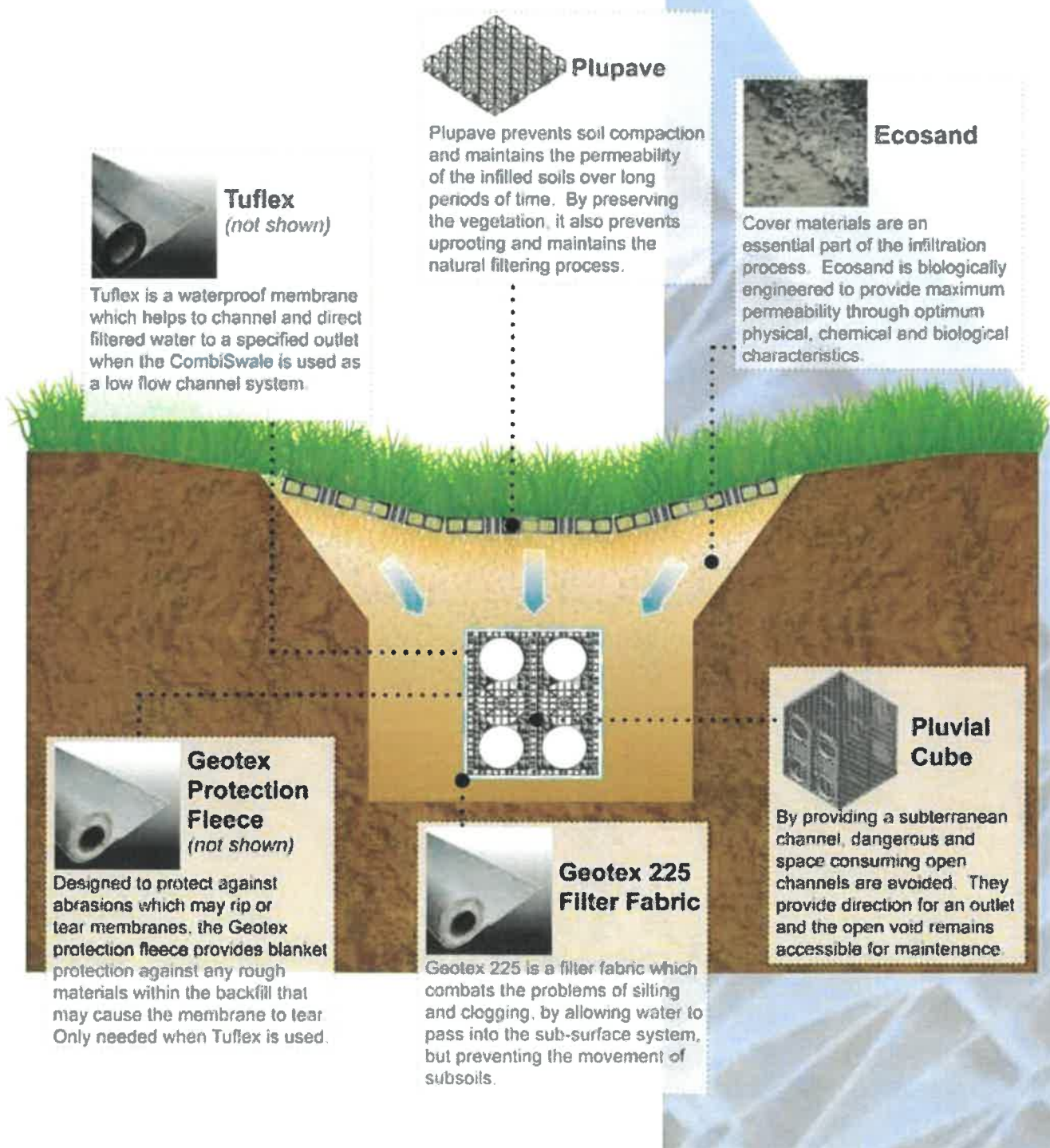
Please refer to separate data sheets for the following products

Water Sensitive Urban Channels

Surface and Sub-Surface Water Treatment

By combining surface and sub-surface channeling and treatment solutions, ESS has created the ideal in bioswale water management.

The CombiSwale system includes the addition of permeable sub-surface waterways that further restore water quality and recharge the natural environment. The sub-surface ESS channel system provides a unique way of working with nature to solve the enormous problems currently associated with open concrete channels and swales.



All products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. ESS Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products. All transactions are subject to our standard condition of sale, copies of which are available on request.

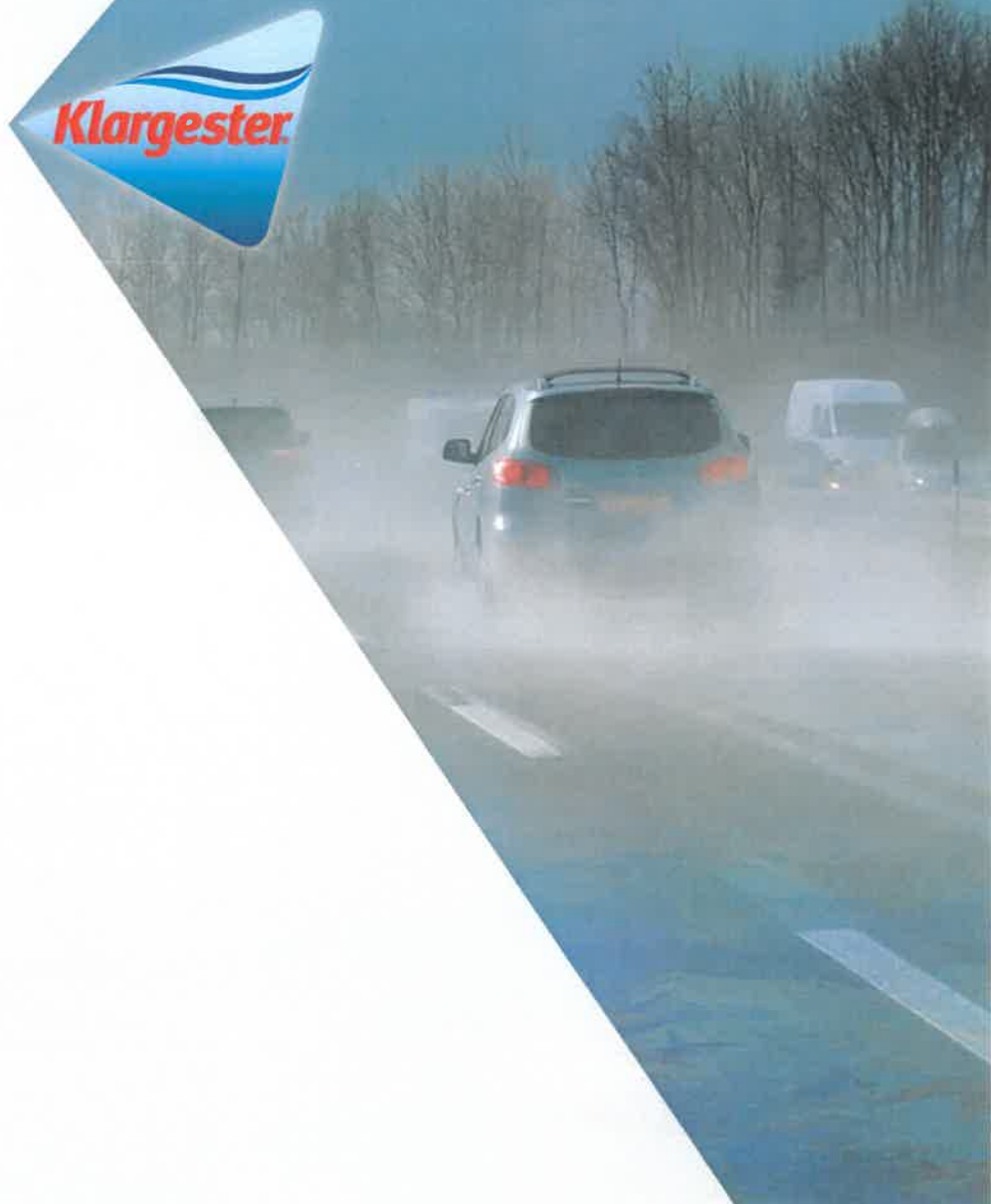


SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS
FOR PEACE OF MIND



60 YEARS OF
Expertise &
Innovation
1955-2015



Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.

helpingyou@klargester.com to make the right decision or call **028 302 66799**

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

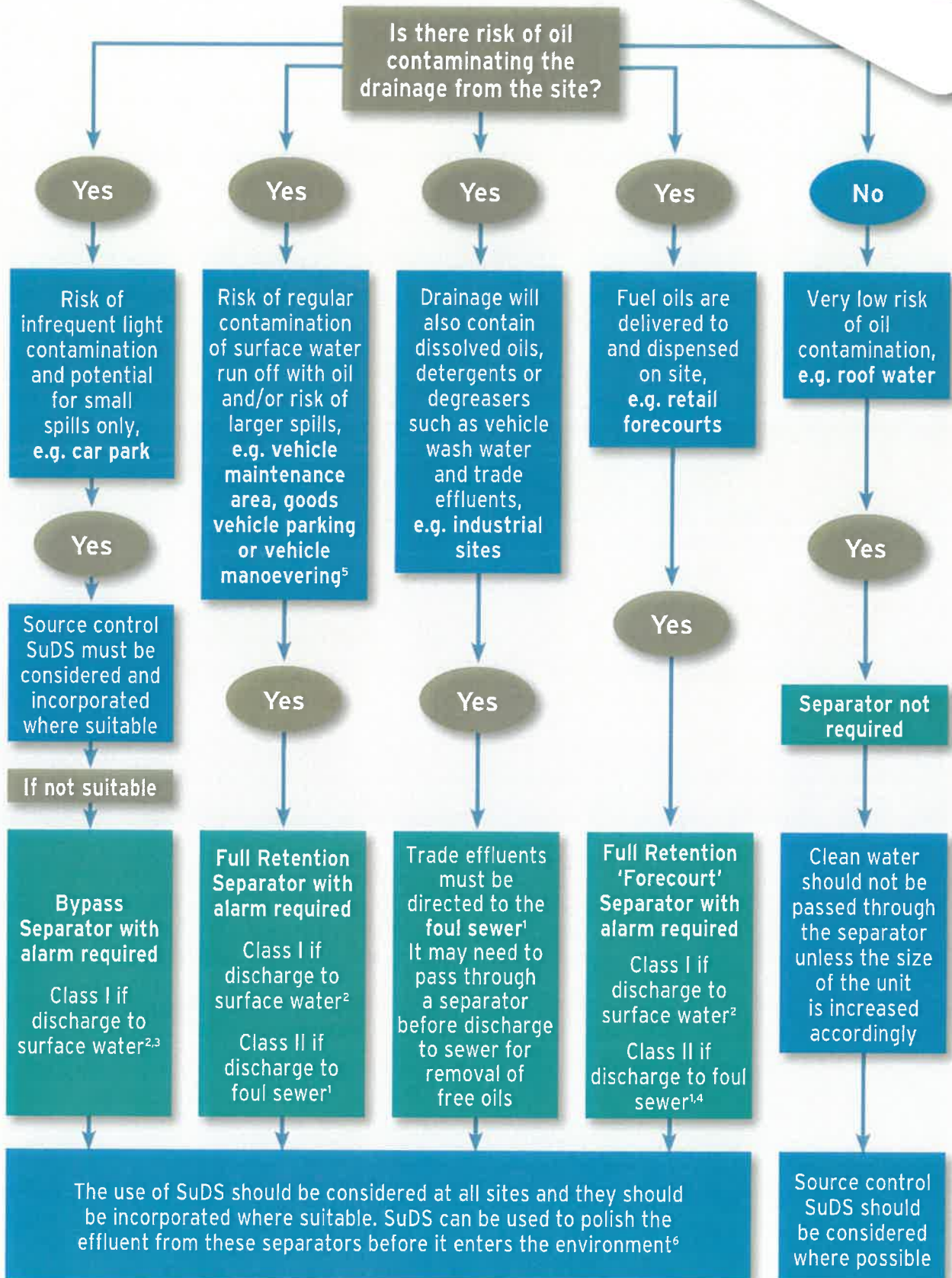
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Kingspan Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.
 2 You must seek prior permission from the relevant environmental body before you decide which separator to install.
 3 In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.
 4 In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.
 5 Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.
 6 In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.

Bypass NSB RANGE

APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

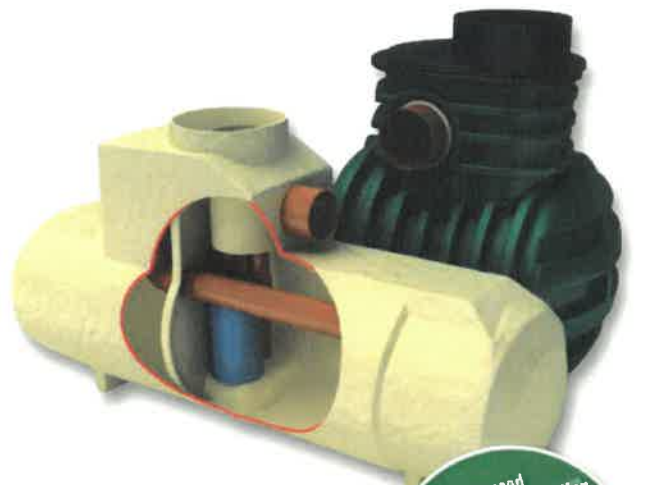
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 $NSB = 0.0018A(m^2)$. Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.



Advanced rotomoulded construction on selected models

- Compact and robust
- Require less backfill
- Tough, lightweight and easy to handle

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m ²)	STORAGE CAPACITY (litres)		UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
				SILT	OIL								
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

■ Rotomoulded chamber construction ■ GRP chamber construction * Some units have more than one access shaft – diameter of largest shown.

Full Retention NSF RANGE

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Kingspan Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer (Class I units only).
- Automatic closure device.

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.



- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size full retention separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m ²) PPG-3 (0.018)	STORAGE CAPACITY (litres)		UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
			SILT	OIL						
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

■ Rotomoulded chamber construction ■ GRP chamber construction

Washdown & Silt

APPLICATION

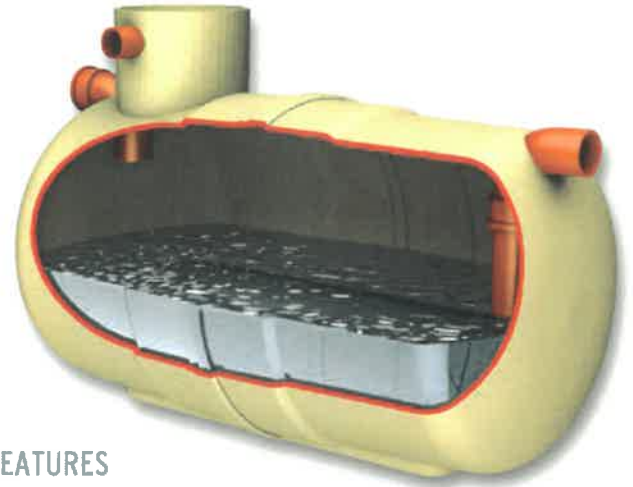
This unit can be used in areas such as car wash and other cleaning facilities that discharge directly into a foul drain, which feeds to a municipal treatment facility.

If emulsifiers are present the discharge must not be allowed to enter an NS Class I or Class II unit.

- Car wash.
- Tool hire depots.
- Truck cleansing.
- Construction compounds cleansing points.

PERFORMANCE

Such wash down facilities must not be allowed to discharge directly into surface water but must be directed to a foul connection leading to a municipal treatment works as they utilise emulsifiers, soaps and detergents, which can dissolve and disperse the oils.



FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

SIZES AND SPECIFICATIONS

REF.	TOTAL CAPACITY (litres)	MAX. REC. SILT	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)	APPROX EMPTY (kg)
W1/010	1000	500	3	1123	1225	460	1150	1100	50	500	160	60
W1/020	2000	1000	5	2074	1225	460	1150	1100	50	500	160	120
W1/030	3000	1500	8	2952	1225	460	1150	1100	50	500	160	150
W1/040	4000	2000	11	3898	1225	460	1150	1100	50	500	160	180
W1/060	6000	3000	16	4530	1440	600	1360	1310	50	500	160	320
W1/080	8000	4000	22	3200	2020	600	2005	1955	50	500	160	585
W1/100	10000	5000	27	3915	2020	600	2005	1955	50	500	160	680
W1/120	12000	6000	33	4640	2020	600	2005	1955	50	500	160	770
W1/150	15000	7500	41	5435	2075	600	1940	1890	50	500	160	965
W1/190	19000	9500	52	6865	2075	600	1940	1890	50	500	160	1200

Car Wash Silt Trap

APPLICATION

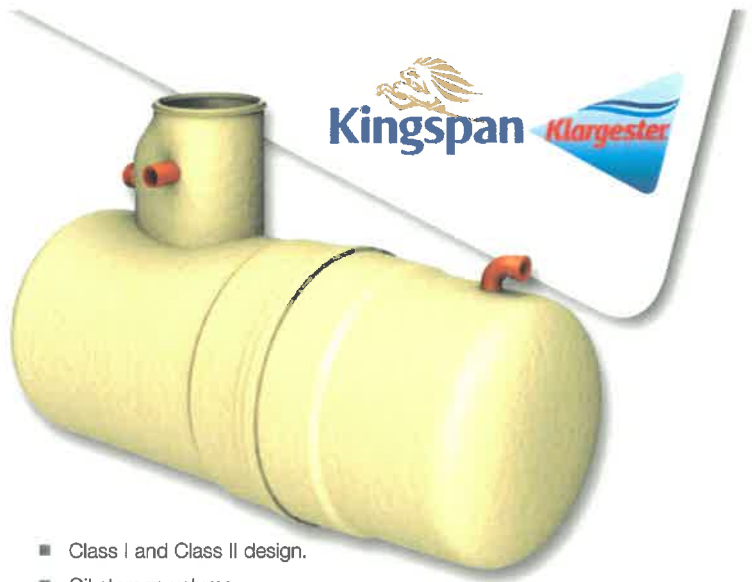
Car Wash silt trap is designed for use before a separator in car wash applications to ensure effective silt removal.

FEATURES

- FACTA Class B covers.
- Light and easy to install.
- Maintenance from ground level.



Forecourt



APPLICATION

The forecourt separator is designed for installation in petrol filling station forecourts and similar applications. The function of the separator is to intercept hydrocarbon pollutants such as petroleum and oil and prevent their entry to the drainage system, thus protecting the environment against hydrocarbon contaminated surface water run-off and gross spillage.

PERFORMANCE

Operation ensures that the flow cannot exit the unit without first passing through the coalescer assembly.

In normal operation, the forecourt separator has sufficient capacity to provide storage for separated pollutants within the main chamber, but is also able to contain up to 7,600 litres of pollutant arising from the spillage of a fuel delivery tanker compartment on the petrol forecourt. The separator has been designed to ensure that oil cannot exit the separator in the event of a major spillage, subsequently the separator should be emptied immediately.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

- Class I and Class II design.
- Oil storage volume.
- Coalescer (Class I unit only).
- Automatic closure device.
- Oil alarm system available.

INSTALLATION

The unit should be installed on a suitable concrete base slab and surrounded with concrete or pea gravel backfill. See sales drawing for installation.

If the separator is to be installed within a trafficked area, then a suitable cover slab must be designed to ensure that loads are not transmitted to the unit.

The separator should be installed and vented in accordance with Health and Safety Guidance Note HS(G)41 for filling stations, subject to Local Authority requirements.

SIZES AND SPECIFICATIONS

ENVIROREPTOR CLASS	TOTAL CAP. (litres)	DRAINAGE AREA (m ²)	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STD. FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STD. PIPEWORK (mm)	EMPTY WEIGHT (kg)
I	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
II	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
I	10000	110	20	3963	1920	600	2110	2060	50	400	200	500
II	10000	110	20	3963	1920	600	2110	2060	50	400	200	500

Alarm Systems

British European Standard EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 requires that all separators are to be fitted with an oil level alarm system and that it should be installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying.

- Easily fitted to existing tanks.
- Excellent operational range.
- Visual and audible alarm.
- Additional telemetry option.



PROFESSIONAL INSTALLERS

Kingspan Klargester Accredited Installers

Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.



Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
- Tank and drainage system installation
- Connection to discharge point and electrical networks
- Waste emptying and disposal

Discover more about the Accredited Installers and locate your local expert online.

www.kingspanenviro.com/klargester



CARE & MAINTENANCE

Kingspan Environmental Services

Who better to look after your treatment plant than the people who designed and built it?



Kingspan Environmental have a dedicated service division providing maintenance for wastewater products.

Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

To find out more about protecting your investment and ensuring peace of mind, call us on:

0844 846 0500

or visit us online:

www.kingspanenvservice.com



COMMERCIAL WASTEWATER SOLUTIONS

- **BIODISC® & ENVIROSAFE**
HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

RAINWATER SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

Klargester

UK: College Road North, Aston Clinton, Aylesbury, Buckinghamshire HP22 5EW

Tel: +44 (0) 1296 633000 Fax: +44 (0) 1296 633001 Scottish Office: Tel: +44 (0) 1355 248484
email: klargester@kingspan.com

Ireland: Unit 1a, Derryboy Road, Carnbane Business Park, Newry, Co. Down BT35 6QH

NI Tel : +44 (0) 28 302 66799 Fax: +44 (0) 28 302 60046 ROI Tel: 048 302 66799 Fax: 048 302 60046
email: klargesterinfor@kingspan.com

Visit our website www.kingspanenviro.com/klargester



In keeping with Company policy of continuing research and development and in order to offer our clients the most advanced products, Kingspan Environmental reserves the right to alter specifications and drawings without prior notice.

Issue No. 21: September 2015

hydropave™ permeable paving

guidelines for the
design & installation of
Tobermore's range of
hydropave products



permeable paving

As urban and industrial areas throughout the country have continued to expand, the total area of impermeable surfaces such as roofs, roads, pavements and car parks has increased. This means that rainfall cannot infiltrate naturally into the ground quickly enough and put our already overloaded drainage systems to an even greater test. The aging traditional drainage systems are high maintenance and no longer able to cope.



Rainwater which would normally recharge groundwater or wetlands is now washed directly into water courses via conventional drainage systems. With global warming leading to increased levels of rainfall, our ageing drainage systems are no longer able to cope with high volumes of storm water run off. This leads to flash flooding and increased pollution.

Pollution risk

During periods of dry weather heavy metals, hydrocarbons, oil, rubber and other pollutants are deposited on impermeable surfaces. When it rains these pollutants are washed into drainage systems and end up further downstream in rivers where they damage wildlife habitats.

Flooding risk

The Environment Agency report on the Autumn 2000 floods in the UK, entitled "Lessons Learned-Autumn 2000 Floods" concluded that an estimated 1.85 million homes, 185,000 commercial properties and 5 million people in the UK are now at risk from flooding.

The Environment Agency's publication "Policy and practice for the protection of floodplains" states that: "Inappropriate development within floodplains should be resisted where such development would itself be at risk from flooding or may cause flooding elsewhere." To minimise any increased surface run off, new developments must be carefully located and designed. Where appropriate, storm water source control measures, which also improve water quality, should be incorporated into the development proposal.

the benefits

The solution to flooding problems is the use of more sustainable methods of storm water drainage which take into account quantity, quality and social issues. These are now referred to as SUDS (Sustainable Urban Drainage Systems). SUDS are made up of a number of structures, which include:

- Permeable pavements
- Swales and filter strips
- Basins and wetlands
- Infiltration devices

They are more sustainable because they:

- deal with run off close to where it falls;
- manage potential flooding at its source;
- protect or enhance water quality;
- provide a habitat for wildlife in urban areas;
- protect water resources from accidental spills and pollution;
- allow new development in areas where existing sewerage systems are at full capacity, enabling new development within existing areas;
- are sympathetic to the environmental setting and the needs of the local community;
- encourage natural groundwater recharge.

The inclusion of a permeable paving surface as part of a SUDS solution will not only increase the likelihood of planning proposals being approved but may also offer the developer a 10-15% cost savings over traditional methods due to a significant reduction in drainage costs (pipes, manholes, petrol interceptors etc). Machine laying the paving blocks also reduces costs.

Water quality improvement

Permeable paving is very effective at removing pollution from runoff. The pollutants may remain on the surface or may be flushed into the underlying pavement layers where a very high percentage of the pollutants are filtered, trapped or degrade over time. Expensive petrol interceptors, which are used in traditional drainage schemes, are generally no longer required due to the natural removal of pollutants through the permeable paving sub-base. For more detailed information on water quality please refer to the *Guide to the design, construction and maintenance of concrete block permeable pavements* -

Edition 6 produced by Interpave available for download on www.paving.org.uk



Four elements of permeable paving

There are four elements which make up permeable paving:

- 1 Permeability
- 2 Detention of storm water
- 3 Pollution control
- 4 Structure

Permeability

The Hydropave range of products have permeability rates in excess of 1800 litres/sec/hectare, providing a significant safety factor on the required permeability rates of 180 litres/sec/hectare.

Detention

The sub-base thickness should be designed to detain rain falling throughout 24 hours and must provide at least 30% void space. A 4/20mm coarse open graded crushed rock to BS EN13242:2002, value of 100kN or more must be used. If the designer opts to specify alternative materials, a site trial must be undertaken to ensure that the laying course material does not invade the sub-base material.

The laying course and jointing material must be a 6.3-2mm grit to BS EN13242:2002. This has been proven in tests to perform best and will not invade the sub-base material. In ground conditions where water cannot infiltrate into the subgrade, an impermeable membrane must be laid between the subgrade and sub-base and wrapped up the sides to detain the water.

Pollution

As water flows slowly into the sub-base it collides with individual aggregate components and deposits pollutants on their surface. The large surface area of the aggregates will ensure effective filtering of the pollutants which are then broken down by natural microbial action or eventually rest at the bottom.

Structure

The specification of a permeable paving structure depends upon the hydraulic and traffic loading characteristics and upon the properties of the subgrade. Most pavements in the UK will be required to have a water detention capability rather than infiltration because of the subgrade types. It is recommended to design a permeable paving system to store rainfall occurring during 24 hours.



A (In accordance with the Green Guide to Specification, 2nd edition 2009).

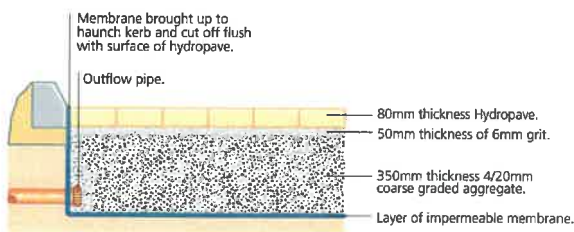
A+ (can be achieved when used with recycled sub-base, in accordance with the Green Guide to Specification, 2nd edition 2009) www.bre.co.uk

system design & installation

What types of systems are available?

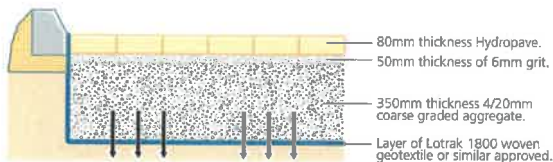
There are two common types of permeable paving systems, Attenuation and Infiltration.

Typical Attenuation System



The Attenuation system temporarily stores the water in the crushed stone beneath the paving before being slowly released back into the drainage systems. This therefore reduces the peak downstream flow from a result of heavy rainfall.

Typical Infiltration System





The Infiltration system allows the water to flow slowly through the crushed stone beneath the paving before being slowly released back into the ground through a geotextile.

What system should I use?

Tobermore can introduce you to specialist engineers, who can provide design advice for your permeable paving project.

What are the key components of a permeable paving system?

The key components of the system are the sub-base, the bedding layer, the paving blocks and the jointing grit. As long as the system has been adequately designed for the site the most important next step is to get these components right.

Paving blocks & jointing grit	Tobermore have a wide range of Hydropave blocks available and they have a permeability of 1800 litres/sec/hectare which more than meets the 180 litres/sec/hectare requirement. The blocks are jointed using a 6.3-2mm grit to BS EN7533-13:2009*.	
Bedding layer	The blocks are jointed using a 6.3-2mm grit to BS EN7533-13:2009*.	
Sub-base	A clean 4/20mm coarse graded aggregate** to BS EN13242:2002 must be used for this component. A crushed rock angular stone works best.	

* In particular, the material should be categorised as LA30, F120 and MDE20 according to table A.3 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material.

** You must ensure the grit and coarse graded aggregate are compatible. For example, if you use a finer grit it may percolate into the sub-base and may destabilise the pavement. Please refer to the following source of information – BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of permeable pavements.

design

How do I design a permeable paving system?

Please refer to the following source of information:

- BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of permeable pavements.

If you require specialist advice Tobermore can put you in contact with experienced design consultants.

Upper geotextile

An upper geotextile may be used between the sub-base and the bedding layer. Please refer to BS7533-13:2009 for further information.

What if the ground is poor or there will be significant vehicles on the paving?

Various improvement layers can be installed below the permeable paving to ensure the system can meet the structural load on the project. The engineer on the project will design these into it based on the loading category required. The two most common types of improvement layers are **Dense Bitumen Macadam (DBM)** and **Cement Stabilised Coarse Graded Aggregate (CSCGA)**.

Specifications for Dense Bitumen Macadam and Cement Stabilised Coarse Graded Aggregate can be found in BS7533-13:2009. Method statements on how to install these layers can be supplied on request.

What is the ratio required of permeable area (Hydropave) to impermeable to areas (roads, roofs etc)?

Sometimes, water from building roofs or nearby impermeable areas is fed into permeable paving. It is best to do this only in the case of attenuation systems when a typical ratio of 2:1 can be used between impermeable and permeable zones.

Note

A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN 13242:2002). In particular, the material should be categorised as LA20 according to Table 9, SZ18 according to Table 10 and MDE15 according to Table 11 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving system.

installation

How to install a permeable paving system

Please refer to the following sources of information - BS 7533-3:2005 Pavements constructed with clay, natural stone or concrete pavers. Part 3: Code of practice for laying precast concrete paving blocks and clay pavers for flexible pavements.

Sub-base: 4/20mm aggregate

After putting the required depth of stone in position, it needs to be re-orientated using either a tandem roller or a plate vibrator.

Bedding layer: 6.3-2mm laying course material

The bedding layer should be screeded over the 4/20mm.

Paving blocks

When the blocks are placed to the chosen pattern they should be plate vibrated, before the 6.3-2mm grit is brushed into the joints until they are completely filled.

Joint filling

All joints must be filled to the top with 6.3-2mm grit. Joints, which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You will need approximately 1 ton of grit for every 100m² of 80mm paving.

Note

Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints. When this type of work is being carried out, the surface of the permeable paving should be protected by an appropriate cover to protect the joints from being contaminated.

Adverse weather

Due to the superior drainage capabilities of Hydropave it is possible to install the product in more adverse weather conditions compared to standard paving.

maintenance

For optimum performance we recommend that paving is cleaned twice a year.

Initial cleaning

When an area has just been paved, allow it to settle for a few weeks. After this, you may wish to lightly hose down the paving to remove any excess dirt. The area should then be treated with a weed killer suppressant, two or three times a year as required.

General dirt

Regular sweeping to prevent the build up of detritus is recommended. Light coloured blocks, emphasise tyre marks and oil spills on the pavement. It must be accepted that these products will need more maintenance if the overall appearance is to be maintained.

A light power hose at medium pressure is generally all that is required to clean general dirt and grime. Any jointing grit which is removed must be replaced. Do not use high pressure power-washers as aggressive power-washing can damage the product surface. A trial area should be tested before large scale power-washing takes place.

Please do not use vacuum sweepers as jointing grit may be removed.

Please refer to the following sources of information - Guide to the design, construction and maintenance of concrete block permeable pavements Edition 6 produced by Interpave available for download on www.paving.org.uk

How to clean clogged joints

After several years use, joints may become clogged with detritus and it may be necessary to clean them. This can be done as follows:

- 1 Remove existing jointing grit and detritus by high pressure water jet.
- 2 Reset the pavers which will have become displaced. Replace any damaged pavers at this time since they will have been loosened.
- 3 Apply 6.3-2mm single size grit to the joints, using a stiff brush to sweep the material in ensuring joints are filled.
- 4 Finish off as above.

hydropave™ permeable paving

The Hydropave system has been developed by Tobermore in conjunction with SF-Kooperation (an international paving organisation) and John Knaption, former Professor of Structural Engineering at Newcastle University, a world authority on Permeable Block Paving systems.

The Hydropave range of products have a 6mm drainage joint which is filled with 6.3-2mm grit allowing storm water to flow through into the bedding layer and sub-base.

This 6mm drainage joint has proved, in tests carried out at The University of Newcastle, to provide a permeability of 1800 litres/sec/hectare. The joint is only required to have a permeability of 180 litres/sec/hectare* therefore the Hydropave blocks have a significant factor of safety built in to cope with any clogging which may develop over time.



Hydropave products available

Product description	Product size	Colours available	Can it be machine laid?
Hydropave Pedesta	200 x 100 x 80mm	Heather, Bracken, Brindle, Charcoal, Natural	Yes
Hydropave 240	240 x 120 x 80mm	Heather, Bracken, Brindle, Charcoal, Natural	No
Hydropave 240 ML	240 x 120 x 80mm	Heather, Bracken, Brindle, Charcoal, Natural	Yes
Hydropave Shannon Duo	208 x 173 x 60mm 173 x 173 x 60mm	Heather, Bracken, Brindle, Charcoal, Natural	No
Hydropave Sienna Duo	208x173x60mm 173x173x60mm	Silver, Sandstone, Graphite	No
Hydropave Sienna 200 ML	200x100x60mm	Silver, Sandstone, Graphite	Yes
Hydropave Tegula ML	200x100x80mm	Heather, Bracken, Slate, Charcoal, Natural, Cedar	Yes
Hydropave Tegula 240	240x120x80mm	Heather, Bracken, Slate, Charcoal, Natural, Cedar	No
Hydropave Tegula 240 ML	240x120x80mm	Heather, Bracken, Slate, Charcoal, Natural, Cedar	Yes
Hydropave Tegula Duo	208x173x60mm 173x173x60mm	Heather, Bracken, Slate, Charcoal, Natural, Cedar	No

catalogue of designs

Although a full engineering approach will be needed for virtually all pavements, Tobermore's experience suggests that the following standard solutions will be suitable in most circumstances and can therefore be used at project appraisal stage.

Note:

In the case of Attenuation designs, subgrade CBR values are equilibrium moisture content values.

In the case of Infiltration designs, subgrade CBR values are soaked values.

Capping thickness may need to be adjusted upwards to achieve a firm working platform which can sustain loads from construction traffic without deforming excessively and which can offer sufficient reaction to allow the overlying materials to be fully compacted.

All pavements must meet the requirements of BS7533 Part 3 in terms of installation.

The thicknesses of coarse graded aggregate will be suitable for the traffic conditions shown and in the case of Attenuation Designs should be sufficiently thick to meet the attenuation requirements. However, a site specific hydraulic analysis should be carried out.

In the case of Infiltration designs, there is usually no need to check hydraulic capacity but a check must be made on the infiltration capacity of the ground. The ground must be proven to accept 20mm of water in one hour which will have to be scaled up if the pavement is infiltrating water draining towards it from impermeable paving or from downpipes.

Where traffic weights exceed those commonly encountered on public highways, specialised design advice should be sought. Contact the Tobermore Sales Office.

Where light vans are included, their maximum capacity is 15kN (300cwt).

Sub-base & Capping Layers

Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrades ground stabilisation may be more cost effective. If CBR is 5% or greater then capping layers are not required. It is advised that all sites need independent inspection and assessment by a suitably qualified engineer prior to project commencement.

Loading categories

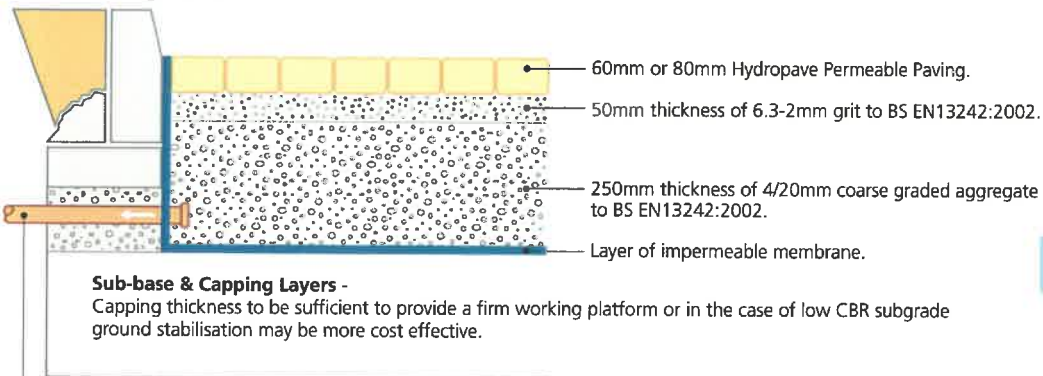
A DOMESTIC	B CAR PARKING	C PEDESTRIAN	D SHOPPING	E COMMERCIAL	F HEAVY TRAFFIC
No large goods vehicles	Emergency large goods vehicles only	One large goods vehicle per week	Ten large goods vehicles per week	100 large goods vehicles per week	1000 large goods vehicles per week
Zero standard axies	100 standard axies	0.015msa	0.15msa	1.5msa	15msa
Patio	Car parking bays and aisles	Town/city pedestrian street	Retail development delivery access route	Industrial premises	Main Road
Private drive	Railway station platform	Nursery access	School/college access road	Lightly trafficked public road	Distribution centre
Decorative feature	External car showroom	Parking area to residential development	Office block delivery route	Light industrial development	Bus station (bus every 5 minutes)
Enclosed playground	Sports stadium pedestrian route	Garden centre external display area	Deliveries to small residential development	Mixed retail/ industrial development	Motorway truck stop
Footway with zero vehicle overrun	Footway with occasional overrun	Cemetery Crematorium	Garden centre delivery route	Town square	Bus stop
	Private drive/ footway crossover	Motel parking	Fire station yard	Footway with regular overrun	Roundabout
		Airport car park with no bus pick-up	Airport car park with bus terminal	Airport landside roads	Bus lane
		Sports centre	Sports stadium access route/forecourt		
Dense Bitumen Macadam (DBM) alternative to cement stabilised coarse graded aggregate					
zero cement bound	zero cement bound	125mm cement bound	150mm cement bound	200mm cement bound CGA	300mm cement bound CGA
zero DBM50	zero DBM50	70mm DBM50	100mm DBM50	130mm DBM35	200mm DBM35

MSA = millions of standard 8,000kg axles

attenuation designs

LOADING CATEGORY A 1-5%CBR

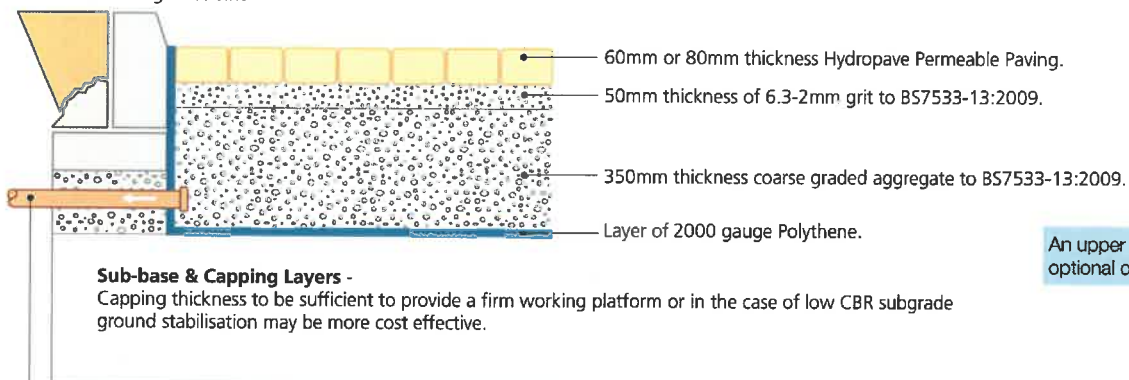
Conventional edge restraint



Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

LOADING CATEGORY B 1-5%CBR

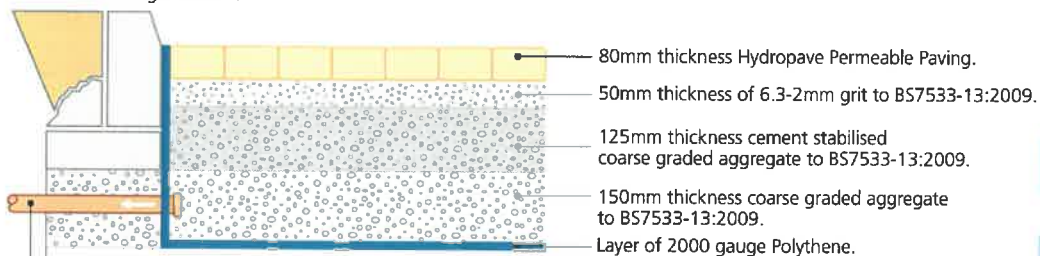
Conventional edge restraint



Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

LOADING CATEGORY C 1-5%CBR

Conventional edge restraint

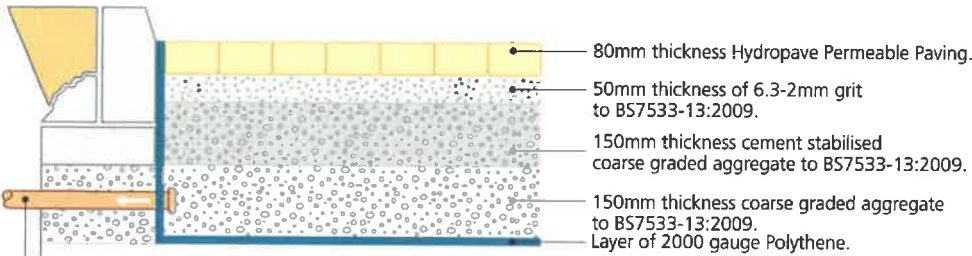


Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

For DBM alternative refer to loading category table on page 5

LOADING CATEGORY D 1-5%CBR

Conventional edge restraint



Sub-base & Capping Layers -

Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

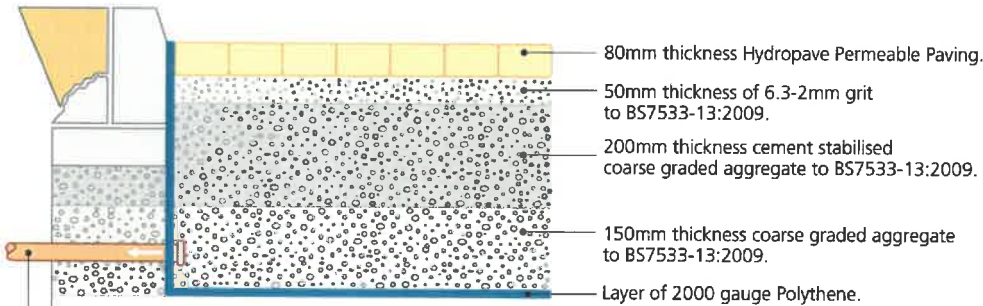
Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

An upper geotextile is optional on this design.

For DBM alternative refer to loading category table on page 5

LOADING CATEGORY E 1-5%CBR

Conventional edge restraint



Sub-base & Capping Layers -

Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

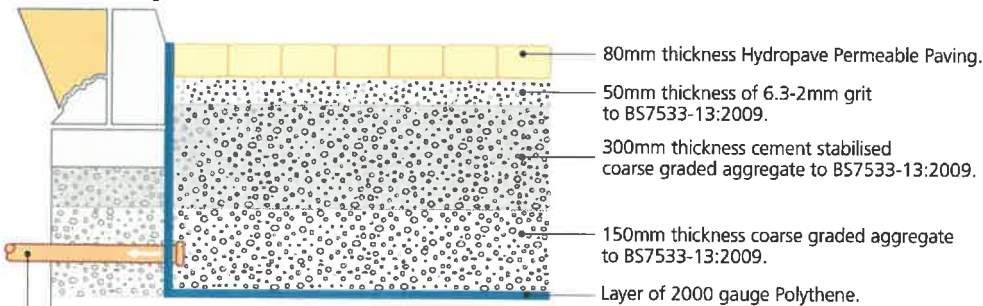
Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

An upper geotextile is optional on this design.

For DBM alternative refer to loading category table on page 5

LOADING CATEGORY F 1-5%CBR

Conventional edge restraint



Sub-base & Capping Layers -

Capping thickness to be sufficient to provide a firm working platform or in the case of low CBR subgrade ground stabilisation may be more cost effective.

Outflow pipe - diameter according to project requirements (with perforated End Cap to prevent blockage of the pipe and a Top Hat Seal is used to achieve a water tight connection)

An upper geotextile is optional on this design.

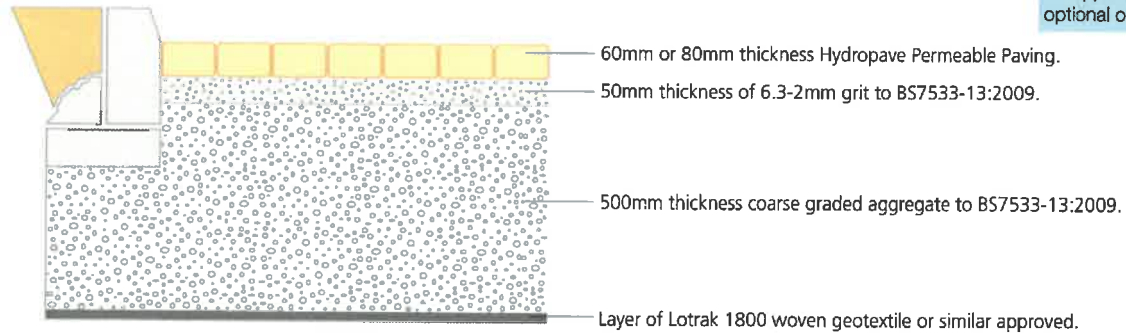
For DBM alternative refer to loading category table on page 5

infiltration designs

NOTE : 1 & 2 % CBR - ground not suitable

LOADING CATEGORY B 3 & 4% CBR

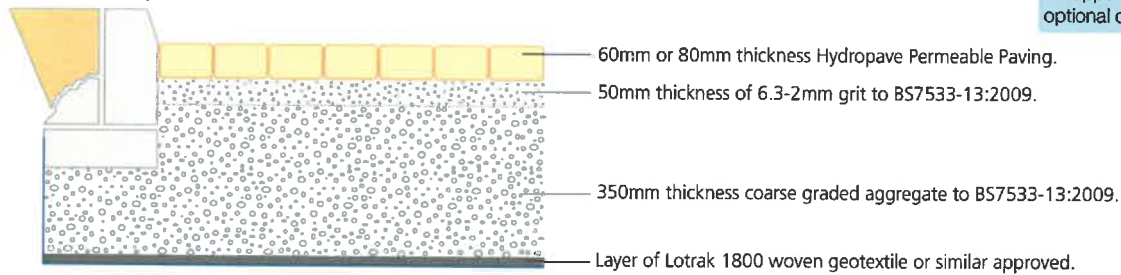
Conventional edge restraint



An upper geotextile is optional on this design.

LOADING CATEGORY B 5% CBR

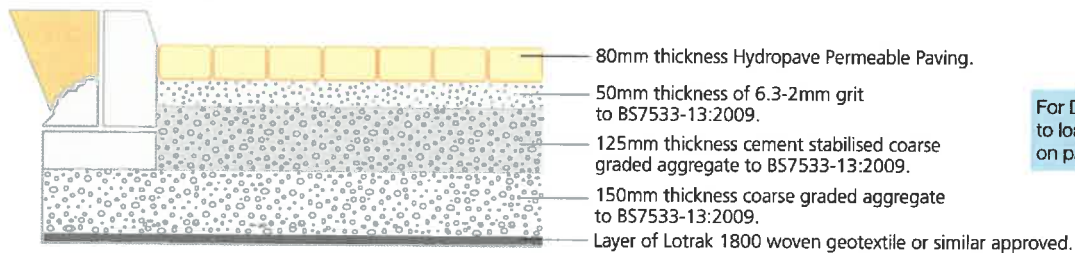
Conventional edge restraint



An upper geotextile is optional on this design.

LOADING CATEGORY C 5% CBR

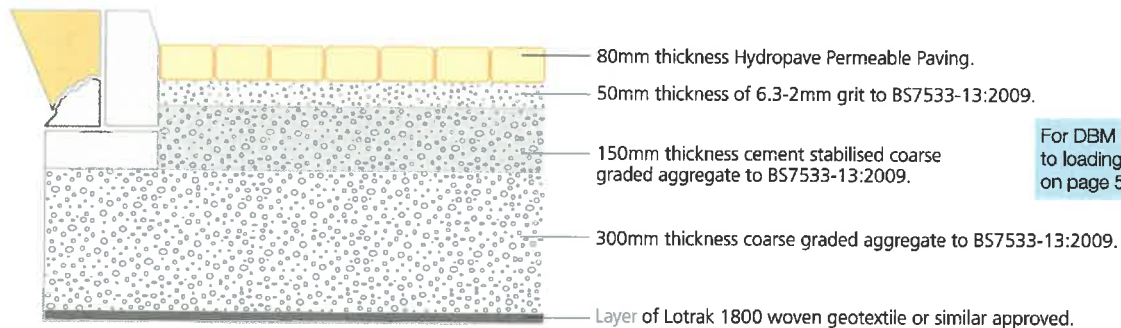
Conventional edge restraint



For DBM alternative refer to loading category table on page 5

LOADING CATEGORY D 3 & 4% CBR

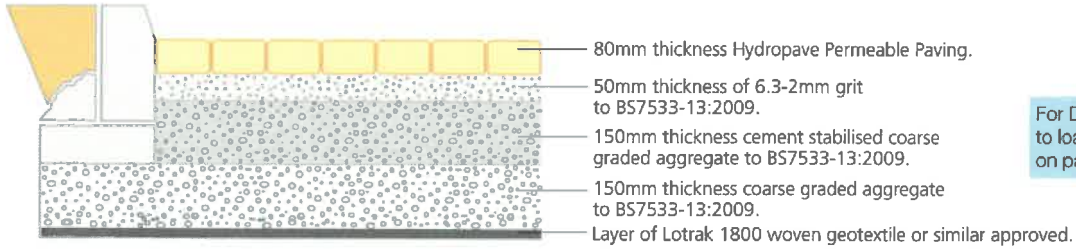
Conventional edge restraint



For DBM alternative refer to loading category table on page 5

LOADING CATEGORY D 5% CBR

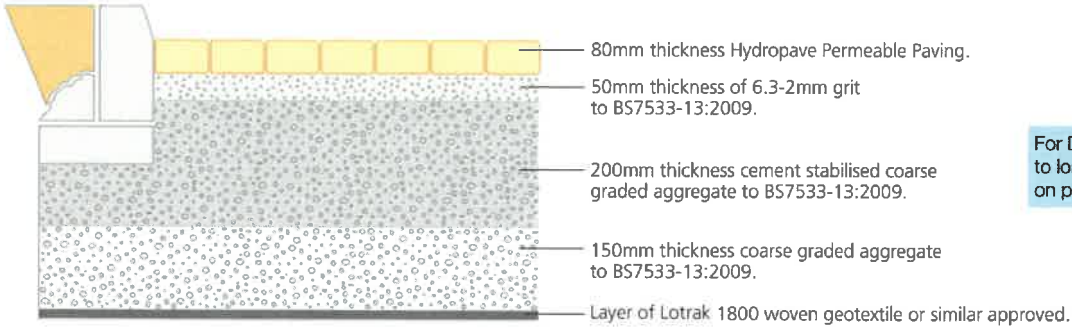
Conventional edge restraint



For DBM alternative refer to loading category table on page 5

LOADING CATEGORY E 5% CBR

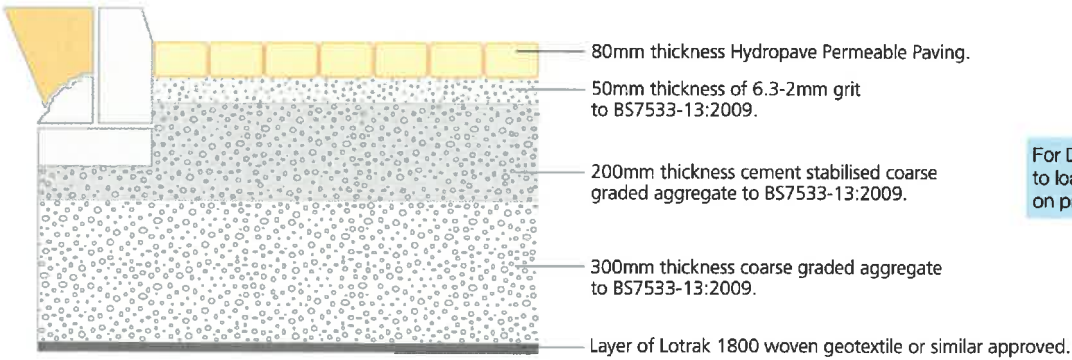
Conventional edge restraint



For DBM alternative refer to loading category table on page 5

LOADING CATEGORY F 3 & 4% CBR

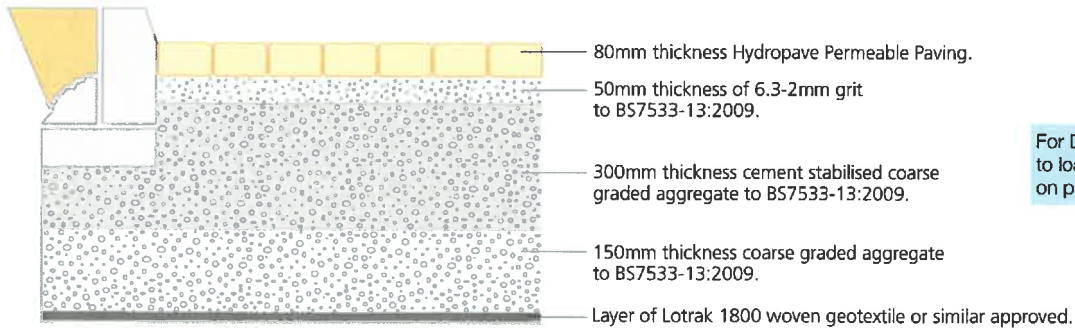
Conventional edge restraint



For DBM alternative refer to loading category table on page 5

LOADING CATEGORY F 5% CBR

Conventional edge restraint

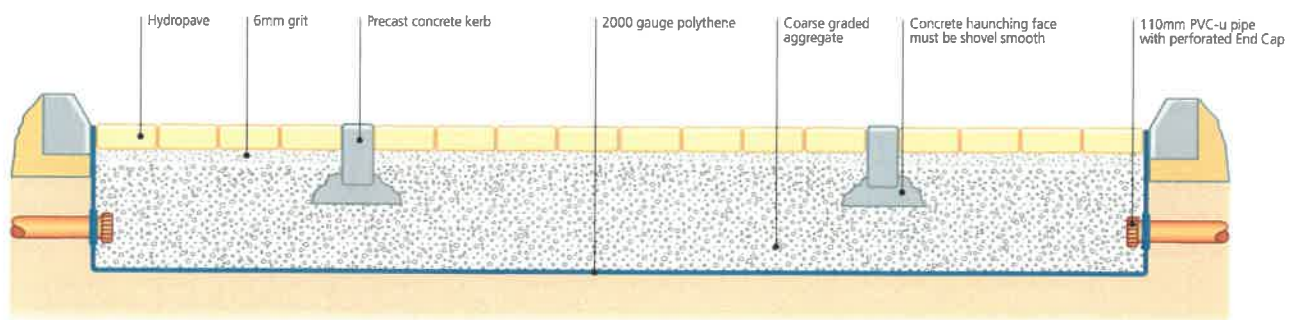


For DBM alternative refer to loading category table on page 5

road attenuation designs

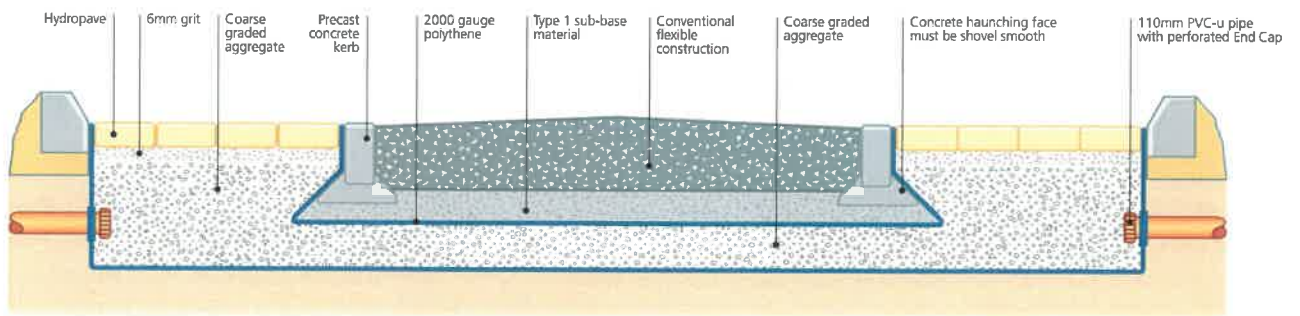
There is no specific provision for the adoption of SUDS techniques such as permeable pavements. Existing legislation, such as Section 38 of the Highways Act, 1980 and Section 106 of the Town and Country Planning Act, 1990, can provide a mechanism for their adoption in some cases. Whatever route is taken it is recommended that early consultation be undertaken with the relevant stakeholders to ensure responsibilities for long term maintenance are agreed. Further information can be found in BS7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of permeable pavements.

HYDROPAVE ROAD ATTENUATION SYSTEM



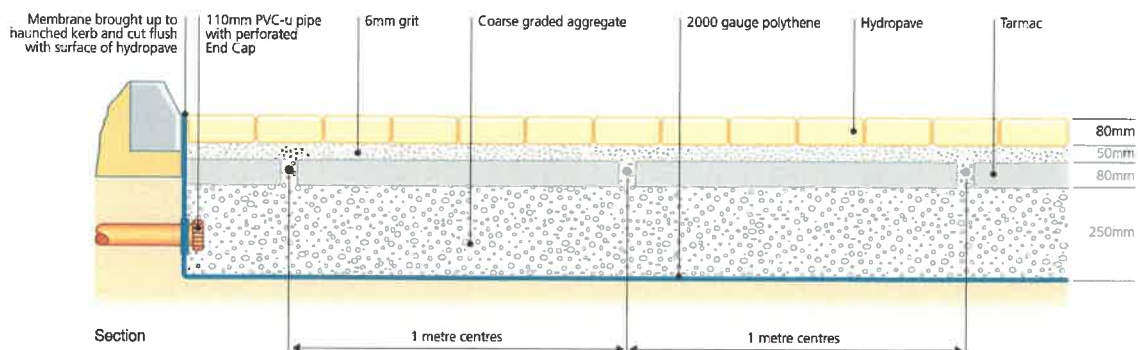
Section

HYDROPAVE ROAD ATTENUATION SYSTEM



Section

HYDROPAVE ROAD ADOPTION/TEMPORARY RUNNING SERVICE

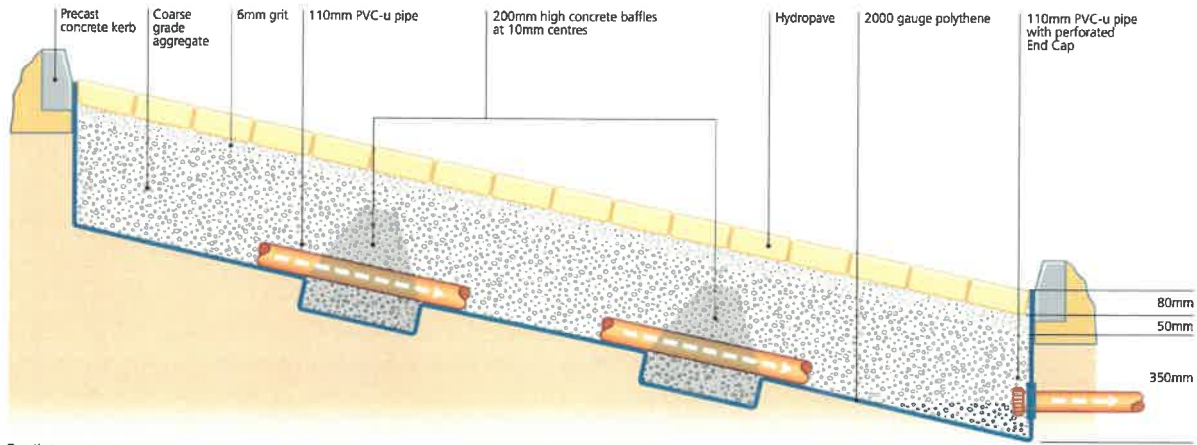


Section

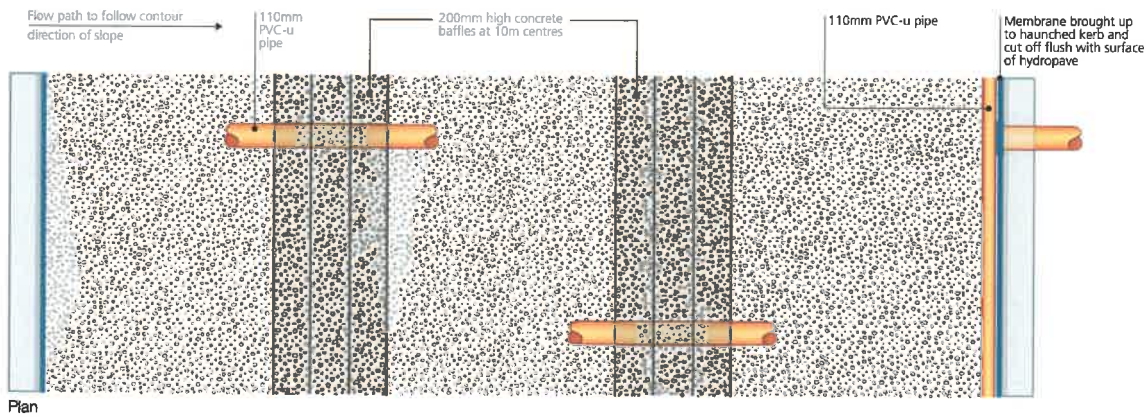
sloping site designs

Lateral restrains are recommended on sloping sites greater than 1 in 20

SLOPING SITES ATTENUATION SYSTEM

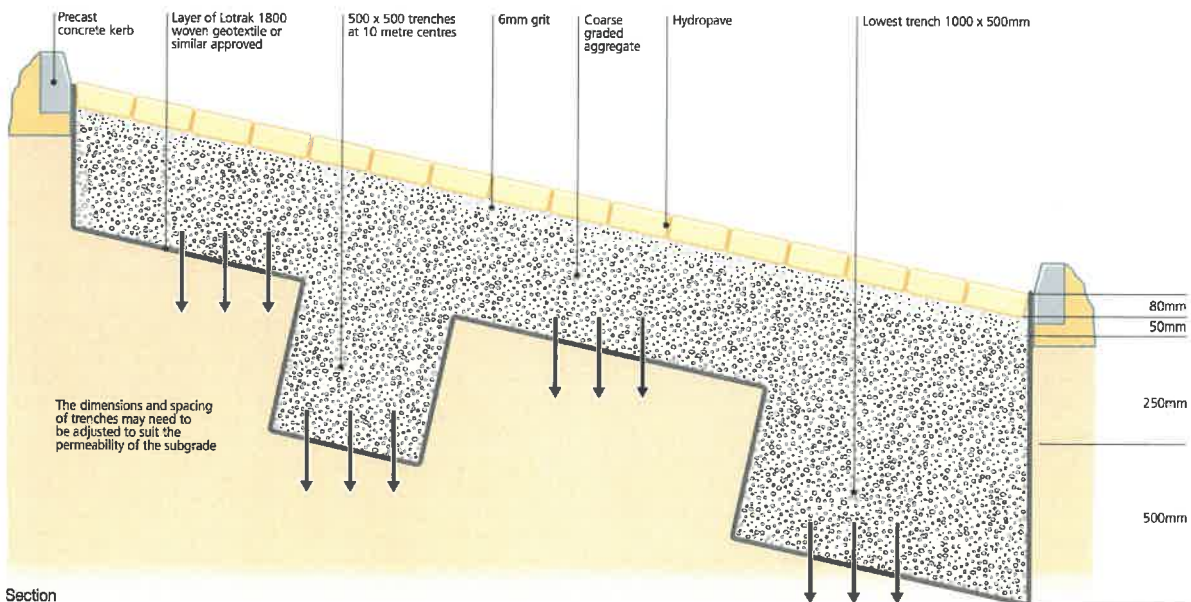


Section



Plan

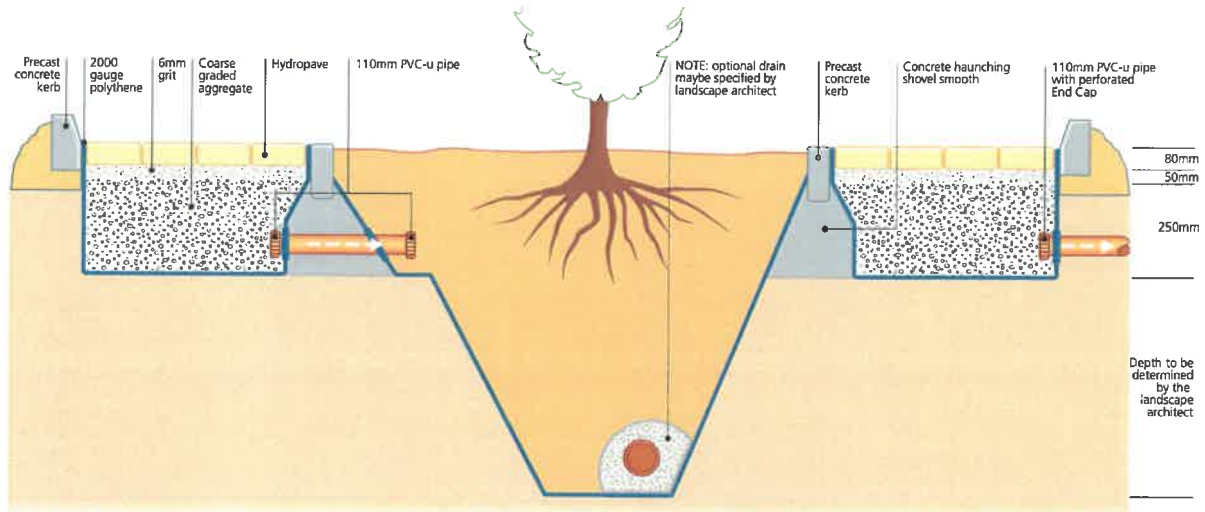
SLOPING SITES INFILTRATION SYSTEM



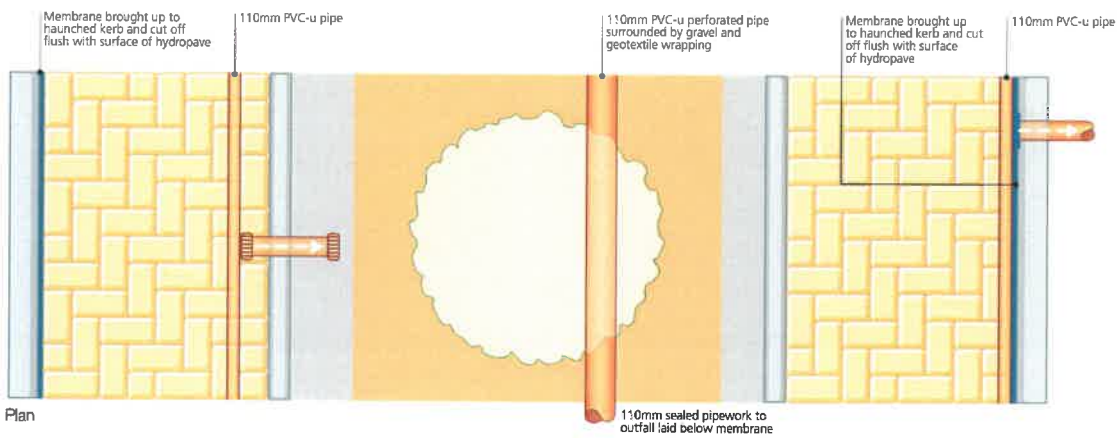
Section

tree planting designs

TREE PLANTING ATTENUATION SYSTEM

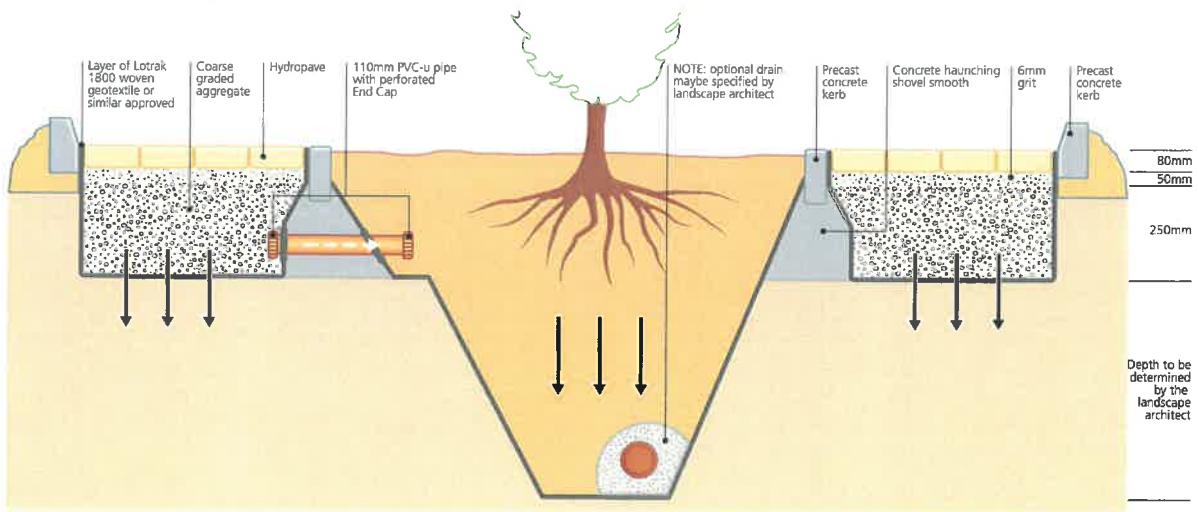


Section



Plan

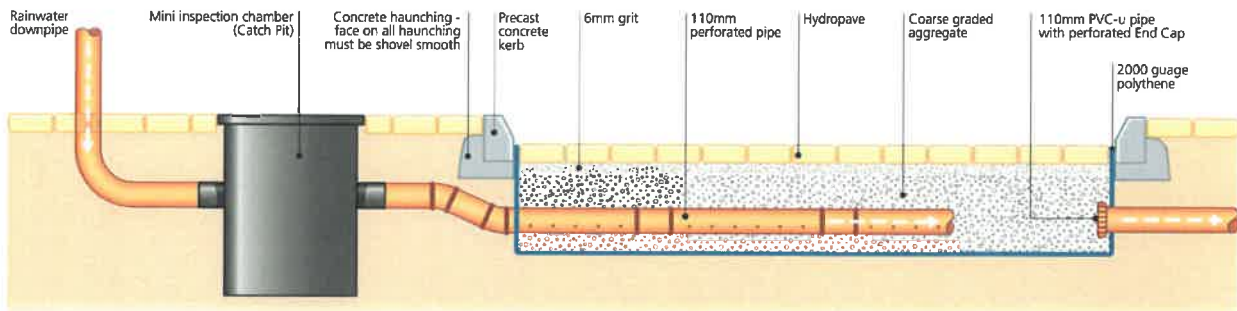
TREE PLANTING INFILTRATION SYSTEM



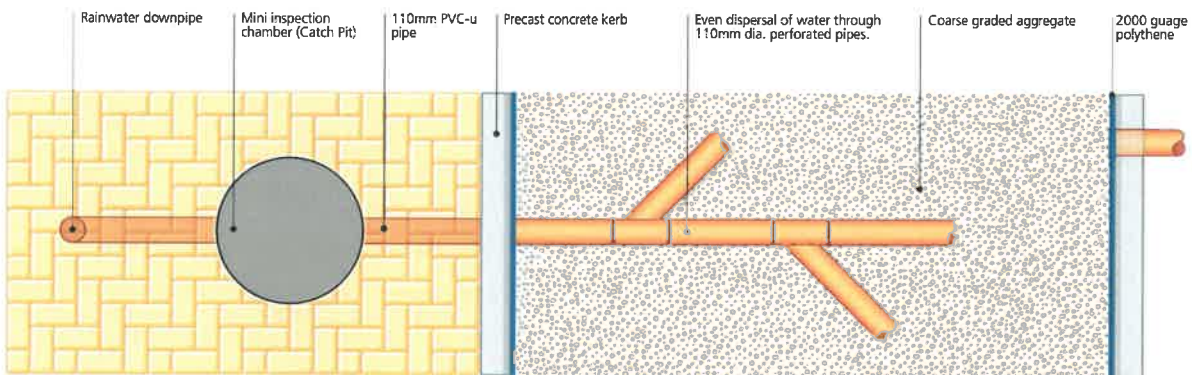
Section

rainwater downpipe designs

DOWNPIPE DRAINAGE INTO ATTENUATION SYSTEM

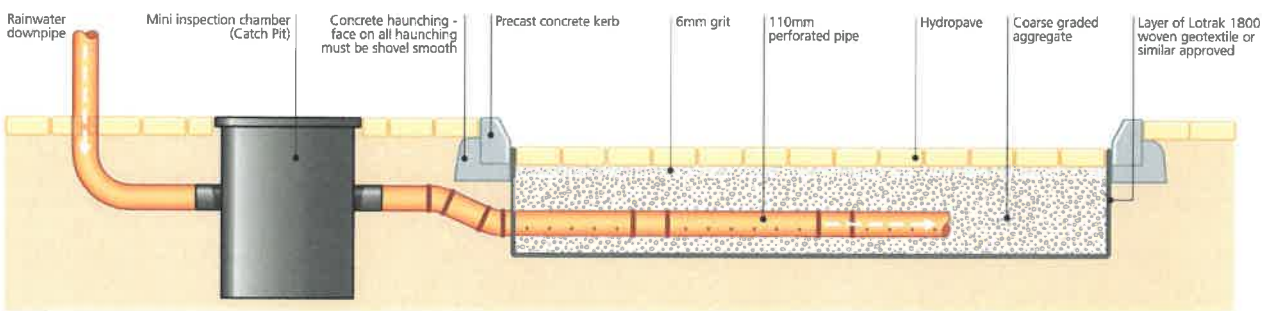


Section

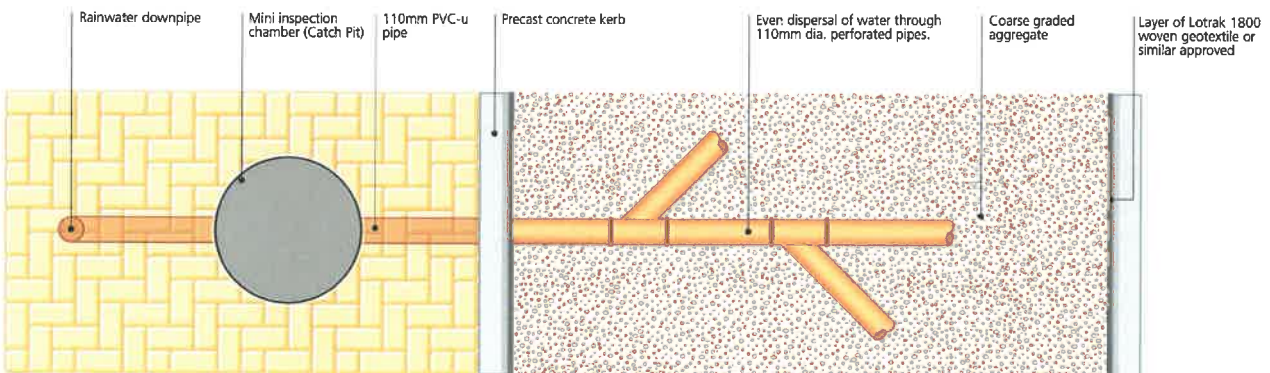


Plan

DOWNPIPE DRAINAGE INTO INFILTRATION SYSTEM



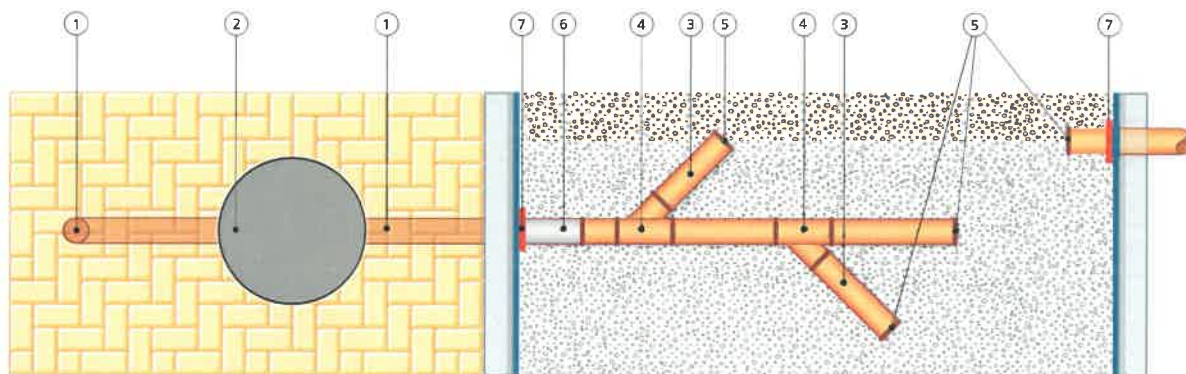
Section










Plan

permeable paving utility items

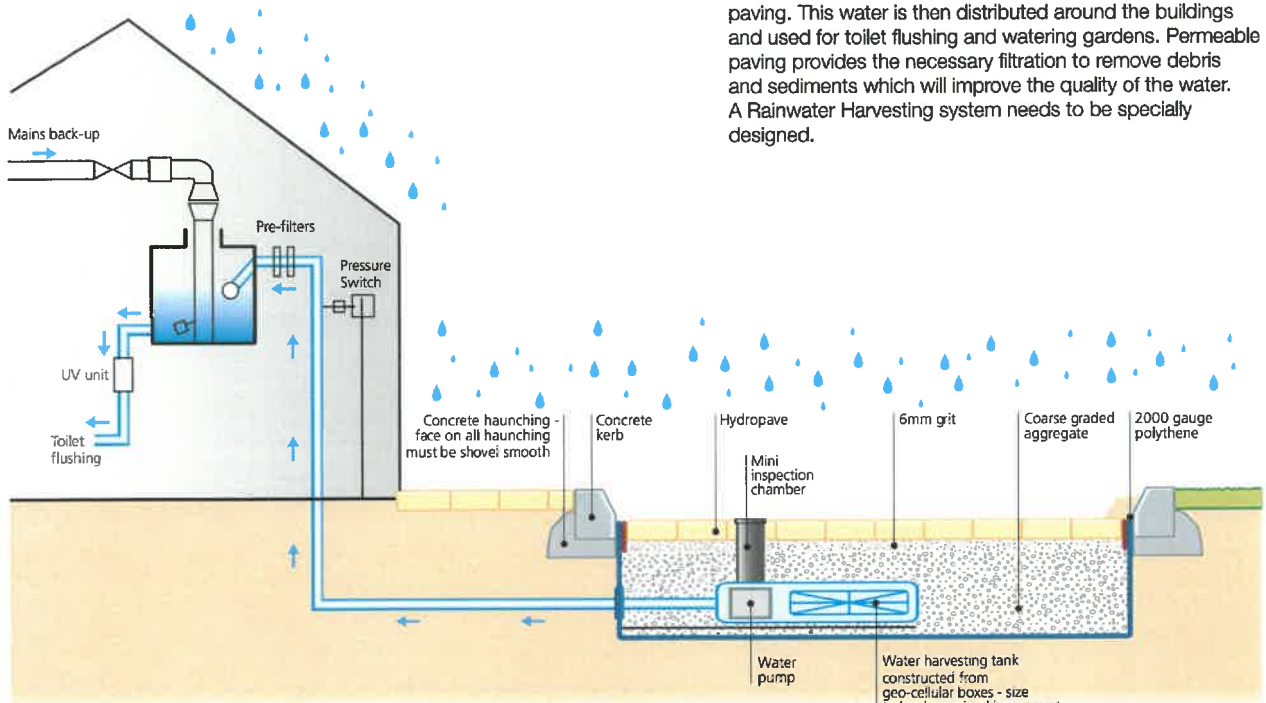
We have detailed a list of utility items that may be required on certain permeable paving schemes. In this example we have used products and codes from Polypipe, however, other equal or approved items can be used.



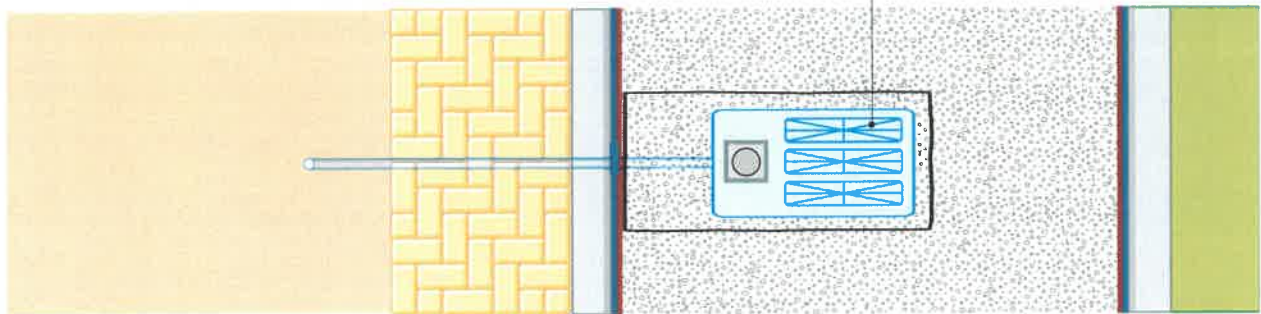
1		'UNIVERSAL' 110mm diameter UPVC SW pipe	available from all builders merchants
2		450mm diameter mini inspection chamber 'Catch Pit' with plastic lid	Polypipe reference code: CP450TOB
3		100mm diameter Perforated Ridge Drain	Polypipe reference code: RD100X6PEP
4		100mm diameter Perforated Ridge Drain - 45o Junction	Polypipe reference code: JRD100100Y
5		100mm diameter External End Cap - perforate on-site using 6mm drill	Polypipe reference code: EC1059INT
6		110/100mm diameter Adaptor	Polypipe reference code: ARD100110
7		110mm Top Hat Seal Joint (Butyl Tape is used to seal the Top Hat to the polythene)	www.radon.co.uk

water harvesting design

Tobermore Hydropave products can also successfully be used in rainwater harvesting projects. Rainwater harvesting is a system where the rainwater from roofs and hard surfaces is collected through geo-cellular boxes under the paving. This water is then distributed around the buildings and used for toilet flushing and watering gardens. Permeable paving provides the necessary filtration to remove debris and sediments which will improve the quality of the water. A Rainwater Harvesting system needs to be specially designed.



Section



Plan

hydropave design form



Job Title: _____

Location: _____

Client: _____

Architect: _____

Engineer: _____

Type of contract: _____

Type of system: Attenuation Infiltration Rain water harvesting

Area to be hydropaved: _____ Area of surface/roof to be drained: _____

Site discharge rate in litres per second: _____ CBR value: _____

Drawing attached to include levels and drainage: Yes No

Site investigation report attached: Yes No

Overrun category (see table below): 1 2 3 4 5 6

Special requirements/notes: _____

A DOMESTIC	B CAR PARKING	C PEDESTRIAN	D SHOPPING	E COMMERCIAL	F HEAVY TRAFFIC
No large goods vehicles	Emergency large goods vehicles only	One large goods vehicle per week	Ten large goods vehicles per week	100 large goods vehicles per week	1000 large goods vehicles per week
Zero standard axes	100 standard axes	0.015msa	0.15msa	1.5msa	15msa
Patio	Car parking bays and aisles	Town/city pedestrian street	Retail development delivery access route	Industrial premises	Main Road
Private drive	Railway station platform	Nursery access	School/college access road	Lightly trafficked public road	Distribution centre
Decorative feature	External car showroom	Parking area to residential development	Office block delivery route	Light industrial development	Bus station (bus every 5 minutes)
Enclosed playground	Sports stadium pedestrian route	Garden centre external display area	Deliveries to small residential development	Mixed retail/ industrial development	Motorway truck stop
Footway with zero vehicle overrun	Footway with occasional overrun	Cemetery Crematorium	Garden centre delivery route	Town square	Bus stop
	Private drive/ footway crossover	Motel parking	Fire station yard	Footway with regular overrun	Roundabout
		Airport car park with no bus pick-up	Airport car park with bus terminal	Airport landside roads	Bus lane
		Sports centre	Sports stadium access route/forecourt		

MSA = millions of standard 8,000kg axles

Signature _____

Date _____

disclaimers

Instructions and warnings

The following Warnings & Instructions relate to the Hydropave System product ("Product") supplied by Tobermore Concrete Products Limited ("Tobermore"), and are set out here to inform prior to the placing of any Product Order. For the avoidance of doubt, these Warnings & Instructions do not vary or amend Tobermore's Terms & Conditions of Sale for the Product ("Terms & Conditions of Sale") to which any Product order shall be subject. In the event of conflict or ambiguity between any provision of these Warnings & Instructions and any provision of the Terms & Conditions of Sale, the provision of the Terms & Conditions of Sale shall prevail.

Technical information

Tobermore excludes liability for any loss or damage resulting from any inaccuracy or insufficiency in the information or specification(s) supplied to Tobermore to enable it to provide any technical information in relation to the Product.

Any technical information provided by Tobermore in relation to the Product (whether before or after Product order) is provided by way of GUIDANCE ONLY and, as permitted by law, without liability on the part of Tobermore for any loss or damage suffered as a result of relying upon it. Such technical information is not to be relied upon in substitution for obtaining independent expert advice, prior to using the Product, from both a suitably qualified engineer and building contractor, in particular, as to the suitability of the Product and its design for both the intended site and the project plan to develop that site.

Product

The Product should be carefully inspected for defects or damage upon delivery and prior to being laid or fitted. As permitted by law, Tobermore excludes liability for both the replacement costs and/or delay suffered as a result of having laid or fitted defective or damaged Product.

Installation

In frequently trafficked areas Hydropave should be laid in a Herringbone pattern. Refer to BS 7533-3:2005.

Product information

Design and development of the Product is a continuing process, and Product information is subject to change by Tobermore without notice. Accordingly, please refer to any of Tobermore's Paving & Walling Centres or offices to ensure that the Product information under review represents the most up-to-date Product information.

Colours - Pigments & illustrations

Whilst Tobermore endeavours, by using iron oxide pigments, to produce products with excellent density and durability to ensure colour retention, as with all concrete products, the Product may suffer from colour variation and/or weathering. Tobermore excludes liability for any such colour variation and/or weathering.

Any colour illustrations of the Product shown in this brochure are as accurate as the printing process at the time of printing allowed. For a more accurate colour match, please refer to actual Product samples available from any of Tobermore's Paving & Walling Centres.

Although every effort is made to ensure consistency of product colour, variations between production batches can occur. We therefore recommend that, when purchasing materials, especially in larger quantities, they all come from the same batch and that products are thoroughly mixed on site by drawing from a minimum of three packs. Tobermore cannot accept responsibility for this. The colour of new paving blocks will inevitably vary compared to older paving blocks, which have been laid for a period of time. Tobermore cannot accept responsibility for this.

Laying of multi-blend coloured bricks

To achieve an even blend of colour when laying multi-blend bricks, it is desirable to mix the bricks from three or four different pallets.

It can be expected that colours may not be as pleasing or as well blended with machine laid product due to the manufacturing and laying process. Lines are not expected to be as straight with Hydropave compared to conventional paving due to the permeable joint.

When paving bricks are laid they sometimes have minor scuffs or bruises, caused mainly by the laying and plate vibrating process. In our experience these marks usually weather off through time. Tobermore cannot accept responsibility for this.

Efflorescence

Efflorescence is a white crystalline deposit that occurs naturally on the surface of masonry materials. If it occurs, efflorescence may mask the colour of the Product for a period of time, but tends to be gradually washed away by rain. Tobermore excludes liability for the occurrence of efflorescence.

Ordering

To avoid waste, you should get your contractor to measure the area accurately on site, before ordering material as we often find that dimensions taken from a project plan can vary significantly from the final layout. (See also under Colours)

Returns

Please note that Tobermore do not accept returns on any materials.

Queries & complaints

Please contact one of Tobermore's Paving & Walling Centres or offices with any queries and/or complaints. Any complaints must be notified to Tobermore without delay.

Manufacturing standards

All Tobermore products are manufactured to meet or exceed British and European Standards. Tobermore use an Integrated Management System for Quality, Health & Safety and Environmental issues.

Quality systems

Tobermore are a registered BS EN ISO 9001:2000 and BS EN 14001 company.



Tobermore (Head Office)

2 Lisnamuck Road, Tobermore
County L'derry BT45 5QF

Email: sales@tobermore.co.uk
Fax: 028 7964 4145

Tobermore Sales

028 7964 2411

Bangor

The Dickson Home & Garden Complex
79 Cootehall Road, Bangor, County Down BT19 1UP

Email: bangoroffice@tobermore.co.uk
Fax: 028 9185 2596

Bangor Sales

028 9185 2545

Dublin

Blakes Cross, Lusk
County Dublin

Email: dublinoffice@tobermore.ie
Fax: 01 8437750

Dublin Sales

01 8437440

Cork

Mill Road, Irishtown
Cross, Bandon, County Cork

Email: corkoffice@tobermore.ie
Fax: 023 8843047

Cork Sales

023 8843046

GB Sales

0844 800 5736

www.tobermore.co.uk

