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Agrément Certificate
14/5099
Product Sheet 1

ACO STORMWATER MANAGEMENT SYSTEMS

ACO STORMBRIXX STORMWATER MANAGEMENT SYSTEM

This Agrément Certificate Product Sheet⁽¹⁾ relates to the ACO StormBrixx Stormwater Management System, comprising black polypropylene modular units for use as below-ground water storage or as a soakaway to manage run-off from impermeable surfaces.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Hydraulic design — data is provided in this Certificate to assist in the design of a below-ground stormwater management system (see section 6).

Structural performance — the system has adequate strength and stiffness to resist short- and long-term loading when designed in accordance with this Certificate (see section 7).

Maintenance — data is provided to assist in planning the maintenance of a completed system installation (see section 11).

Durability — the system will have a service life of up to 60 years when installed in accordance with this Certificate (see section 12).



The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Handwritten signature of Brian Chamberlain in black ink.

Brian Chamberlain
Head of Technical Excellence

Handwritten signature of Claire Curtis-Thomas in black ink.

Claire Curtis-Thomas
Chief Executive

Date of Second issue: 20 June 2017

Originally certificated on 3 April 2014

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, the ACO StormBrixx Stormwater Management System, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	H3(3)	Rainwater drainage
Comment:		The system can be used in a construction to satisfy this Requirement. See sections 6.1 to 6.11 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The system components are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Durability, workmanship and fitness of materials
Comment:		The system can contribute to satisfying this Regulation. See sections 11 and 12 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	3.6	Surface water drainage
Comment:		The system components can contribute to a construction satisfying this Standard, with reference to clauses 3.6.1 ⁽¹⁾⁽²⁾ to 3.6.5 ⁽¹⁾⁽²⁾ . See sections 6.1 to 6.11 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the system under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	23(a)(i)(iii)(b)	Fitness of materials and workmanship
Comment:		The system components are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.
Regulation:	82	Rainwater drainage
Comment:		The system can be used in a construction to satisfy this Regulation. See sections 6.1 to 6.11 of this Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 1 *Description* (1.3), 3 *Delivery and site handling* (3.3 and 3.5) and the *Installation* part of this Certificate.

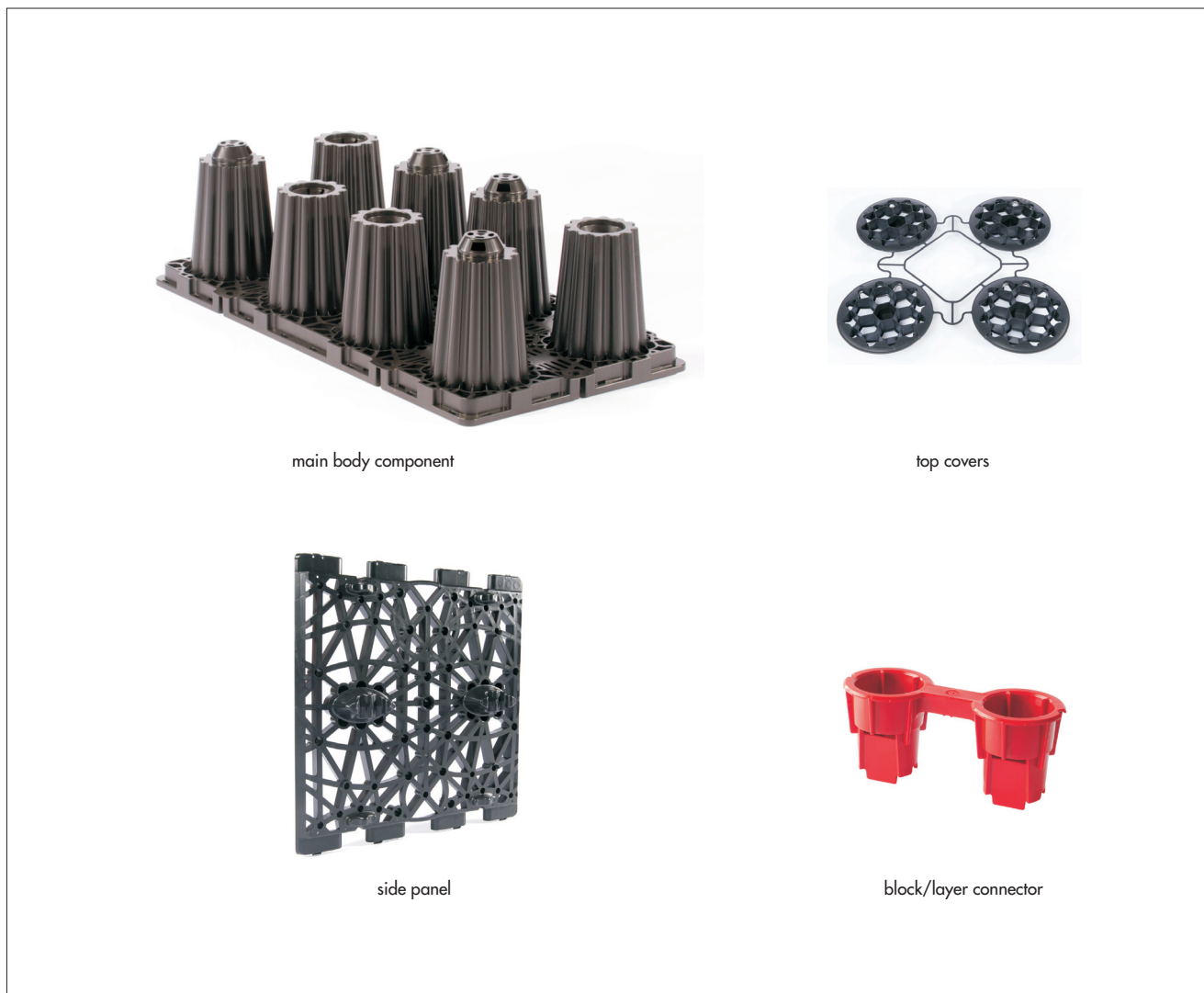
Technical Specification

1 Description

1.1 The ACO StormBrixx Stormwater Management System comprises modular, black polypropylene, push-fit/clip-together components, which are assembled on site (see Figure 1). These consist of: main body components, side panels, top covers and block/layer connectors (coloured red).

1.2 Two main body components are required to form each storage cell. The side panels are installed around the outside perimeter of the completed system. The top covers are inserted on the top surface layer of the completed system. The block/layer connectors are used to form a connection between adjacent storage cells and adjacent layers of cells.

Figure 1 The ACO StormBrixx Stormwater Management System components (not to scale)



1.3 The overall unit dimensions and characteristics of ACO StormBrixx storage cells are shown in Table 1.

Characteristic (unit)	Value
Unit dimensions per storage cell (nominal) (mm) (L x W x H)	1200 x 600 x 610
Unit volume per storage cell (nominal) (m ³)	0.44
Storage volume per storage cell (nominal) (m ³)	0.42
Porosity (void ratio) (%)	95
Nominal weight per storage cell (excluding side panels and top covers) (kg)	20
Nominal weight of storage cell (including side and end panels on one side and end) (kg)	24.8

1.4 Other items used with the system, but outside the scope of this Certificate, include:

- adaptors and connecting pipework
- air vents
- inspection points
- inspection chamber modules
- silt traps and sediment separators
- permeable geotextile — wrapped around each assembly when used for infiltration
- geomembrane — wrapped around each assembly when used for storage (attenuation)
- protective fleece — wrapped around each assembly when used for storage (attenuation), to give added protection to the geomembrane
- granular material/coarse sand.

2 Manufacture

2.1 The component parts of ACO StormBrixx storage cells are injection moulded using polypropylene material to one specification.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested, calibrated and operated by trained personnel
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management systems of the Certificate holder's distribution and manufacturing divisions have been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by BSI (Certificate FM 13502), Kiwa International Certificate GmbH (Certificate K103.575) and TUV Rheinland (Certificate 01 100 113625).

3 Delivery and site handling

3.1 The main body components are delivered to site stacked one on top of another, in quantities of 16 and secured to a wooden pallet. The side panels are delivered to site in quantities of 100 units, secured to wooden pallets. The top covers are delivered in boxes of 18, with six boxes per pallet. The block/layer connectors are delivered in sealed polythene bags of 50, with 20 bags to a box.

3.2 Each pack/pallet of components includes a label stating the product identification article number, product type and quantity.

3.3 The packs/pallets should be carefully placed on level ground and should not be stacked on site.

3.4 The components contain an inhibitor to resist the effects of ultraviolet light for limited periods. However, prolonged storage in direct sunlight and high temperatures should be avoided.

3.5 The components should not be stored near fuel bowsers, fuel tanks or other solvents to avoid potential chemical damage.

3.6 The components should be handled with care to avoid damage from impact, including dropping from height.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the ACO StormBrixx Stormwater Management System.

Design Considerations

4 General

4.1 The design of the ACO StormBrixx Stormwater Management System must be in accordance with the Certificate holder's design guidelines. Guidance on the application of sustainable drainage systems (SUDS) for new developments can be found in the Planning Policy Statement 25 and CIRIA Report C697 published by the Construction Industry Research and Information Association.

4.2 The system is suitable for the management of stormwater run-off from impermeable surfaces and can be utilised in two main ways (see Figure 2):

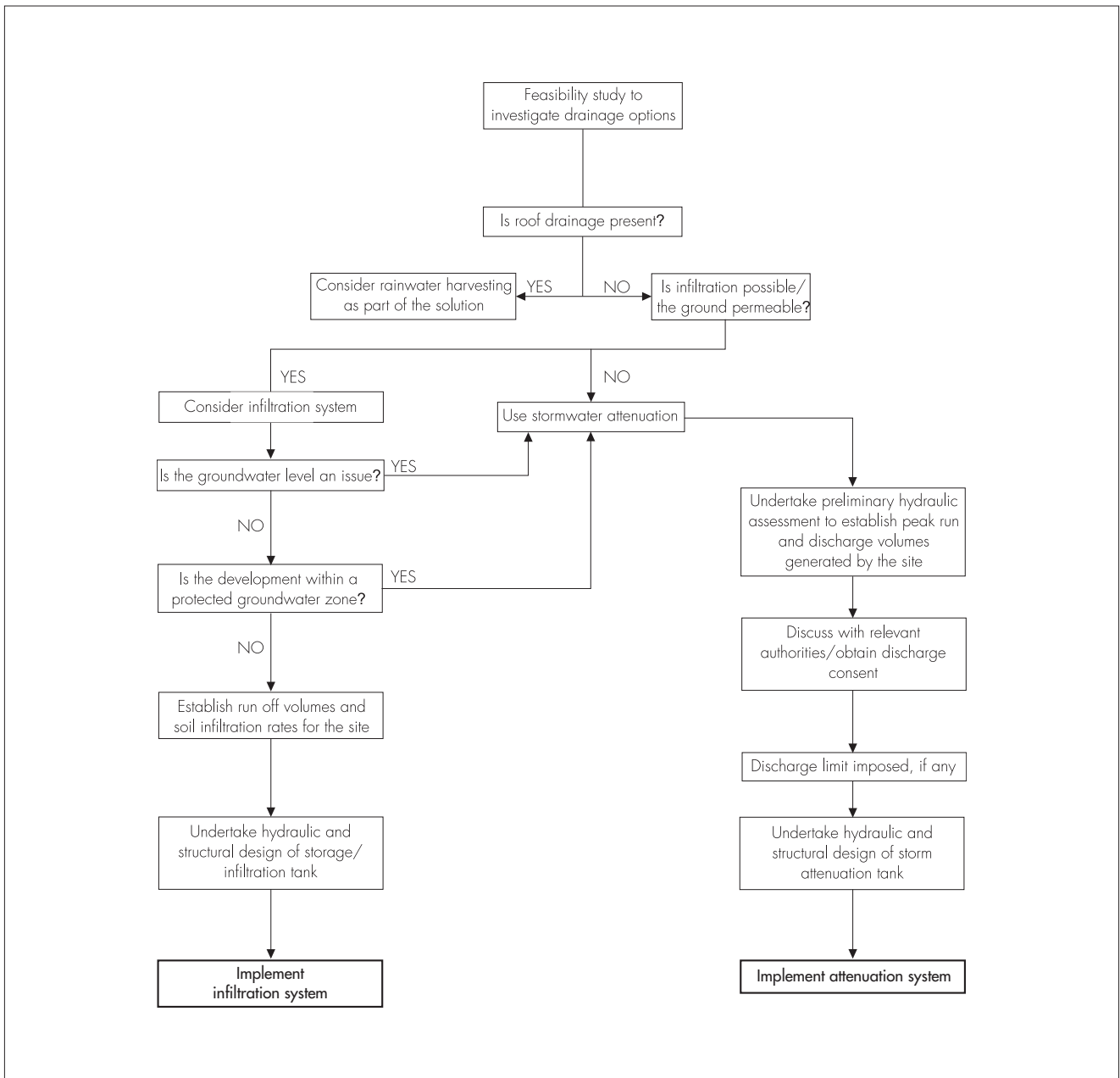
- infiltration — stormwater is collected within the system during rainfall and allowed to drain away by soaking into the surrounding ground over a substantial period of time after rainfall
- attenuation — stormwater is stored within the system during rainfall and released at a reduced flow rate through a flow control device into an appropriate outfall. This reduces peak flows in the watercourse and, therefore, minimises the risk of flooding, or
- a combination of infiltration and attenuation.

4.3 The design of a specific project must always be preceded by a detailed audit of the proposed site to establish:

- existing factors and considerations applicable to the site
- predicted factors relating to the site's use following the planned development, and the parameters within which the installation is required to function
- the type of function of application suggested by this audit.

4.4 Once the project criteria have been established from the site audit, there are two main parts to the design procedure of individual installations: hydraulic design and structural design.

Figure 2 Sustainable drainage system selection and design



5 Practicability of installation

The ACO StormBrixx Stormwater Management System is designed to be installed by a competent general builder, or a contractor, experienced with this type of system.

6 Hydraulic design

Infiltration

Calculation principles



6.1 There are two approaches, either of which can be adopted: the Construction Industry Research and Information Association (CIRIA) Report 156 or BRE Digest 365. Further information on the design of sustainable drainage systems (SUDS) may be obtained from CIRIA Report C697.

6.2 A simplified approximate approach can be used on a small site (ie a single-house development), where detailed site infiltration rate information may not be required nor available (see Table 2). In Approved Document H, a storage volume equal to the area to be drained multiplied by 10 mm, for areas up to 25 m² is allowed. Beyond this size, design should be carried out in accordance with BS EN 752 : 2008 or BRE Digest 365. BS EN 752 : 2008 suggests a storage volume equal to 20 mm multiplied by the area to be drained. In Scotland, guidance for the design of single-house soakaways is given in clause 3.6.5 of the Technical Handbook (Domestic).

Table 2 Simplified soakaway design for single-house development⁽¹⁾

Number of units	Storage volume (m ³)	Maximum area to be drained (m ²)
1	0.42	25 ⁽²⁾
2	0.83	42 ⁽³⁾
3	1.25	63 ⁽³⁾
4	1.67	83 ⁽³⁾
5	2.09	104 ⁽³⁾
6	2.50	125 ⁽³⁾

(1) When doubt exists over suitability of ground for infiltration permeability, figures should be derived by test (see BRE Digest 365).

(2) In accordance with Approved Document H.

(3) In accordance with BS EN 752 : 2008, clause NA 4.4.8.

6.3 When the BRE or CIRIA approach is used, the design volumes and areas for trench or cuboid type installations can be found in Tables 3 and 4 of this Certificate.

Table 3 Data for use in hydraulic design — one unit wide trench configuration

Number of units high	System volume (m ³) per metre length of trench	Vertical surface area (m ²) (both sides) per metre length of the system	Area beneath system (m ²) per metre length of trench
1	0.35	1.22	0.60
2	0.70	2.44	0.60


Table 4 Data for use in hydraulic design — three-dimensional systems, two units high

System length (Number of units long) (1.2 m side)	2 units wide (0.6 m side)			4 units wide (0.6 m side)			8 units wide (0.6 m side)		
	Volume (m ³)	Area around sides and ends (m ²)	Area under base (m ²)	Volume (m ³)	Area around sides and ends (m ²)	Area under base (m ²)	Volume (m ³)	Area around sides and ends (m ²)	Area under base (m ²)
1	1.67	5.86	1.44	3.34	8.78	2.88	6.68	14.64	5.76
2	3.34	8.78	2.88	6.68	11.71	5.76	13.35	17.57	11.52
4	6.68	14.64	5.76	13.35	17.57	11.52	26.70	23.42	23.04
8	13.35	26.35	11.52	26.70	29.28	23.04	53.41	35.14	46.08
10	16.69	32.21	14.40	33.38	35.14	28.80	66.76	40.99	57.60
100	166.90	295.73	144.00	333.79	298.66	288.00	667.58	304.51	576.00


6.4 For calculations, the size and volume of the units are given in Table 1. The total areas of the base and sides are required as water is absorbed through the geotextile soil interface. Storage volume is 95% of the total volume. As an example using Table 4, for a typical system 2 units wide (1.2 m), 10 units long (12 m) and 2 units high (1.22 m), the volume is 16.69 m³, the vertical area along the sides and ends of the system is 32.21 m² and the area under the base of the system is 14.40 m².

Attenuation

Calculation principles

 6.5 The anticipated total run-off volume from the site is estimated. The most commonly-used method for evaluating storm rainfall events in the UK is the Wallingford Procedure by which the total rainfall level of storms over defined time periods ranging from 5 minutes up to 48 hours is assessed. The allowable discharge rate from the site to an appropriate outfall is established, but will normally be set by the Environment Agency, Scottish Environmental Protection Agency or Planning Authorities. The volume to be stored underground in the system is then determined and the number of units needed to contain this volume is calculated on the basis that the storage volume is equal to 95% of the total volume of the system.

Connections

 6.6 Pipe connections are made to the ACO StormBrixx Stormwater Management System using either a pipe adaptor or an integral StormBrixx access chamber (outside the scope of this Certificate).

6.7 When connecting pipes to the system, when used for storage applications (in which the system is wrapped with a geomembrane), care must be taken to ensure a watertight seal. It is recommended that connections are made using a flange adaptor. Adhesive or double-sided tape should be used between the geomembrane and flange adaptor to ensure a watertight seal and where practical, a jubilee clip.

Manifold design



6.8 The units are manufactured to allow connection of pipes up to 500 mm internal diameter.

6.9 If the anticipated design flow is greater than the hydraulic capacity of a single connection pipe, then the flow may be split between a number of pipes from an adjacent manhole. The system designer should ensure that the number and size of the pipe connections is sufficient to convey the anticipated design flow without restriction.

6.10 Where large diameter incoming connections carrying full bore flow are planned, consideration should be given to the need for energy dissipation prior to the point of connection.

Flow control



6.11 When used for attenuation purposes, the outflow from the system must be controlled to comply with the discharge rate consent of the site. The main methods to achieve outflow control are: orifice plate, vortex control or small pipe. Comparative features and benefits of these various control flow devices should be considered prior to selection.

Outflow positioning and head calculations

6.12 The invert level of the outflow pipe should be flush with the bottom of the lowest unit to allow the system to drain. As the system fills, a depth of water develops on the upstream side of the outflow control. For a system with two layers of units, this depth is 1.22 m when full, creating a driving head to push the flow through the control device. For design purposes, the head used in calculations is taken as that at the invert line of the outflow device.

7 Structural performance

General

7.1 The structural design of each installation incorporating the system should be carried out by a suitably qualified and experienced engineer.

7.2 Guidance on the design and installation of systems incorporating the units can be found in CIRIA Report C680. Consideration should be given to the effects of cumulative deflection in systems comprising several layers of units.

7.3 The system can be placed under a wide variety of landscaped or lightly-trafficked areas. Design procedures for heavily-trafficked applications are outside the scope of this Certificate.

7.4 Care should be taken when the system is used for infiltration below trafficked areas and close to structures. It is important to ensure that the infiltrating water will not soften the soils or cause loss of fines and settlement.

7.5 The engineer responsible for the design of the installation must confirm that the ground-bearing capacity at the formation level is sufficient for the proposed operational loads. In areas of weak or compressible soils, advice should be sought from a geotechnical engineer.

7.6 When the system is wrapped in an impermeable geomembrane and placed below the groundwater table, flotation may occur. To prevent this, the weight of the soil over the top of the system must be greater than the uplift force caused by the system's buoyancy in the water. This can be achieved with most types of fill if the depth of cover fill is equal to, or greater than, the depth of penetration of the system below groundwater level.

Unit performance characteristics

7.7 Characteristic compressive strength at the yield point and elastic deflection values for the system have been determined from independent, short-term tests (see Table 5).

Table 5 Short-term performance values

Performance characteristic	Value
Characteristic compressive strength at the yield point (kN·m ⁻²)	
vertical loading on top face	455
lateral loading on side face	95
Short-term elastic deflection (mm per kN·m ⁻²) (applied load)	
vertical loading on top face	1 per 50.3
lateral loading on side face	1 per 10

7.8 The following equations have been established from creep tests on a single unit exceeding 10,000 hours and can be used to estimate the long-term vertical deflection for periods up to 60 years at 20°C (see Table 6).

Table 6 Equations for estimating of long-term creep deflection

For loads up to (kN·m ⁻²):	Equation for estimation of long-term vertical deflection
28	Deflection = 0.2463 Ln [time (hours)] - 0.0405
84	Deflection = 0.4203 Ln [time (hours)] + 1.3419
140	Deflection = 0.7480 Ln [time (hours)] + 2.5778

7.9 The partial load and material factors given in Table 7 of this Certificate, as defined in CIRIA Report C680, should be used for design.

Table 7 Partial factors for loads and materials

Description	Ultimate limit state	Serviceability limit state
Partial factors for loads		
Vertical dead-load (F_{dl})	1.40	1.00
Earth pressure (horizontal) + hydrostatic (horizontal) load (F_{ep})	1.35	1.00
Imposed live-load (F_{ll})	1.60	1.00
Partial safety factors for materials (F_m)	2.75	1.50

7.10 Example maximum installation depths and minimum depths of cover calculated as described in this section and in accordance with CIRIA Report C680 are shown in Tables 8, 9 and 10 of this Certificate:

For soakaways serving an individual house — the system is located below a garden a minimum of 5 m from the building, inaccessible to motor vehicles. The information given in Table 8 indicates the maximum installation depth and minimum cover.

Table 8 Design criteria for use of the system as a soakaway for an individual house⁽¹⁾

Criteria	Value (m)
Maximum depth to base of units (m)	4.00
Minimum cover depth (m)	0.50

(1) The following assumptions apply:

- soakaway constructed in sandy gravels with a soil weight not exceeding 20 kN.m⁻³ and angle of shearing resistance for surrounding soil not less than 38°
- groundwater at least one metre below the base of the units
- soakaway located beneath small gardens or landscaped areas, no vehicles in accordance with Table 4.2 of CIRIA Report C680.

For installations below landscaped and lightly-trafficked areas — the information given in Tables 9 and 10 is only applicable in temperate climate conditions such as those in the UK. Site specific calculations should be carried out for configurations and prevailing ground conditions other than those shown.

Table 9 Maximum installation depths (to base of units)

Soil description	Soil weight (kN.m ⁻³)	Angle of internal friction (degrees)	No groundwater present		Groundwater present (1.0 m below ground level)	
			Car parks ⁽¹⁾	Landscaped areas ⁽²⁾	Car parks ⁽¹⁾	Landscaped areas ⁽²⁾
Over consolidated stiff clay	20	24	2.98	2.98	2.25	2.25
Silty sandy clay	19	26	3.38	3.38	2.39	2.39
Loose sand and gravel	18	30	4.00 ⁽³⁾	4.18	2.61	2.61
Medium dense sand and gravel	19	34	4.00 ⁽³⁾	4.69	2.69	2.69
Dense sand and gravel	20	38	4.00 ⁽³⁾	5.32	2.78	2.78

(1) Car parks are: *Car Parks, cars or light vehicles up to 9000 kg (GVW)* in accordance with Table 4.2 of CIRIA Report C680.

(2) Landscaped areas are: *Landscaped area where drive on mowers are used, drive on mowers* in accordance with Table 4.2 of CIRIA Report C680.

(3) Installations greater than 4.00 m deep beneath car parks are outside the scope of this Certificate.

Notes:

- calculations based on systems constructed from two layers of StormBrixx units
- weight of ground water taken as 10 kN.m⁻³
- angle of spread of wheel loadings taken as 27° in car parks with asphaltic surfacing
- spread of wheel loading taken as angle of internal friction of soil in landscaped areas
- no account is taken of accidental loading
- ground surface in vicinity of system assumed to be level
- formation below system assumed to have adequate bearing capacity
- partial load and material factors are defined in Table 7 of this Certificate
- values for distributed load and concentrated wheel loads/contact areas as defined in Table 4.2 of CIRIA Report 680.

Table 10 Minimum cover depth

	Landscaped areas ⁽¹⁾	Driveways and car parks with height barriers ⁽²⁾	Car parks ⁽³⁾
Minimum cover depth required (m)	0.50	0.60	0.75

(1) Landscaped areas are: *Landscaped area where drive on mowers are used, drive on mowers in accordance with Table 4.2 of CIRIA Report C680.*

(2) Driveways and car parks with height barriers are: *Driveways to individual houses and car parks with height barriers to limit vehicle size, cars up to 3000 kg GVW (eg people carrier) in accordance with Table 4.2 of CIRIA Report C680.*

(3) Car parks are: *Car Parks, cars or light vehicles up to 9000 kg (GVW) in accordance with Table 4.2 of CIRIA Report C680.*

Notes:

- calculations based on systems constructed from one layer of StormBrixx units
- soil weight and angle of internal friction of the soil above the system taken as 20 kN·m⁻³ and 38°, respectively.
- calculations based on there being no groundwater present
- angle of spread for wheel loads taken as 27° in car parks with asphaltic surfacing and angle of internal friction of soil in landscaped areas.
- no account is taken of accidental loading
- ground surface in vicinity of system assumed to be level
- formation below system assumed to have adequate bearing capacity
- partial load and material factors are defined in Table 7 of this Certificate
- values for distributed and concentrated wheel loads/contact as defined in Table 4.2 of CIRIA Report C680.

8 Geotextiles and geomembranes

Infiltration

8.1 The system requires a geotextile wrapping when used as an infiltration system to:

- allow the water infiltration into adjacent ground
- prevent silt that may be contained in the surface water run-off contaminating the surrounding soil, in addition to reducing its permeability
- prevent surrounding soil from entering the units.

8.2 The selection of an appropriate geotextile requires careful consideration (see section 8.6).

Attenuation

8.3 The system requires a sealed geomembrane wrapping to create an attenuation storage system, to prevent:

- the release of surface water into the surrounding ground
- inflow of groundwater that may overload downstream systems and contain pollutants on contaminated sites.

8.4 Site conditions may also require the use of an additional thick, protective geotextile fleece to prevent puncture or excessive strain in the geomembrane, on which further advice should be sought from the geomembrane manufacturer.

8.5 Selection of an appropriate geomembrane requires careful consideration (see section 8.7).

Specification of geotextile

8.6 The selection of an appropriate geotextile for a specific StormBrixx Stormwater Management System should be considered carefully, particularly with reference to the surrounding soil properties and required performance. Points to consider are:

- pore size — this should be designed and specified to assist infiltration and prevent migration of fine soil particles
- permeability and breakthrough head — the geotextile should not limit flow of water in the system and should have a similar or greater permeability than the surrounding ground
- puncture resistance — the geotextile must be able to resist piercing by potentially sharp objects (eg stones in the soil)
- tensile strength — the geotextile should have sufficient strength to resist any imposed forces (eg from traffic)
- specialist advice should be sought if surrounding soil characteristics exhibit a high degree of fines/low infiltration capacity and/or there is risk of damage from ground contaminants.

Specification of geomembrane

8.7 The specification and selection of the impermeable geomembrane must be correct for the proposed installation, to ensure it performs to the level required. It is essential that the specified material:

- withstands the rigours of installation
- resists puncture
- resists multi-axial elongation stress and strains associated with settlement
- resists environmental stress cracking
- resists damage from ground contaminants
- remains intact for the full design life.

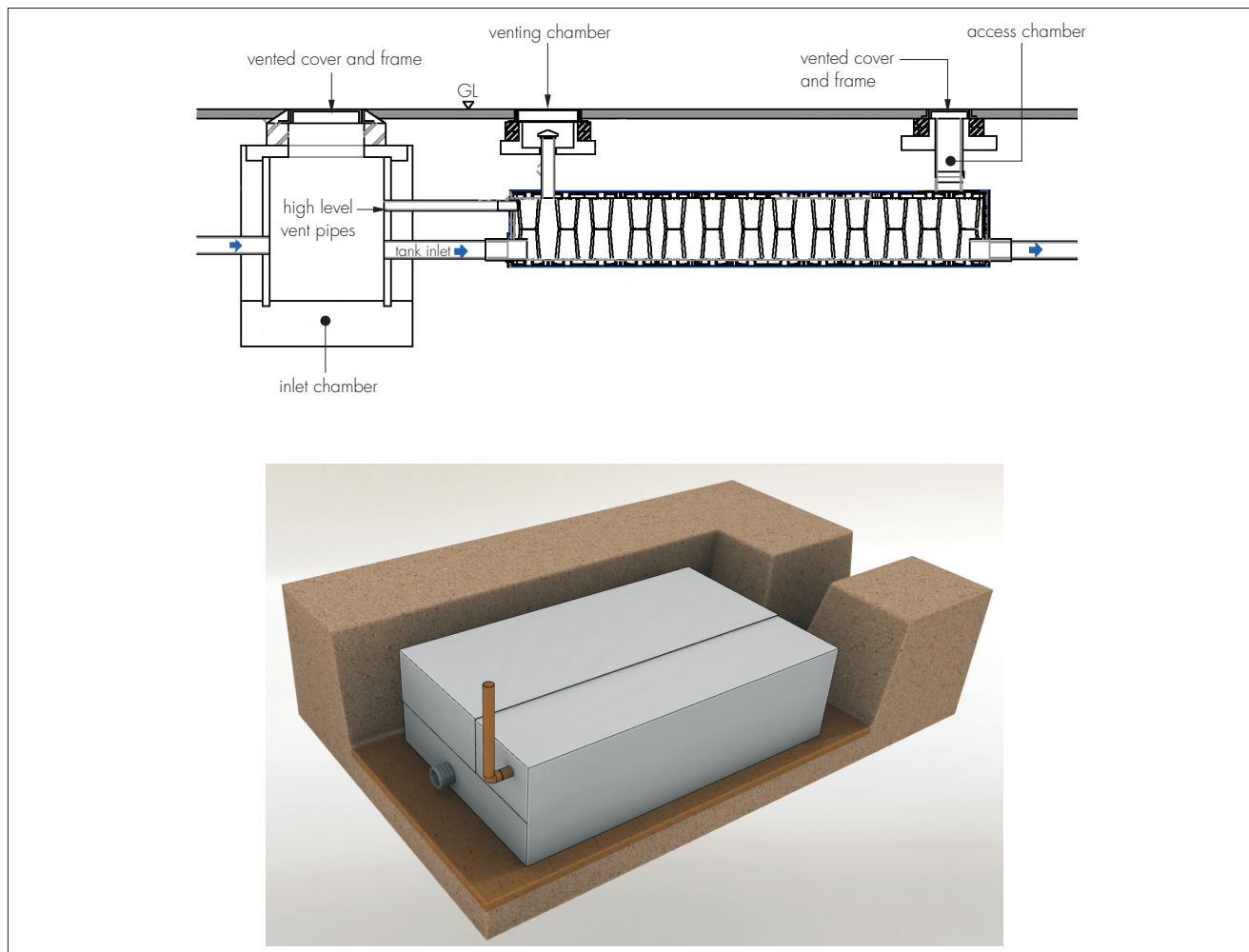
8.8 A geomembrane less than 1 mm thick is unlikely to meet these criteria (except in shallow, domestic installations), and is not recommended for use with the ACO StormBrixx Stormwater Management System. For further details the Certificate holder's advice should be sought

8.9 All joints must be sealed, using proprietary techniques recommended by the manufacturer. Advice on seam testing procedures is given in CIRIA Report SP 124 : 1996.

9 Venting

Adequate venting must be provided to the system, either through high level pipe connections, through direct venting to the atmosphere or via StormBrixx access chambers (see Figure 4). One 110 mm diameter air vent is required per 7500 m² impermeable catchment area to be drained. Air vent connections and pipework for use with the system are outside the scope of this Certificate.

Figure 4 Typical ACO StormBrixx Stormwater Management System arrangements including ventilation pipes



10 Resistance to chemicals

10.1 An assessment by the BBA indicates that the ACO StormBrixx Stormwater Management System components covered by this Certificate are suitable for use in contact with the chemicals likely to be found in stormwater.

10.2 An assessment of the suitability for use of the system on brownfield sites should be made only after a suitable site investigation to determine the possibility for chemical attack. Particular care must be taken where acids and organic solvents are present at high concentrations. Such applications are outside the scope of this Certificate and the advice of the Certificate holder should be sought.

11 Maintenance



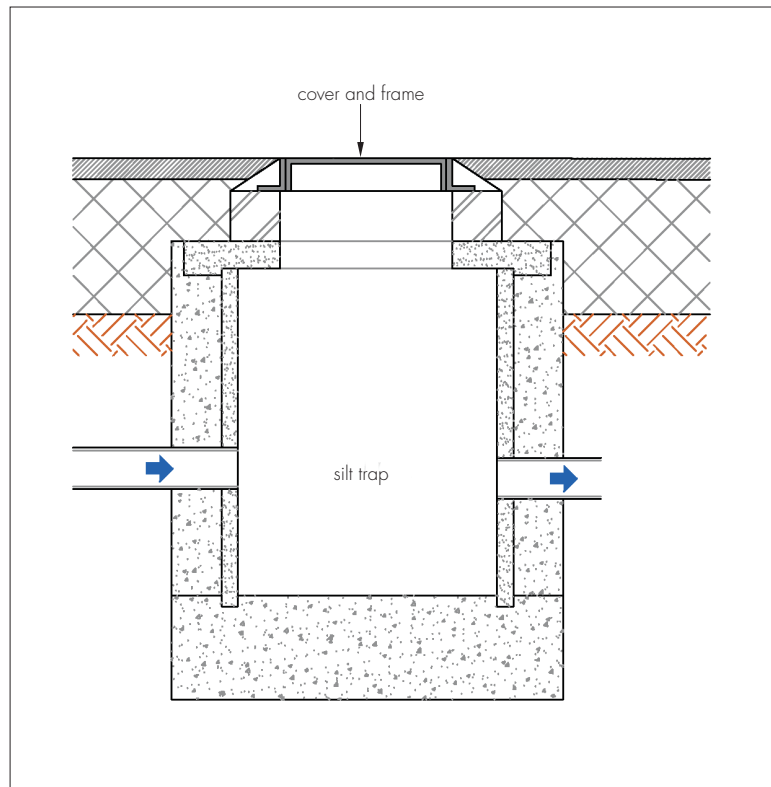
11.1 The owner of the structure is responsible for its maintenance.

11.2 For soakaways to individual houses, the only necessary maintenance of the system is to keep all gullies clear of debris such as leaves.

11.3 For large installations, or where the receiving waters are environmentally sensitive; a programme of regular inspections should be established to prevent siltation of the system which, if allowed to develop, would reduce the effectiveness of the system. The system should also be inspected after every major storm event.

11.4 It is recommended that sediment tunnels with low flow channels or sediment fore bays are incorporated within the ACO StormBrixx Stormwater Management System together with a silt trap or sediment removal separator upstream of the inlet pipework to the system (see Figure 5). A maintenance plan must be in place to ensure regular cleaning of all traps and sumps to ensure correct performance. Silt traps and sediment removal separators for use with the system are outside the scope of this Certificate.

Figure 5 Typical silt trap



11.5 For all flow control devices it is sensible to incorporate access (via a manhole or similar) to the location of the pipe entry, orifice or vortex control. This will enable removal of any blockage. The orifice itself may be protected by a debris screen.

11.6 Paved surface areas above an installation should be inspected at the same time to ensure the units continue to provide the required structural support.

12 Durability



The structural properties of the polypropylene used in the components of the ACO StormBrixx Stormwater Management System will deteriorate with time and should be taken into account at the design stage by the application of suitable safety factors (see section 7). In the opinion of the BBA, the system as covered by this Certificate will have a life of up to 60 years, when used in accordance with this Certificate.

13 Reuse and recyclability

The units consist of polypropylene material which is readily recyclable.

Installation

14 General

The ACO StormBrixx Stormwater Management System should be installed in accordance with the Certificate holder's installation instructions and this Certificate. Special attention should be paid to temporary work requirements in excavations.

15 Procedure

15.1 The installation site is excavated to the required dimensions and levels ensuring that the excavation will allow installation of connecting pipework. Sufficient space is also necessary and must be maintained for reinstating around the installed units. The base of the excavation must be smooth and level without sharp drops or humps. All slopes must be cut to a safe angle or adequately supported and safe access provided to allow personnel to enter the excavation.

15.2 It is imperative that the ground-bearing capacity at formation level is adequate for the design loads.

15.3 The base must be inspected for soft spots in the formation and any present must be excavated and replaced with compacted granular fill material.

15.4 A 100 mm thick bedding layer of DOT Type 1 or 2, self-compacting gravel, or if a soakaway, 100 mm of coarse sand, is laid on the base and sides of the excavation.

15.5 The geomembrane and protective fleece, if required, (or the geotextile, for infiltration systems) is laid over the bedding layer and up the sides of the excavation.

15.6 Where a geomembrane is used, the membrane must be inspected and all welds tested as required with any damage or faults rectified. Joints between adjacent sheets of impermeable membrane should be sealed correctly using proprietary techniques with a minimum lap of 150 mm. Double seam welds should be used. Generally, jointing with tape is not recommended as the system becomes reliant on the mechanical properties of the tape to maintain its integrity.

15.7 StormBrixx units are assembled and installed in accordance with the installation schedule. A number of different methods for cross bonding the individual StormBrixx units and a number of different configurations for construction of the system are described in the Certificate holder's installation instructions. The units are arranged so that the columns are in line, giving access through the system. For single-layer applications where brick bonding has not been used, lateral connectors are used; and for multiple layer systems, two connectors are joined together on top of each other to provide stability between layers and vertical alignment.

15.8 Once all the units are configured in place, the side panels are fitted around the perimeter of the system. On the top layer of the system, top covers are fitted over all columns.

15.9 Inlet and outlet connections are made to the installation using pipe adaptors.

15.10 The geotextile or geomembrane enclosure of the base, sides and top of installation, including protective fleece (where required), is completed.

15.11 The installation is backfilled with Type 1 or 2 sub-base or Class 6P (side fill only) selected granular material in accordance with the *Manual of Contract Documents for Highway Works (MCHW)*, Volume 1. The backfill is compacted in 150 to 300 mm thick layers. The side fill and the first 500 mm of compacted material above the system should be compacted using a suitable lightweight plate compactor only.

15.12 A 100 mm thick coarse sand or gravel protection layer should be placed over the top of the units that are wrapped in either a geotextile (for infiltration systems) or a geomembrane with protective fleece, where required (for attenuation systems).

15.13 Backfilling is continued with:

- trafficked areas (eg car parks) — Type 1 or 2 sub-base material compacted in 150 mm layers in accordance with the MCHW, Volume 1. Compaction of the first 300 mm of cover should be carried out using a suitable lightweight plate compactor. Thereafter compaction plant over the top of the system should not exceed 2300 kg per metre width
- landscaped and non-trafficked areas — selected 'as-dug' material with size of pieces less than 75 mm, compacted to 90% maximum dry density vehicle movement over the top of the system should be performed in straight passes only.

15.14 The pavement construction or landscaping is then completed over the system.

Technical Investigations

16 Tests

Tests were carried out on the system to determine:

- long- and short-term resistance to loading
- impact resistance at 0°C, 5°C and 23°C.

17 Investigations

17.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained on the quality and composition of the materials used.

17.2 An assessment of the system was made in relation to:

- material properties
- design procedures
- volumetric capacity.

17.3 A site visit was made to assess the practicability and ease of installation and connection.

Bibliography

BRE Digest 365 *Soakaway Design*

BS EN 752 : 2008 *Drain and sewer systems outside buildings*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

CIRIA Report SP 124 : 1996 *Barriers, liners and cover systems for containment and control of land contamination*

CIRIA Report 156 *Infiltration drainage — Manual of good practice*

CIRIA C680 *Structural design of modular geocellular drainage tanks*

CIRIA C697 *The SUDS manual*

Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works*

Planning Policy Statement PPS25, *Development and Flood Risk*

18 Conditions

18.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

18.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

18.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

18.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

18.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

18.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.