

# delivering benefits through evidence



## Appraisal of existing flow stemming systems

Project: SC090025/R2

The Environment Agency is the leading public body protecting and improving the environment in England and Wales.

It's our job to make sure that air, land and water are looked after by everyone in today's society, so that tomorrow's generations inherit a cleaner, healthier world.

Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

This report is the result of research commissioned by the Environment Agency's Evidence Directorate and funded by the joint Environment Agency/Defra Flood and Coastal Erosion Risk Management Research and Development Programme.

**Published by:**

Environment Agency, Horizon House, Deanery Road,  
Bristol, BS1 5AH

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

ISBN: 978-1-84911-229-1

© Environment Agency - August 2011

All rights reserved. This document may be reproduced with prior permission of the Environment Agency.

The views and statements expressed in this report are those of the author alone. The views or statements expressed in this publication do not necessarily represent the views of the Environment Agency and the Environment Agency cannot accept any responsibility for such views or statements.

Email: [fcerm.evidence@environment-agency.gov.uk](mailto:fcerm.evidence@environment-agency.gov.uk)

Further copies of this report are available from our publications catalogue: <http://publications.environment-agency.gov.uk> or our National Customer Contact Centre: T: 08708 506506

E: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)

**Author(s):**

Peter Halstead  
Tim Marshall

**Dissemination Status:**

Publicly available

**Keywords:**

stop logs, flow stemming

**Research Contractor:**

Halcrow Group Limited  
44 Brook Green  
Hammersmith  
London  
W6 7BY  
Tel: 0207 602 7282

**Environment Agency's Project Manager:**

Jim Walker, Research Scientist, Flooding and Communities Team, Evidence Directorate

**Theme Manager:**

Geoff Baxter, Sustainable Asset Management

**Project Number:**

SC090025/R2

# Evidence at the Environment Agency

Evidence underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us, helps us to develop tools and techniques to monitor and manage our environment as efficiently and effectively as possible. It also helps us to understand how the environment is changing and to identify what the future pressures may be.

The work of the Environment Agency's Evidence Directorate is a key ingredient in the partnership between research, guidance and operations that enables the Environment Agency to protect and restore our environment.

This report was produced by the Research, Monitoring and Innovation team within Evidence. The team focuses on four main areas of activity:

- **Setting the agenda**, by providing the evidence for decisions;
- **Maintaining scientific credibility**, by ensuring that our programmes and projects are fit for purpose and executed according to international standards;
- **Carrying out research**, either by contracting it out to research organisations and consultancies or by doing it ourselves;
- **Delivering information, advice, tools and techniques**, by making appropriate products available.

Miranda Kavanagh

**Director of Evidence**

# Executive summary

Stop logs are widely used within the Environment Agency. Their infrequent use often means severe deterioration in their condition, which necessitates additional planning and flow control measures. Stop logs are also inflexible, requiring site-specific design and procurement, and provision of site-dedicated equipment. This is expensive and labour intensive.

This initial desk-based study of existing proprietary temporary flood control products was undertaken with a view to utilising such products in traditional stop log applications. An appraisal matrix (see Appendix) details the findings of this study for each flood control product. This report provides further background information on the study.

# Contents

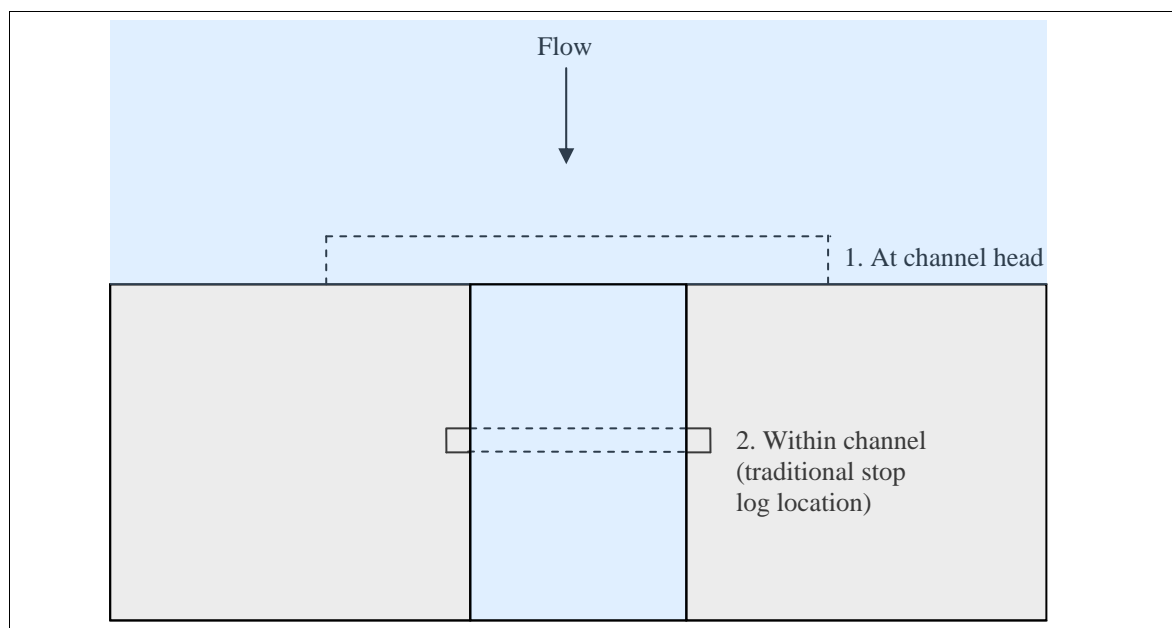
<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Proprietary flood defence and flow stemming systems</b>	<b>3</b>
2.1	Tubes	3
2.2	Containers	5
2.3	Freestanding barriers (temporary)	7
2.4	Frame barriers (temporary)	8
	<b>Appendix A: Appraisal matrix of existing flow stemming systems</b>	<b>10</b>

# 1 Introduction

Stop logs are widely used within the Environment Agency. Their infrequent use often means severe deterioration in the condition of stop log barriers and seals, necessitating carefully planned activities (e.g. diver channel entry, sandbagging) to allow isolation of the channel. Stop logs are also inflexible, requiring site-specific design and procurement, and provision of site-dedicated equipment. This is expensive and labour intensive.

A more flexible system for blocking flows within open channels may deliver improved efficiencies. The methodology for blocking flows within a channel depends on the following criteria:

1. Required position of barrier (at Position 1 or Position 2 in Figure 1.1)
2. Site-specific features
3. Risk associated with downstream assets and planned activities
4. Channel width
5. Channel depth
6. Water depth
7. Water flow rate



**Figure 1.1 Barrier positions**

Applications might be categorised according to common criteria (1–7 above), allowing a more focused assessment of the suitability of available flow stemming products for specific site characteristics. Effective use might be made of such devices where they can be employed on a number of sites, grouped geographically within operational regions and areas.

It is important to use a suitable technology to mitigate physical, ergonomic and chemical risk (e.g. overtopping, physical barrier failure, failure due to poor maintenance or chemical exposure etc.). It is equally important to undertake suitable risk

assessments for each activity, employing appropriate methods and contingency planning to mitigate risks.

This document supplements the appraisal matrix, which (after discussions with manufacturers and suppliers) evaluates proprietary flood defence and flow stemming products and their suitability for replacing stop logs.

Technologies presented here are temporary and do not require permanent structural fittings. Other 'demountable' technologies are available, which require permanent sockets and/or grooves to allow installation of a barrier. Such technologies are not deemed to offer significant advantage over stop logs, and are discounted.

## 2 Proprietary flood defence and flow stemming systems

Many temporary and demountable systems currently on the market are targeted at temporary flood defence or cofferdams (i.e. they are long, relatively low barriers for single or infrequent use). Hence, they are typically benchmarked against sandbags and permanent flood defence schemes. Note that the installation of such devices should also conform to Health and Safety Construction (Design and Management) Regulations 2007.<sup>1</sup> A number of existing products offer some potential to replace stop logs, although few are specifically designed for such applications. A range of systems have been considered for the broad range of potential applications.

The analysis within the appraisal matrix is based on a one-week study to elicit data from manufacturers and suppliers, and requires further investigation and validation if procurement of such systems is required. All products are available in the UK – although some are manufactured and/or supplied from overseas.

### 2.1 Tubes

These are impervious membranes, filled with water or air, to form a barrier. Typical characteristics (positive and negative) are as follows:

- + Water retention up to 1.8 m head
- + Some products offer good flexibility to adjust to channel width
- + They allow safe and controllable release of water
- + Very compact (relative to length) for storage
- + Reusable
- + Manned channel entry is not mandatory
- + Some products can be installed into deep, flowing water
- + Have been used in canals and culverts
- Prone to damage – limited service life
- Use within concrete channel may reduce service life
- Significant source of water required for tube filling
- Larger barriers require mechanical lifting equipment
- Some products are not recommended for installation within concrete channels and culverts

---

<sup>1</sup> <http://www.hse.gov.uk/aboutus/meetings/iacs/coniac/200706/m220061a3.pdf>



Images of products appraised:

1. Aqua-Barrier (water filled)



2. Aquadam (water filled)



3. Double-Tube Boom (water filled)



#### 4. Tubewall (air filled)



#### 5. Argos Waterwall (water filled)



## 2.2 Containers

These are modular rigid or semi-rigid containers, ballasted with water or sand. Typical characteristics are as follows:

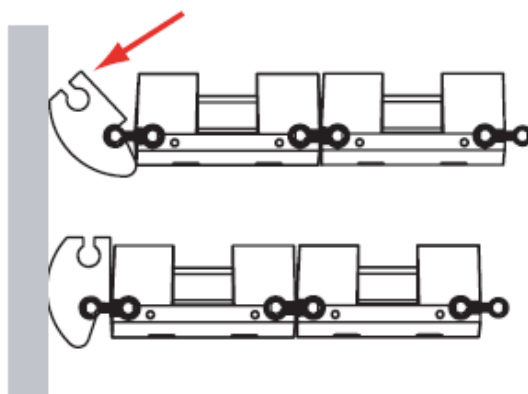
- + Some products are stackable
- + Can be joined linearly to any length
- + Robust design
- + Highly reusable
- + Ease of installation
- + Collapsible for storage
- Effective for static heads up to 1.2 m (may be positive or negative depending on water depths experienced at the site)
- Manned channel entry required
- Deployment into water can be problematic
- Limited adjustability to barrier length

Images of products appraised:

1. Aqua-Levee



2. FLOODSTOP



## 2.3 Freestanding barriers (temporary)

These are rigid or flexible barriers which can be installed and removed with no permanent supporting structures. Typical characteristics are as follows:

- + Fast deployment
- + Highly reusable
- + Effective for static heads up to 1.5 m
- Limited flexibility to adjust to channel width
- Manned channel entry required
- Supplementary sandbagging required

Images of products appraised:

### 1. Rapidam



### 2. Boxwall





## 2.4 Frame barriers (temporary)

These are rigid or flexible barriers which are fully removable. Typical characteristics are as follows:

- + Controllable heads of up to 2.5 m
- + Collapsible for storage
- + Flexible barrier length adjustment
- + Robust design
- + Highly reusable
- + Can be joined linearly to unlimited maximum length
- Labour-intensive installation and removal
- Manned channel entry required

Images of products appraised:

### 1. Aqua Fence



### 2. Geodesign Barrier



### 3. Portadam



# Appendix A: Appraisal matrix of existing flow stemming systems

Category	Product Name	Manufacturer/Supplier	Description	Dimensions (m)						Installation/Removal										Advantages	Disadvantages	Case Study/Applications	Potential to replace Stop Logs
				Max Controlled Head (m)	Max Barrier Height (m)	Unit Height (m)	Min Unit Length (m)	Max Unit Length (m)	Length Adjustment Resolution (m)	Max Component Weight (kg)	Manual Handling	Special equipment	Manned Entry Required	Wet installation possible?	Controlled water release	Indicative capital cost	Indicative Installation time	Permanent structural fittings					
Container - Water-Filled (Temporary or Demountable)	Aqua-Levee	Independent Flood Defence products Ltd.	Stackable Modular water-filled triangular tubes with solid frame	1.2	1.35 (Stacked)	0.68	1.9	1.9	0	30	Yes	Pumps	Yes	Up to 0.6m depth of flowing water	Empty the container in a controlled manner	Circa £1100/m *	30 hours per 100m length (1 person)	Temporary ground anchor required for >0.2m head	Stackable and can be joined linearly to any max length Robust design Highly reusable Ease of installation Collapsible for storage Deployable in 0.6m water depth	Discreet unit length Ground anchors required Manned channel entry required	Used for temporary flood control by Government Agencies and private users in the USA.	Possible	
Container - Water-Filled (Temporary)	FLOODSTOP	Fluvial innovations	Modular rigid containers, filled with water or other ballast	0.4 or 0.72	0.9	0.5 or 0.9	1.69 (0.5m height, including wall hubs)	1.8m (0.9m height, including wall hubs)	1m (although some adjustability with wall hubs)	24	Yes	None	Yes	Max 0.3m water depth (Untested)	Remove one joint	£150 - £340 per metre (for 0.5m and 0.9m heights)	2 hours per 100m length (1 person)	No	Good wall joints Self-filling Low head Can be pre-filled with ballast before deployment Robust and highly reusable Can be joined linearly to unlimited max length	Bulky for storage Limited barrier length adjustability Low head Manned channel entry required 'Wet' deployment is untested No option for ground anchors in high flows	The EA use them at Sandwich Quay, Kent Used by a number of Local Authorities Used by the Nuclear Decommissioning Authority	Possible	
Frame Barrier (Temporary)	Aqua Fence	Flood Defence Limited	Ply-based rigid barriers	0.6 - 1.8	1.8	0.6 - 1.8	2.4	2.4	1.2	Designed for 2-man deployment	Yes	None	Yes	Not tested	Not possible	Circa £500/m *	1 hour per 100m length (6-8 people)	Requires mounting to the ground	Collapsible for storage Robust design Highly reusable Can be joined linearly to unlimited max length	Unable to release a head of water in a controlled manner Unit barrier lengths are non-adjustable 'Wet' Installation is untested Manned channel entry required	Unknown	Limited	
Frame Barrier (Temporary)	Geodesign Barrier	Geodesign Barriers Ltd.	Galvanised steel collapsible frame with slanted, rigid barrier covered with flexible membrane	0.65 - 2.4	2.4	0.65	0.25	N/A	Fine - adjustable rods allow adjustment. Barrier panels can overlap	60 (2.4m barrier height)	Yes	Heaviest components require mechanical lifting equipment	Yes	Max 2.3m water depth (divers required >1.25m)	Removal of membrane allows water to pass through barrier	Circa £300 - £550 per metre (depending on barrier material. 1.25m height) *	1 hour per 100m length (8 people)	Support bolts required for smooth concrete	Collapsible for storage Flexible barrier length adjustment Robust design Highly reusable Can be joined linearly to unlimited max length Barrier facing material/method is optional, according to the situation	Labour intensive installation and removal Manned channel entry required Installation method is somewhat site-specific Limited experience of butting up to walls	Used frequently by the EA in the Severn region for temporary flood defence	Strong	
Frame Barrier (Temporary)	Portadam	Onsite	Steel A-frames with impervious fabric membrane	2.5	2.5	1.5-2.5	1	Any	Fine - membrane excess not used	100	Size-dependent	None	Yes	Yes	Remove membrane	Not a commercial product - cost would depend on arrangement with Onsite	2 days per 100m length (2-3 people)	None	Flexible barrier length adjustment Robust design Highly reusable Can be joined linearly to unlimited max length Impervious membrane is adaptable according to the situation	Difficult to install - specialist training required Labour intensive installation and removal Manned channel entry required	EA Framework Contractors for SE and SW areas.	Strong	
Freestanding Barrier - Flexible (Temporary or Demountable)	Rapidam	Floodguard Systems Ltd.	Modular single-component membranes with a skirt. Freestanding or demountable	0.5, 1.0 or 1.5	1.5	0.5, 1.0 or 1.5	5	150	Limited - excess material at barrier ends provides some flexibility	Length dependent	Yes	Longer barriers require mechanical lifting equipment	Yes	Yes, but requires weighting down	Not well tested. Bungs and flumes can be provided	£350 - £600 per metre (depending on freestanding or demountable. 1m height) *	45mins per 100m length (3-4 people)	Optional	Fast deployment Very compact for storage Highly reusable	Limited operational use as a cofferdam Requires Sandbagging on leading edge and at walls Divers required Ground anchor required on leading edge Limited flexibility - Channel width must be similar to barrier length	Used on a slipway, with some sandbagging; <a href="http://www.floodguards.com/video_clip/rapidam.html">http://www.floodguards.com/video_clip/rapidam.html</a>	Possible	
Freestanding Barrier - rigid (Temporary)	Boxwall	NOAQ	Plastic 'L-section' barriers which link together	0.5	0.5	0.5	0.7	0.7	0.7	3.5	Yes	None	Yes	Yes	Methodology unclear	£180 per metre	30mins per 100m length (1 person)	None	Compact storage Easy manual handling Highly reusable	Discreet unit length - channel width must be a multiple of 0.7m Seals with walls would require sandbags Low barrier height Manned channel entry required	Unknown	Limited	
Stop Logs	Coplastix	Ham Baker	Traditional Stop Log	0.4 - 2.0	2	0.3 or 0.4	0.4	5	0	Size dependent	Yes	None	Not mandatory	Yes	Yes (lifting system and methodology required)	Bespoke product cost depends on the requirements	Not Supplied	Frame and seals permanently installed	Proven Accepted and well known technology within the EA Reusable (at one site)	Infrequent use means seals deteriorate, possibly necessitating diver access and sandbagging Storage required at each site	Used extensively across EA sites	N/A	
Tube - Air-Filled (Temporary)	Tubewall	NOAQ	Temporary air-filled tube with skirt on water side	0.35, 0.5 or 1.0	0.35, 0.5 or 1.0	0.35, 0.5 or 1.0	5	to order	Limited - barrier length should match channel width	7m	Yes	Compressor Longer barriers require mechanical lifting equipment.	Yes	Up to half barrier height. No flow permissible	Deflate	£200 - £250 per metre (depending on barrier height)	1 hour per 100m length	in flow	Fast deployment Safe and controllable release of water Very compact for storage Reusable	Barrier length must be equal to channel width Prone to damage - limited longevity Air-filled offers little advantage over water-filled	Unknown	Possible	
Tube - Water-Filled (Temporary)	Aqua-Barrier	Independent Flood Defence products Ltd.	Water-filled dam with internal baffle	0.17 - 1.83	2.4	0.23 - 2.44	4	32 (larger at request)	Infinite - Excess Tube remains uninflated	1.96 - 20.23 /m (dependent on tube height)	Yes (dependent on size)	Pumps Longer barriers require mechanical lifting equipment	Not mandatory	Yes, in flows of <0.9m/s. In flowing water, barrier must be held in place until filled	Empty the tube in a controlled manner	\$118 - \$860 per metre (0.23 - 2.44m barrier height)	1.5 hours per 100m length	None	Good flexibility to adjust to channel width Safe and controllable release of water Very compact for storage Reusable Manned channel entry is not mandatory Can be installed into deep, flowing water	Recommended to install upstream of channel structure this may not be possible at some sites Prone to damage - limited longevity Use within concrete channel may reduce service life Significant source of water required	Used in Culverts and canals	Strong	
Tube - Water-Filled (Temporary)	Aquadam	Albion Water Structures Limited	Water-filled dam with internal baffle	0.35 - 1.8	2.4	0.46 - 2.44	Any	330	Infinite - Excess Tube remains uninflated	1.5 - 19.4 /m (dependent on tube height)	Yes (dependent on size)	Pumps Longer barriers require mechanical lifting equipment	Not mandatory	1.8m max Water depth. Rope deployment method for fast flows	Empty the tube in a controlled manner	£23 - £387 per metre (0.46 - 2.44m high barrier)	1.5 hours per 100m length	None	Good flexibility to adjust to channel width Safe and controllable release of water Very compact for storage Reusable Manned channel entry is not mandatory Can be installed into deep, flowing water	Prone to damage - limited longevity Use within concrete channel may reduce service life Significant source of water required	Used within a canal Lock to allow maintenance. (presentation provided)	Strong	
Tube - Water-Filled (Temporary)	Okotec Double-Tube Boom	Okotec (supplied through Clan Tools)	Water-filled dam with two separate chambers	0.4	0.5	0.5	8	150	Limited - barrier length should match channel width	52	Yes	Compressor	Yes	Unknown	Deflate	Unknown	Unknown	None	Fast deployment Safe and controllable release of water Very compact for storage Reusable	Max controlled head is low Barrier length must be equal to channel width Prone to damage - limited longevity Air-filled offers little advantage over water-filled	Unknown	Limited	
Tube - Water-Filled (Temporary)	Argos Waterwall	Argos Fire and Safety Ltd.	Water-filled dam with internal baffle	0.8 or 1.4	1.1 or 1.6	1.1 or 1.6	2	5 (Longer barriers available on request)	2m - Channel width should closely match barrier length	40 - 210 (depending on Barrier size)	Yes (up to 5m length)	Pumps >5m long barriers require mechanical lifting equipment	Yes	Yes - methodology is not well developed	Empty the tube in a controlled manner	€500 - €1600 per metre (depending on barrier size)	40 mins per 30m length	None	Safe and controllable release of water Very compact for storage Reusable Manned channel entry is not mandatory Can be installed into deep, flowing water Other sizes manufactured to order	Limited flexibility to adapt to channel width Prone to damage - limited longevity Use within concrete channel may reduce service life Significant source of water required	Used in Ireland on Canals	Possible	



We are The Environment Agency. It's our job to look after your environment and make it **a better place** – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency  
Horizon House  
Deanery Road  
Bristol, BS1 5AH  
Tel: 0870 8506506  
Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

© Environment Agency

All rights reserved. This document may be reproduced with prior permission of the Environment Agency.

**Would you like to find out more about us,  
or about your environment?**

**Then call us on**

**08708 506 506\*** (Mon-Fri 8-6)

**email**

**enquiries@environment-agency.gov.uk**

**or visit our website**

**www.environment-agency.gov.uk**

**incident hotline 0800 80 70 60** (24hrs)

**floodline 0845 988 1188**

\* Approximate call costs: 8p plus 6p per minute (standard landline).  
Please note charges will vary across telephone providers



**Environment first:** This publication is printed on recycled paper.