



Know Your Flood Risk™

# Homeowners guide to flood resilience

A living document

# Contents

## SECTION ONE

### **Learn about your flood risk** 2

Why should I think about flood risk? 3

Flood Re 4

What is the risk to houses from flooding? 6

How do I find out if my home is at risk from flooding? 7

Should I consider protecting my home from flooding? 8

How best to protect myself, my family and my home from flooding 10

## SECTION TWO

### **Flood expertise around the UK** 16

Who does what in the UK? 17

## SECTION THREE

### **Protecting your home** 20

The flood protection product information tables 21

Permanent resistance 22

Temporary resistance 27

Ancillary products 30

Resilience 34

Community solutions 38

## SECTION FOUR

### **Sustainable drainage solutions** 42

Another piece of the jigsaw: 'SuDS' 43

## SECTION FIVE

### **Case studies** 46

## SECTION SIX

### **Directory of manufacturers** 72

# Foreword

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**Mary Dhonau, OBE**  
Chief Executive  
Know Your Flood Risk Campaign



**Carly B Rose**  
Researcher  
Know Your Flood Risk Campaign

Having been flooded ourselves, we know that flooding can have a devastating impact on homes and families. This was clearly shown by the terrible floods caused by storms Desmond, Eva and Frank in December 2015 and January 2016, which hit northern England and parts of Scotland, Wales and Ireland.

The government's recent National Flood Resilience Review states that, as: "...the risk that these or similar events will occur again, it is appropriate to reconsider our approaches to assessing flood risk, to reducing the likelihood of flooding, and to making our nation as resilient as possible to flooding."\*

Protecting your own home from being flooded still continues to be a very sensible option, however, as insurance arrangements cannot prevent the appalling disruption and emotional trauma that comes with the flooding and its aftermath.

The prospect can be a baffling one, with many people not knowing how to go about protecting their homes other than with the humble and inefficient sandbag.

This guide which is written especially with the home owner in mind hopes to reduce the worry about what flood protection products to use, and illustrates the variety of ways a home can be protected, how difficult the product is to fit and when it is appropriate to use them.

It is often the case when the flood water is too high that it is better to let the floodwater in and adapt your home to reduce the devastation the floodwater can have, so there is a section on this too, using case studies from people who have been flooded but have now taken moves to make their homes resilient to flooding.

Sadly, flooding is set to get worse and it is essential that we not only know our own flood risk, prepare in advance and take moves to protect our own homes. Being flooded is an appalling experience. This guide has been written by the Know Your Flood risk campaign in conjunction with RAB Consultants Ltd (first edition) and MDA (2014/15/16/18 updates). We hope that it will help inform you as to what can be done to mitigate against floods and help to reduce the misery that being flooded brings with it.



\* [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/551137/national-flood-resilience-review.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/551137/national-flood-resilience-review.pdf)

# 101 Learn about your Flood risk



# Why should I think about flood risk?

## For a personal perspective from Mary Dhonau

Having suffered first hand from the effects of being flooded, I know only too well what an appalling experience it is. Being a victim of floodwater ravaging your home has far-reaching and long-term consequences for everyone concerned. Flooding is not just when the media and the minister come to visit. To watch helplessly as everything you have worked so hard for is thrown into a skip is hard enough, but to lose precious sentimental items - such as children's first drawings or photos of relatives who are no longer with us - is completely devastating.

Many people have told me of occasions when they have gone to look for something only to remember it having been lost years earlier in a flood; once again, the pain comes teeming back to haunt them. The misery is further compounded by having to move out of your home into alternative accommodation for months, sometimes years on end and to stand powerlessly by and watch as your precious home becomes a building site. When re-building your home doesn't go to plan, it can often cause more upset than the actual flood itself. It is these intangible consequences of being flooded that are often overlooked when thinking about protecting your home from being flooded again in the future.

Many of us happily invest in smoke alarms and security locks to protect ourselves against fires or thefts but if you live in a floodplain you're far more likely to be flooded than have your house lost in a fire. A flood is the most effective and indiscriminate 'burglar' there is, it will take everything you have including items of no value to anyone else. We don't stop to think about investing in flood prevention as we believe that Government should protect us, or our insurance will cover it. The sad truth is that with so many of us at risk of being flooded, there just isn't enough Government money to protect everyone and your insurance cover might not pick up the full bill.

Whilst protecting a home from being flooded is not cheap, flood insurance is becoming extremely expensive, if you are not eligible for Flood Re (see page 4). Taking steps to protect your home from flooding may enable you to obtain insurance at a more affordable price than would otherwise have been available, you'll certainly be looked on more favourably than if you do nothing.

## How can resistance and resilience help people access affordable insurance currently?

Resistance and resilience measures can avoid the need to claim, or reduce the value of any claim made, which can help maintain access to mainstream insurance. It is more common for insurers to take account of flood resilience measures when providing insurance to large commercial and public sector customers. For homes, some specialist insurers will take account of resistance and resilience that are installed to reduce the effects of flooding.



For information about how to purchase a flood report go to:  
[www.knowyourfloodrisk.co.uk](http://www.knowyourfloodrisk.co.uk)



# Flood Re



**Andy Bord**  
CEO at Flood Re

## Delivering more affordable home insurance for those affected by flooding

Being flooded is a devastating experience. Sadly it is one that those who have lived through it, know only too well.

As many of you are aware, the trauma of dealing with the clean-up is not the only challenge that comes once the water has disappeared. Those of you who have been hit by flooding are more than familiar with the difficult task of finding and paying for insurance cover if you have been flooded or live in a high flood-risk area.

You may or may not be aware, but a scheme designed specifically for those who have been affected by flooding or are at risk of flooding launched in April 2016. The scheme – Flood Re – has been jointly set up by the insurance industry and Government and works through a £180m levy on the insurance industry. This has been used to create a subsidy for householders that should significantly reduce excess levels for those in high flood-risk areas and give them access to affordable insurance cover.

Flood Re works in the background to help provide more affordable cover. In fact, local people in flood-prone areas won't deal directly with Flood Re. All contact remains with consumers' chosen insurer, including the process for handling claims in the event of a flood.

Our team has been working hard to promote the scheme since its launch which has included meetings with local

flood forum leaders, councillors and key stakeholders to raise awareness of the scheme and answer questions about how it works and what it means for customers. Over the first 18 months, we have underwritten 142,000 policies, which means that at risk households across the country are benefitting from the increased availability of more affordable flood cover.

Before the introduction of Flood Re, only 9% of householders who had made prior flood claims could get quotes from two or more insurers, with 0% being able to get quotes from five or more.

By October 2017, availability had improved so that 100% of those surveyed could get quotes from two or more insurers, while 93% of these households could get quotes from five or more.

Four out of five of householders with a prior flood claim saw price reductions of over 50%.

Since the scheme launched, we now have well over 60 insurers which have signed up the scheme, representing 90% of the home insurance market. A list of those insurance brands that are providing Flood Re supported products can be found on our website.

In 2017, we ran a hugely successful campaign to recognise 'local heroes' across the UK that have shown leadership and resilience around their flood relief efforts. Entries from around the UK were judged by an expert panel. After much deliberation, the panel awarded Geraldine Brown





## FLOODRE

from Yalding in Kent who has committed almost 20 years to reducing the impact of flooding, the Local Heroes Award and £10,000 towards supporting her ongoing community work. She was one of six finalists, who were recognised for their sterling efforts at an event in the House of Commons. You can read more about the Local Heroes award [here](#).

### What do you need to do?

**To see if you are eligible for Flood Re, there are three easy steps to follow:**

1. Talk to your existing insurer and ask them if your home is eligible for the Flood Re Scheme (details of our eligibility are set out on our website)
2. Be prepared to shop around
3. Remember, finding the right advice and products is important

We have created a video which helps explain how the scheme works which can be viewed on our website:

Are you on social media? If so, we have also created dedicated feeds which we would invite you to follow on Facebook and Twitter.

At Flood Re, we are committed to working with insurers to get this right for households. If you have any specific policy queries do speak to your current insurer who will be able to provide you with more information.

**Before the introduction of Flood Re, only 9% of householders who had made prior flood claims could get quotes from two or more insurers, with 0% being able to get quotes from five or more.**

# What is the risk to houses from flooding?

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## 1. Surface water flooding

In prolonged, exceptionally heavy downpours, which are becoming more frequent, the ground may saturate and the drains and sewers which carry away surface water may not be able to cope or may even be blocked with debris or hailstones, leading to surface water flooding. Surface water flooding will flow downhill and collect in low-lying areas which means that houses in low basins or at the foot of slopes may be at particular risk of surface water flooding.

## 2. Groundwater flooding

Groundwater flooding generally occurs during long and intense rainfall when infiltration into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by porous soils and rocks, or in areas with a naturally high water table. Groundwater flooding is a particular risk to buildings with basements.

## 3. River flooding

River flooding occurs following heavy rainfall (or melting snow) across the upstream reaches and tributaries of a watercourse where the normal river channel is unable to carry the resulting high flow of water. Adjacent low-lying properties and land are then liable to flood. River flooding can extend over very large areas causing widespread damage and may be long-lasting and difficult to drain away. Fast-flowing floodwaters can be dangerous to people and animals and can structurally damage buildings.

## 4. Coastal and tidal flooding

Coastal and tidal flooding is caused by high tides coinciding with a low pressure storm system which raises sea and tidal water levels, overwhelming coastal defences. This may be made worse by strong winds blowing sea water onto the coast. Coastal flooding may affect not only property on the coast itself but also property in tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers.

## 5. Reservoir or dam failure

There are many thousands of reservoirs and retained bodies of raised water across the UK, that pose a flood risk from failure of the retaining dam. Reservoirs larger than 25,000 cubic metres must be registered with the Environment Agency (or equivalent bodies in Scotland and Wales) and will be regularly inspected to ensure their safety. Dam failures in the UK are uncommon, so while the consequences of a dam failure are potentially catastrophic and could affect a large area, the chances of it happening are remote. There are many smaller bodies of raised water, such as mill ponds and agricultural treatment lagoons that may pose a flood risk locally.

## 6. Burst water mains

Considerable amounts of water may be released, which may flood the street and enter adjacent properties. The flooding is usually comparatively shallow and short-lived, but may nevertheless cause extensive damage to the ground floors or basements.

## 7. Sewer flooding

When sewage escapes from the pipe through a manhole, drain, or by backing up through toilets, baths and sinks this is known as sewer flooding. Sewer flooding can be caused by: a blockage in a sewer pipe; a failure of equipment; too much water entering the sewers from storm run-off (from roads and fields) and rivers and watercourses which overflowed; or the sewer being too small to deal with the amount of sewage entering it. The cause of the problem may be some distance away from where the flooding is happening. A flood can happen to any property from one or more of these sources and at any time. For most property in the UK the risk is small, however some premises are more at risk than others because of their geographic location and particular local situation. Flooding of your home will almost always involve water entering the building from outside. Houses are usually built to prevent 'normal' water sources getting in by the use of damp proof membranes, roof over-hangs, guttering, below ground drains and raised finished floor levels in the ground floor. Normal house construction is not designed to keep flood water out when large amounts of water lie against the building for any period of time. There are many routes by which external flood water can enter your house. Some are very obvious such as doorways, windows, air bricks and cracks in walls. Others are not so visible such as washing machine outlets, downstairs toilets, soaking through brick walls, below ground gaps in the walls and floors. The chance of water getting into your house will also depend on things like the depth of flood water and the time it takes to drain away.



# How do I find out if my home is at risk from flooding?

The first check that you can do, and which doesn't cost anything, is to investigate whether your property is at risk of flooding from a number of sources, using the maps provided by the relevant agency for your part of the UK.

These are:

## England

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

## Wales – (in English or Welsh)

<https://bit.ly/2Dp1rBc>

## Scotland

[www.sepa.org.uk/environment/water/flooding/flood-maps](http://www.sepa.org.uk/environment/water/flooding/flood-maps)

## Northern Ireland

<https://bit.ly/2sYG8Sv>

(The colour coding and symbols used may vary)

By choosing the relevant map and entering your post code the map will indicate the areas at risk of flooding, for example: in England, the dark blue shading for the highest risk, lighter shades where there is some risk and no shading where the risk is very low (meaning that each year, this area has a chance of flooding of less than 1 in 1000 or 0.1%). Click the map at the location of your house and a summary of flood risk at that area will be provided. The risk is graded as 'very low', 'low', 'medium' or 'high'.

An additional map, called 'Flood and coastal risk management activities' shows where new schemes are being planned, and the likely year of the work. These maps give a general guide only, and are not accurate down to individual properties. They show areas at risk, and if so, whether there are considered to be adequate flood defences in place. However, they do not take into account local variations in physical features, nor the height of a property's lowest floor above the surrounding ground.

At the time of writing, the maps do not give any information about the flood risk from raised bodies of water holding less than 25,000 cubic metres (such as agricultural lagoons or mill ponds), nor groundwater flooding. The Know Your Flood Risk campaign is currently uniquely placed to provide information on your groundwater flood risk as part of our (chargeable) Flood Report.

Local knowledge is an important source of information about the flood risk to your home. Long-standing neighbours may have useful knowledge about flooding that occurred in the area before you moved in. Your local council or water company may hold flood records. For a more accurate assessment of flood risk you can go to a specialist search provider who, for a small fee, will provide you with a more detailed, 'desktop' property-specific report. This will determine the risks from the different types of flooding, including local groundwater flooding risks which are not currently included on the Environment

Agency's flood maps. Currently (2015) the VAT exclusive cost of such a search is around £25 for a residential property, though higher for commercial properties depending on the total number of hectares covered. This type of report will not go to the level of detail where you would know what to expect when a flood occurs, you may still have questions such as: From which direction will water come? How much warning will I get? How deep will the water get? For how long will the water stay? How often will I flood? Will water get into my house? Can I protect my home? A specialist flood risk consultant would be able to answer these questions but you should expect fees of several hundred pounds. These are very modest costs when compared with the overall price of your house, mortgage costs and ongoing insurance fees.



# Should I consider protecting my home from flooding?

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Whether and to what extent flood protection measures are necessary will depend on the degree of flood risk, and the vulnerability of your house and occupants. As a minimum you should investigate the degree of risk to your property using the map links provided on page 6 of this Guide.

Even if your property does not lie in a shaded area (very low risk) it is very important to note there may still be risk of flooding, for example, from groundwater, or raised bodies of water holding less than 25,000 cubic metres (such as agricultural lagoons or mill ponds).

If there is a low risk, usually meaning that the chance of flooding is less than 1 in 100 (1%) in any year (Insurance Band 1 type properties as a broad guide), but the risk is not serious enough to significantly affect the buildings insurance, you should make some plans about how you would deal with a flood if one was to occur, bearing in mind that floods are happening to many properties which have never previously flooded. As a minimum, you need a Flood Plan (discussed as part of the next question). You may also consider introducing some flood protection measures when convenient, for example when you are carrying out refurbishment and replacement work.

If the risk is medium, there is a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%). (Insurance Band 2 properties and some others at local risk), for example if the property has previously been flooded, you should have a Flood Plan (discussed as part of Section 5) and you may also consider whether some flood protection measures to the property would be appropriate. These measures can be implemented when improvements and alterations are undertaken, perhaps as a consequence of new ownership, or may be undertaken solely to ensure peace of mind and maintain market value. If the risk is high, with a chance of flooding greater than 1 in 30 (3.3%). (Insurance Band 3 properties, and those which have been flooded more than once within the last ten years or so), you will need a Flood Plan (discussed as part of Section 5) and you should actively consider flood protection measures, in order to maintain insurance cover and to minimise the negative impact on market value.

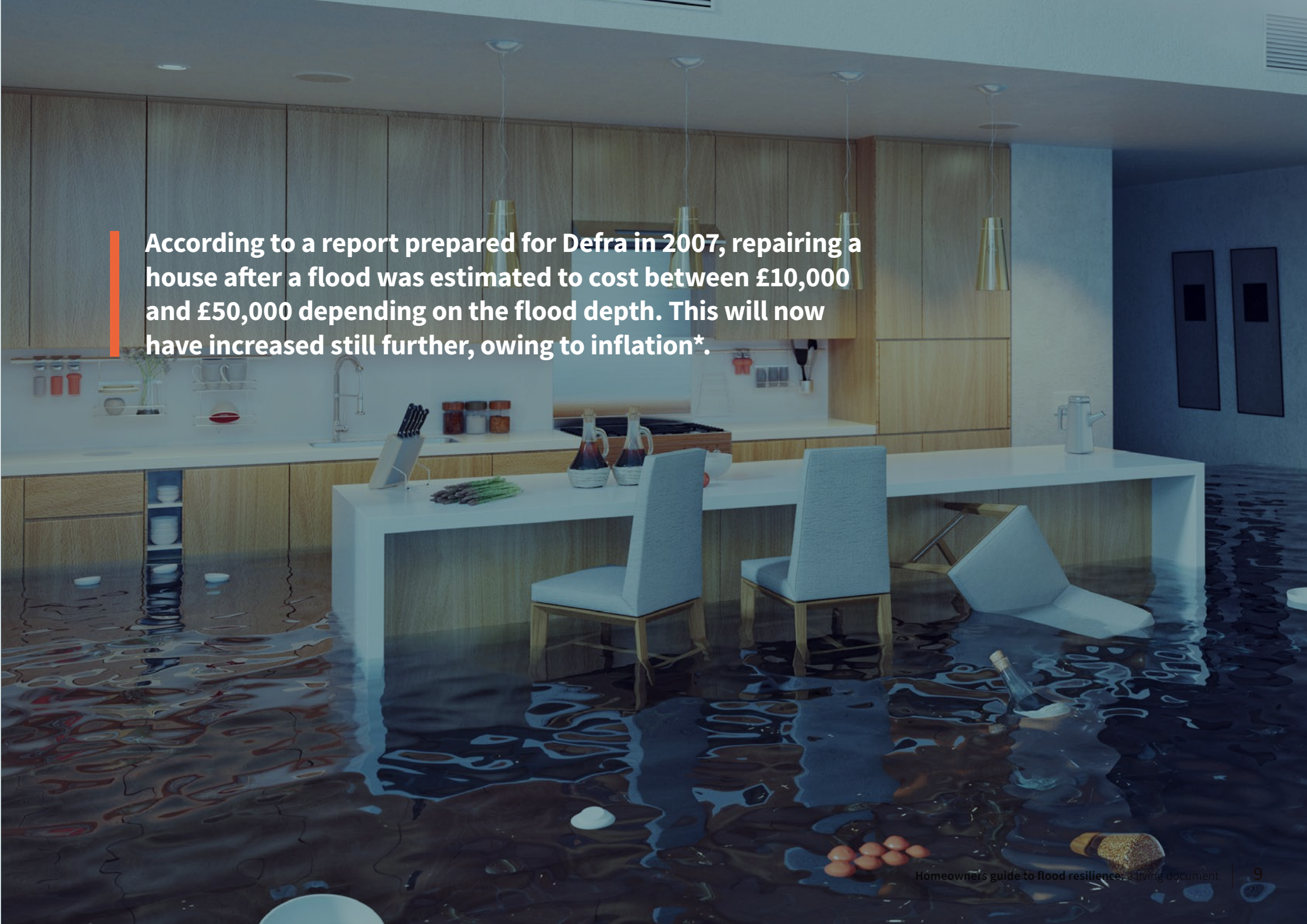
**Having decided whether you should apply flood protection, the next question is, of the many options available, which is the best choice for me?**

Academic research has found flood protection measures to be cost-effective\*\*:

“While resilient repairs were found to be more expensive than traditional methods (average 34% higher) they were found to significantly reduce the repair costs assuming a subsequent flood were to take place. Resilient flood mitigation measures... will help in limiting the cost of repairs up to as much as 73 per cent for properties with a 20 per cent annual chance of flooding... the up-front investment would be recovered following a single subsequent flood event.”

\* Bowker, P, 2007. Flood Resistance and Resilience Solutions. An R&D Scoping Study. R&D Technical Report.

\*\* Rotimi Joseph, David Proverbs, Jessica Lamond, Peter Wassell, (2011) “An analysis of the costs of resilient reinstatement of flood affected properties: A case study of the 2009 flood event in Cockermouth”, Structural Survey, Vol. 29 Iss: 4, pp.279 - 293



**According to a report prepared for Defra in 2007, repairing a house after a flood was estimated to cost between £10,000 and £50,000 depending on the flood depth. This will now have increased still further, owing to inflation\*.**

# How best to protect myself, my family and my home from flooding

To keep yourself and your family safe and to choose the best option for protecting your home, you are going to need some facts about the flood risk and facts about the vulnerability of your house. The more reliable the facts then the more certain you can be that you have chosen the best option. Factors that influence the best choice of flood protection is discussed below. However you should be aware that many of the important facts can be difficult to establish and require technical knowledge and experience to make reliable estimates. You should obtain specialist advice from surveyors with flood risk experience or specialised flood risk consultants.

The area at risk of flooding should be identified and the mechanism of flooding determined, such as the source of flooding (e.g. rivers, seas, reservoirs, groundwater, surface water, sewers and mains supply) and the pathways that water will take to reach the site.

## Facts about the flood risk

These four key factors are used to decide what you and your family should do when flooding strikes, for example 'evacuation' or 'go-in, stay-in and tune-in'. The factors are also important for guiding the best way to flood protect your home. As well as listing currently available flood protection products, this handbook includes a simple graphical indication of the applicability of the products to flood depth, flood duration, flood onset and flood probability.

There are other important factors that have an impact on flood risk at your home, notably the expected velocity of flood water. Rapidly flowing water at even low depths will increase the risk to both people and buildings.

The effect of flood defences should also be taken into account when estimating the above factors.

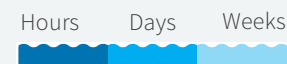
Sources of information for the important factors include the Environment Agency, local authority and local library archives. Local knowledge, particularly from long-standing residents, is invaluable. Calculations of things like rainfall, river flows, pipe capacities and measurements of ground levels may be needed to make reliable estimates, for which you should obtain specialist help.

## There are four facts about the flood water that are of particular importance:

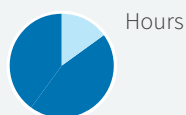
**Flood depths** expected at your house. Low depths, for example 100mm, are unlikely to put people at risk but water damage to buildings and contents may be significant without any flood protection. High water depths, for example 1m, may severely threaten the safety of people and may cause extensive damage to buildings. It may be dangerous to keep deep floods out of a building because of the large weight of water pressing against the walls.



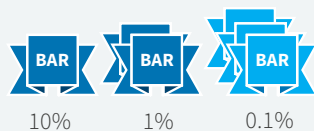
**Flood duration** is the time that flood water is expected to stay at your house. Temporary flood defences may successfully keep water out if flooding is expected to last for just a couple of hours, whereas, long flood durations may give time for water to penetrate into the building. It may be safe to take refuge and stay in a building for short duration floods but this will depend on the other factors.



**Flood onset** is the time for flood water to reach your house from its source. Short onset flooding (flash floods) are particularly dangerous as there is little time available to get people to safety or to protect buildings.



**Flood annual probability** is a measure of the chance of flooding to your house over the course of 1 year. Different approaches to flood protection may be needed depending upon how likely flooding is expected.



**Dark blue** indicates strong applicability of products in dealing with flooding, with **light blue** indicating reducing applicability.

## Facts about your home – a property-level survey

A property level survey should establish facts such as the level of thresholds and floors, the likely points of water entry, whether attempts should be made to keep water out of your home or just to allow the water in and enhance the building in such a way as to limit the damage and promote rapid clean up. The property-level survey of your house should be performed by an experienced professional. A standard template for surveying property-level flood risk has been developed by the Environment Agency/Defra in association with the Association of British Insurers, British Institution of Insurance Brokers and the National Flood Forum.

The documents can be found at:  
<https://bit.ly/2KyCCsY>

This gives surveyors a recognised framework for assessing flood risk and will help people set out the flood risk information that insurers may ask them to provide. This offers a way of encouraging insurers to accept good property level protection schemes as a way of mitigating insurance, and therefore making insurance more available and affordable. However, it will need to be promoted to people, local authorities and agencies, as well as the insurance industry.

## Choosing the right flood protection products

Flood protection designed to keep water out of your house is referred to as flood ‘resistance’ products. Temporary flood resistance products are those that need deploying (fitting or activating) prior to flooding arriving whereas permanent flood resistance products do not need activating. Flood ‘resilience’ refers to measures that reduce flood damage to buildings in situations where water is allowed to enter.

The important facts about the flood risk and the facts about your home, when taken together, will guide the best choice of permanent resistance, temporary resistance or resilience and the product lists in this handbook will help with this. Other factors will play a part in the decision making process, such as cost, visual impact, ease of deployment and product performance.

The best answer for your home will most likely involve a combination of products. Other risks, such as the continued operation of fire exit doors, will need to be considered and competing priorities balanced as well as ensuring that any protection methods do not unnecessarily add to flooding elsewhere. In some situations, such as where surface water is the main source of flooding, the best answer may not involve the products discussed in this handbook, such as improving drainage systems or re-landscaping gardens.

The chosen flood protection products will only be effective if they are used in the right way, at the right time and are stored and maintained correctly to ensure their long term effectiveness. You need to be clear about the best way to act in a flood emergency to protect lives and buildings. A flood plan is essential for achieving these aims.

## Make a Household Flood Plan!

Being prepared for an emergency will reduce the risk to you and your family and limit the damage to your house and its contents. A Household Flood Plan will need to establish the best emergency actions and who does what when flooding looks set to strike.

The important facts about flood risk and the availability of flood warnings will guide your best action in an emergency. Evacuation is most appropriate where flooding is deep and flood warnings will give you time to move to a place of safety unaided. Identifying a place of safe refuge with possible rescue by the emergency services may be the best approach where rapid flooding occurs and safe evacuation is not possible.

The Household Flood Plan should clearly list actions needed on receipt of a flood warning, such as how to set up any temporary flood protection devices as well as giving a maintenance schedule to ensure correct operation of devices in the future. The plan should take account of the possibility of flood protection devices failing or their design being exceeded.

## Flood warnings

Flood warnings will give you time to prepare for flooding which could save you time, money and heartache. They are also vital in order to know when to carry out your flood plan. A free Flood Warning service is currently available for England, Wales and Scotland. To find out if a service is available in your area, and to sign up contact Floodline on: **0345 988 1188**

This service sends you a direct message when flooding is expected and may affect your property. You can receive warnings by telephone, mobile, email, SMS text message or fax, whichever you prefer. You can also view flood warnings through a variety of websites, phone apps and social media channels.

There are other warning services that are available where an area isn't covered by a formal flood warning service, for example the Met Office provides a National Severe Weather Warning Service (NSWWS) to warn the public of severe weather, including heavy rainfall. The NSWWS issues alerts when severe weather is expected more than 24 hours ahead and warnings when severe weather is expected in the next 24 hours.

All warnings and alerts appear on the Met Office website: **[www.metoffice.gov.uk/public/weather/warnings](http://www.metoffice.gov.uk/public/weather/warnings)**

They are also communicated to the public via electronic and broadcast media. Some local authorities may also issue warnings to residents. Private flood level alarms are also available for purchase (refer to page 22).

It is vital that your Household Flood Plan is kept up to date, such as when circumstances change, and to make sure that everyone knows what to do what flooding occurs.

Your local council is an important resource when creating a Household Flood Plan for things such as finding a place to evacuate and whether you are best to evacuate or stay in your house. They may have an emergency planning officer to offer assistance.

The Environment Agency provides a guide for preparing a Flood Plan and offers a template to follow on the website. You can access this by visiting: **<https://bit.ly/2K5wojZ>**

As the floods of December 2015 showed, people who currently live behind community flood defences can still be flooded if the water should ever flow over the top. For these properties, as well as those at risk of very deep floods, keeping the water out (even if only temporarily) using resistance measures can 'buy' some valuable extra time for raising and moving belongings (although the advice of the emergency services regarding evacuation must always be followed). If resilience measures (such as waterproof/water resistant materials) are also used, then the post-flood clean up and the amount of time families have to spend out of their home, can be drastically shortened. An imaginary home that combines both these approaches is shown overleaf.

There are three flood warning codes:



### **FLOOD ALERT**

A Flood Alert means that flooding is possible and that you need to be prepared



### **FLOOD WARNING**

A Flood Warning means that flooding is expected and that you should take immediate action. You should take action when a flood warning is issued and not wait for a Severe Flood Warning.



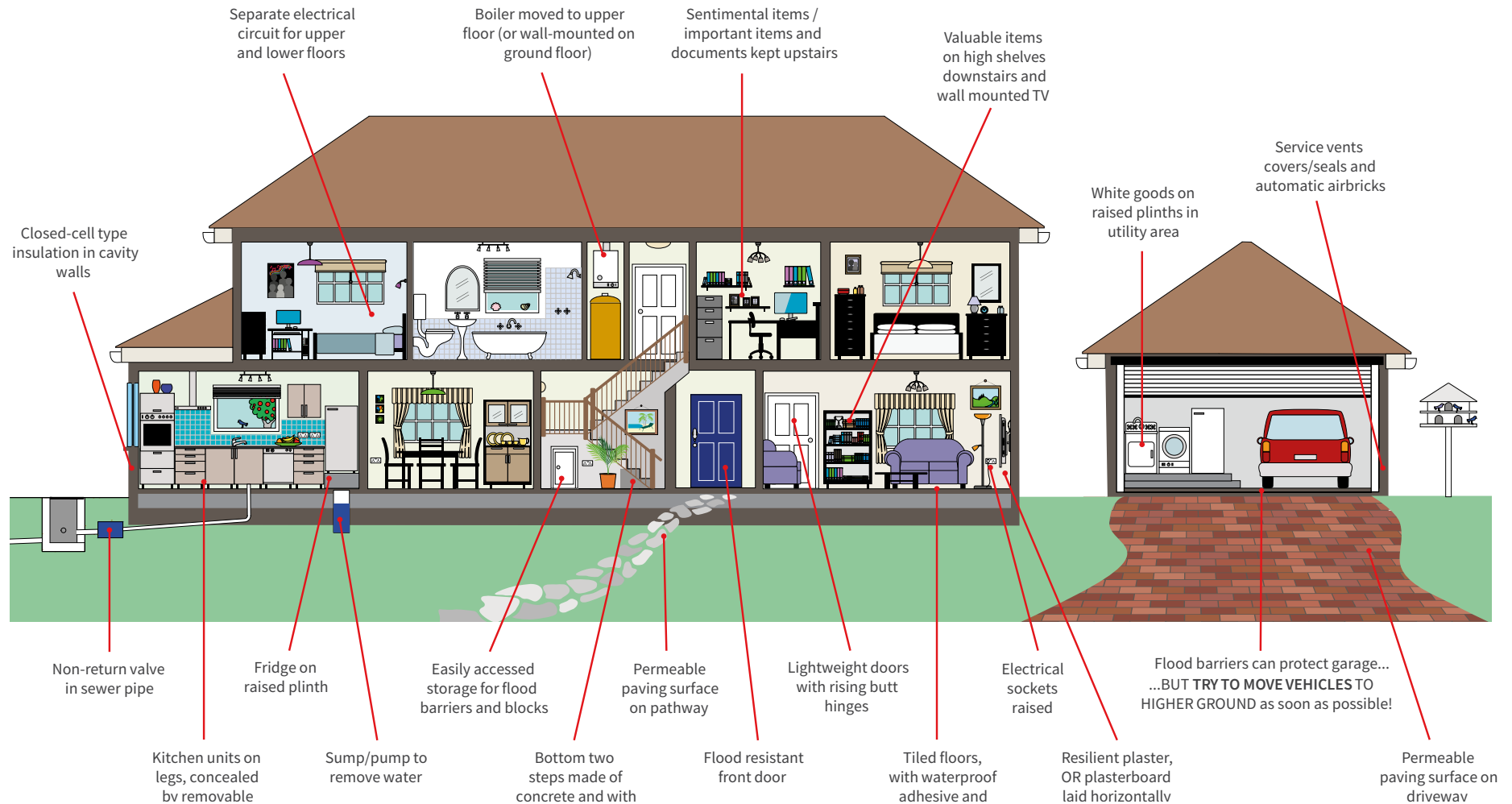
### **SEVERE FLOOD WARNING**

A Severe Flood Warning means that there is severe flooding and danger to life. These are issued when flooding is posing significant risk to life or disruption to communities.



## Combined resistance and resilience measures

Keeping water out for as long as possible buys valuable time to raise / move your belongings







# 02 Flood expertise around the UK



# Who does what in the UK?

Many organisations are involved in managing various aspects of flooding in the UK – and the picture is still more complex, because different arrangements can apply to England, Scotland, Wales and Northern Ireland. We therefore approached each organisation, asking them to describe their responsibilities in simple terms – and we are extremely grateful to the friendly folk whose pictures appear below for shining a light into some of the darker corners!

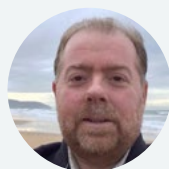
This section aims to provide an easy-to-follow summary, with a brief description of each body's involvement – the symbols indicate the areas of the UK in which that organisation operates.



**John Curtin**  
Executive Director of Flood & Coastal Risk Management



The **Environment Agency** is the national flood risk agency for England and we play a central role in managing flood risk. We advise on, and bring together, the planning and management of risks from all sources of flooding and coastal erosion (rivers, the sea, groundwater, reservoirs and surface water).



**Stewart Prodger**  
Communications & Customer Service Manager



The **Scottish Environment Protection Agency (SEPA)** is Scotland's national flood forecasting, flood warning and strategic flood risk management authority. SEPA forecast flooding by working closely with the Met Office to predict the likelihood and timing of river, coastal and surface water flooding. SEPA delivers the free Floodline service for Scotland providing live flooding information and advice on how to prepare for or cope with the impacts of flooding 24 hours a day, 7 days a week. We work closely with other organisations responsible for managing flood risk including local authorities, Scottish Water, the National Park Authorities and Forestry Commission Scotland.



**Defra**  
Department for the Environment, Food and Rural Affairs



**Defra** (the Department for the Environment, Food and Rural Affairs) has policy responsibility for flood risk management in England. This includes: working with the Environment Agency to prioritise and fund flood defence spend, for new build and maintenance; considering complementary approaches to flood management, such as catchment management; and leading on flood response for complex or wide area floods.



**Phil Rothwell**  
Chair, English Severn and Wye



**Regional Flood and Coastal Committees (RFCCs)** play a key role in local funding and giving consent to programmes of work that protect local communities from flooding and coastal erosion in England. The 12 RFCCs, with the Environment Agency and other Risk Management Authorities, seek to reduce flood risk and the risk of coastal erosion by working in partnership with other organisations, especially in local government and with local communities.

**Scottish Government**  
Flood Risk Management



Policy responsibility for flood risk management in Scotland rests with the Scottish Government.



**Kirsty MacRae**  
Director



The **Scottish Flood Forum** is a charitable organisation working to improve understanding and raise awareness of the risks and consequences of flooding to individuals and communities throughout Scotland; and to facilitate effective support to them after a flood event.



**Josie Bateman**  
Flood and Water Manager



A **Lead Local Flood Authority (LLFA)** is a county council or a unitary authority that is responsible for local flood risk management in its area. The LLFA will provide a wide range of measures to manage local flooding in a co-ordinated way that balances the needs of communities, the economy and the environment.

**Welsh Government**  
Flood Risk Management



Policy responsibility for flood risk management in Wales rests with the Welsh Government.

**Highways Authorities**  
Highways Agency & unitary  
/ county councils across the UK



Highways authorities (the Highways Agency and unitary/ county councils across the UK) have the lead responsibility for providing and managing highway drainage and roadside ditches under the Highways Act 1980. The owners of land adjoining a highway also have a common-law duty to maintain ditches to prevent them causing a nuisance to road users.



**Jeremy Parr**  
Head of Flood and  
Incident Management



**Natural Resources Wales'** purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future. We work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution.



**David Porter**  
Chief Executive  
DfI Rivers



The **DfI Rivers** is part of the Department for Infrastructure in Northern Ireland. Its vision is to manage flood risk to facilitate the social, economic and environmental development of Northern Ireland. We aim to reduce risk to life and damage to property from flooding from rivers and sea, by undertaking watercourse and coastal flood management in a sustainable manner.



**Jonathan Millard**  
Senior Hydrometeorologist



The **Flood Forecasting Centre (FFC)** is a partnership between the Environment Agency (EA) and Met Office (MO) based at the MO headquarters in Exeter and is a 24/7 operational centre. The staff work closely with MO, EA and Natural Resources Wales operational staff to understand current weather, ground, river and coastal conditions in order to produce forecasts and understand the potential for flooding.



**Steve Grebby**  
Policy Management



The **Consumer Council for Water (CCWater)** is the independent voice for all water consumers in England and Wales. We provide free advice to consumers and keep them informed on the issues that affect their water and sewerage services. We also take up the complaints of household and non-domestic customers when they are unable to resolve them directly with their water company. If you have suffered flooding from public sewers and you are unhappy with the response from your Water Company, we will be able to provide advice, help and support to make sure the problem is resolved.



**Paul Cobbing**  
Chief Executive



The **National Flood Forum** exists to help, support and represent individuals and communities at risk of flooding. We understand the impact a flood can have on lives and livelihoods and we focus on putting people first. We do this by: supporting and listening to communities so they feel empowered to reduce their flood risk; helping people to recover after they have been flooded; and representing people at risk of flooding to ensure the authorities and government develop a community perspective.



**Steve Hodgson** CEO



The **Property Care Association (PCA)** is the trade association representing professionals in the property care industry in the UK, including flood recovery and flood resilience.

The PCA's mission is to work to promote high standards of technical competency, expertise and service across the sectors it represents.

The PCA has developed a range of Codes of Practice and Best Practice Guidance including a comprehensive 'Code of Practice for the Flood Protection of Buildings'.



**Innes Thomson**  
Chief Executive



The **Association of Drainage Authorities (ADA)** is the membership organisation for those involved in drainage, water level and flood risk management. Its members include Internal Drainage Boards (IDBs), the Environment Agency, Regional Flood Defence Committees, Local Authorities, Natural Resources Wales, the Northern Ireland Rivers Agency, consultants, contractors and suppliers.



**Jonathan Glerum**  
Asset Management



**Tim Smith**  
Flood Risk Manager



Water and sewerage companies' main role in flood risk management is to provide and maintain a system of public sewers. These are designed to protect properties from the risk of flooding in normal wet weather conditions, however, in extreme weather conditions there is a risk that sewers can become overwhelmed and result in flooding. Sewer flooding can also occur because of blockages and defects with the sewerage network.

# 03 Protecting your home



# The flood protection product information tables

The following pages of this handbook provide a list of flood protection products grouped into categories to help you understand the way they work and to assist with choosing the best product. Each category is described with simple graphics showing the kind of flood situation to which that group of products is most applicable. Advice on flood plans is given within the product categories, such as the importance of warning systems to deploy products in good time or training needed to correctly erect flood defences.

A list of products currently available for each category is provided with notes on advantages/disadvantages and the current suppliers of such items. The indicative costs (for application to a single dwelling) are banded as follows:

< £100	Low
£100 - £750	Low-medium
£750 - £1500	Medium
£1500 - £5000	Medium-high
> £5000	High
> £10000	Very high

Flood protection products that have been performance tested and comply with the relevant kitemark standards are indicated by 'BSi'.

## Kitemarked products

**PAS 1188' is an industry driven standard**, which provides a benchmark for flood resilience technologies. A 'publicly available specification' (PAS) typically forms the first stage in formulating a full British Standard. Testing involves static water, waves and currents. It was first developed by the British Standards Institution (BSi) in association with the Environment Agency in 2003, updated in 2009, and again in 2014. The 2014 edition is a more stringent standard (with lower permitted leakage rates, for example). The categories are as follows:

### Building aperture products PAS1188-1

This includes parts of the building which allow people to enter or provide ventilation to the building (e.g. windows) up to a width of 2,400 mm. The products are tested in conditions for static flood water rising up to a level between 600 mm and 900 mm above ground level. The permissible leakage rate is now reduced from one litre to a maximum of 500ml per hour per metre of seal under the designated maximum water depth.

### Temporary products PAS1188-2

A temporary flood protection product is for use away from buildings but may be sealed against structures or buildings at section ends. They can also help to reduce the seepage of groundwater into the lower foundations and ground floor level of the property. The 2009 maximum leakage rate was 40 litres per hour per metre of product measured along its base where it forms a seal.

### Building skirt and wall sealant systems PAS1188-3

It is intended for the temporary sealing of the above ground external faces of buildings and properties, in the event of flood water rising up to a level between 600 mm and 900 mm above ground level. (There are no products licensed in this category at the time of writing, October 2015).

### Demountable products PAS1188-4

A demountable flood protection product is capable of being removed and reinstalled on permanent mountings. It is for use away from buildings and may be sealed against structures or buildings at section ends. The 2009 maximum leakage rate was 40 litres per hour per metre of product measured along its base where it forms a seal.

For more information visit the British Standards Institute website: <https://www.bsigroup.com/en-GB/Product-Directory/>

Followed by: 'and select Flood Protection from the Sector menu'

# Permanent resistance

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Permanent resistance products are designed to stop water entering your home either through existing openings (doors, windows, airbricks, vents and pipes) or to stop it penetrating the walls. Flood protection is permanently in place, with no action needed to deploy the device, which is why it is often described as a 'fit and forget' approach. These measures are designed to lessen the damage that floodwater can do and also to give homeowners extra time to move ground floor contents. The measures may only be effective for a limited time and limited water depth.

These products will only keep water out if they are correctly used as part of a package of measures identified from a property-level flood protection survey carried out by a qualified and experienced surveyor. No particular action is required by you to make the product work and so they will protect even while you are away from your home and if flooding arrives quickly with no warning. The products are designed to keep water out for long periods, however seepage is possible (depending upon both workmanship and flood conditions) and the BSI Kitemark standard allows for some seepage.

There is a risk to the structure of your home if deep water is held back by the external walls due to the pressure of water. For this reason the products are only suitable for limited flood depths. A structural assessment of the building is recommended where flood depths in excess of 300mm (about a foot) are intended to be resisted.

## Flood plan considerations

These products do not require activating to make them work and so protection to your home does not depend upon receiving and acting on a flood warning. No training is needed to operate the products and no long term storage of items is required. Routine inspection and maintenance of the products is however essential.


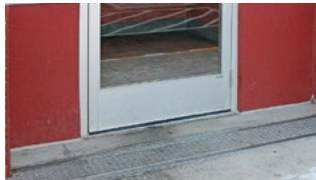

Creating a flood plan is important for protecting people and your property in an emergency. As well as stating who does what when flooding is expected, the flood plan should say what to do in a 'worst case scenario' such as water seepage through flood protection devices, flooding that is higher than the flood protection product s are designed to resist and people being trapped in the home with rising water.




## Private flood level alarms




As the devices themselves are permanently installed, details of these products are included in the first section. If your home is in an area not served by official flood warnings, you may be able to install a private flood level alarm system. These normally include a water sensor and an alarm unit. The sensor will detect flood water and send a signal to the alarm unit that will make a sound an alert to warn you of the approaching flood risk. The sensor will need to be carefully installed at a location where rising flood water will be detected well before your home is about to flood to alert you to the risk (such as during the night) and to give you time to take action. It is recommended that you obtain expert help choose the right system and correctly install it. Permission from landowners and local authorities may be needed prior to installing the sensor.


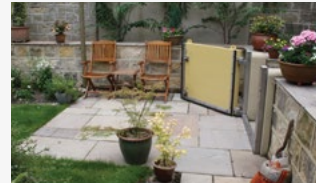
**Permanent resistance products are designed to stop water entering your home either through existing openings (doors, windows, airbricks, vents and pipes) or to stop it penetrating the walls.**



Product type	Indicative cost	Available products/suppliers	Comments	Images
Auto-barriers	High to very high	<ul style="list-style-type: none"> <li>• Self Closing Flood Barrier (Flood Control International)</li> <li>• 'Auto Roller shutter'; 'FloodBreak' (Aquobex)</li> <li>• 'Spring Dam' (Littlehampton Welding Ltd)</li> <li>• Vertical Rising Barrier/Lateral Rising Barrier (IBS Engineered Services)</li> </ul>	<p>Powered by floodwater itself, no electrics.</p> <p>Unobtrusive. Structure of building is not the limiting factor. High initial cost, including below-ground work; May need additional seepage measure.</p>	 <p>Self Closing Flood Barrier (raised position)</p>  <p>Self Closing Flood Barrier (concealed below ground)</p>
Water-resisting external doors / windows	Medium-high	<ul style="list-style-type: none"> <li>• Flood Safety Door' BSi (Aquobex);</li> <li>• 'Flash Flood Door' BSi; and 'Flood Resistant Garage-door' (Flash Flood Doors Ltd)</li> <li>• Flood Resistant Doors (Flood Divert Ltd; Crocodile)</li> <li>• 'FloodProof' doors (FloodGuard Uk Ltd)</li> <li>• 'StormMeister' flood doors and windows (StormMeister Flood Protection)</li> <li>• Window hatches/Steel overdoors (IBS Engineered Services)</li> <li>• 'Flood Plan door' (Stormguard)</li> <li>• 'Whitehouse Flood Door' (Whitehouse Construction Co Ltd)</li> <li>• 'Ark' Flood Defence Door BSi (Lakeside)</li> <li>• 'Hydrodoor' wooden, composite or UPVC doors (The Flood Company)</li> <li>• Lakeside Flood Windows (Lakeside)</li> <li>• 'Manor Prime' windows (The Flood Company)</li> </ul>	<p>Some models include 'Escape hatch' option, built in to the top half of the door, to aid rescue/delivery of emergency supplies etc whilst keeping water out of the property.</p> <p>Unobtrusive - look the same as normal doors. Some types may need measures to deal with seepage. May be difficult to evacuate if people are trapped inside with rising water. A door may keep water out at depths that are dangerous to the structure of the building.</p> <p>These windows still open when required; designed to withstand collision from floating debris.</p>	 <p>Flash Flood Door (BSi)</p>

Product type	Indicative cost	Available products/suppliers	Comments	Images
Render / external tanking	Medium to High	<ul style="list-style-type: none"> <li>• 'Polyprufe' ext tanking (Aquobex)</li> <li>• 'Vandex' cementitious range (Safeguard Europe)</li> </ul>	<p>Should seal all cracks even when walls are in relatively poor condition.</p> <p>Below-ground work involved. May just reduce penetration rate. May need facing bricks as well. May need planning approval – visually alters building. May lead to damp within the walls.</p>	 <p>Ref: Severn Trent</p>
Wall sealant	Medium (including labour)	<ul style="list-style-type: none"> <li>• 'Aquistop'/'InsuDry' liquid (DrainAngel Ltd)</li> <li>• Nanoshell'; 'Stone Water-Guard' (Aquobex)</li> <li>• Stone waterguard (Crocodile)</li> </ul>	<p>Aquistop = For painting DPC joints and below; dries to cement colour. (For above DPC, InsuDry recommended.)</p> <p>Note – 'Water repellent coatings' (also called 'damp-proofing masonry creams') are not intended for under-water use (in accordance with ISO 15148:2002(E) - Hygrothermal performance.)</p>	 <p>Nano-technology sealant applied to right of breeze block, none on left (Aquobex)</p>
Tanking (internal), including cavity drain membrane systems	Very high	<ul style="list-style-type: none"> <li>• Internal cavity wall tanking with membrane/drain channel/pump system plus joint sealant (Aquobex/FloodGuards; Delta Membrane Systems Ltd)</li> <li>• 'Newton System 500' (John Newton &amp;Co Ltd)</li> <li>• 'Oldroyd' range (Safeguard Europe)</li> <li>• 'Triton cavity drain membranes' (Triton Chemicals)</li> <li>• 'Wykamol cavity drain membranes'/sump/pump systems</li> </ul>	<p>Designed to be completely waterproof. Offers groundwater protection.</p> <p>Needs sump and pump. Vulnerable to damage due to later alterations. Primarily designed to protect against groundwater.</p>	 <p>Aquobex</p>

Product type	Indicative cost	Available products/suppliers	Comments	Images
<p>Water resisting airbricks / permanent airbrick covers</p>	<p>Low (single product) Medium (including fitting costs for multiple units)</p>	<ul style="list-style-type: none"> <li>• ‘SMART airbrick’ (Aquobex; Floodguards; CSI Flood-products; Floodgate Ltd; Lakeside; Multi Flood Solutions; FloodStop UK Ltd; UK Flood Defence Alliance)</li> <li>• Automatic anti-flood airbrick (FloodArk; Whitehouse Construction Co Ltd; Flood Defence Solutions)</li> <li>• ‘Snorkelvent’ (from 310 to 900mm height) (Aquobex; Donite Plastics)</li> <li>• Smart Eco AirBrick (Flood Defence Solutions)</li> </ul>	<p>Inexpensive and unobtrusive. Needs careful installation and maintenance. May need measures to deal with seepage. Need to choose correct height from range available to avoid overtopping.</p>	 <p>SMART airbricks</p>  <p>Snorkelvent</p>
<p>Anti-backflow valves for sewer pipes (backwater valves)  Non-return valves (NRVs) for appliance waste-pipes</p>	<p>Low to medium</p>	<ul style="list-style-type: none"> <li>• ‘Kessel’ NRV BSi (Mission Rubber; Aquobex)</li> <li>• ACO ‘QUATRIX’ BSi (ACO Building Drainage)</li> <li>• Mainline Fullport Backwater valve (Aquobex)</li> <li>• Other: ‘Forge’ antiflood sewer valve (Forgevalves); (Multi Flood Solutions; Whitehouse Construction Co Ltd)</li> <li>• NRV/‘Flusher’ combination (Aquobex; Crocodile)</li> <li>• Appliance NRVs (washing machine outlets etc.); FloodArk; Flood Divert Ltd; Flood Defence Solutions; Builders’ merchants)</li> </ul>	<p>Relevant standard is BS EN 13564 – ‘Anti-flooding devices for buildings’.  Unobtrusive and inexpensive. May need to assess the impact on neighbours.</p>	 <p>Waste pipe NRV – Aquobex</p>

Product type	Indicative cost	Available products/suppliers	Comments	Images
Built-in sump and pump systems	Low (pump only) Medium-high (system)	<ul style="list-style-type: none"> <li>Aquobex; Flood Divert; Whitehouse Construction Co Ltd; Crocodile</li> </ul>	<p>Rapid deployment. Relatively low cost. Helps where a resistance product leaks. Can remove flood water in an emergency.</p> <p>Must be positioned and sized correctly. May require ancillary power supply. Will need servicing and maintenance.</p>	
Permanent barrier walls with demountable gates/ concealed gates /permanent swing gates	Medium-high to Very high (depending on length required /groundworks involved)	<ul style="list-style-type: none"> <li>Glazed barriers (Aquobex; IBS Engineered Products Ltd)</li> <li>Flip-up hydraulic gates (IBS Engineered Products Ltd)</li> <li>Flood gates (Whitehouse Construction Co Ltd; IBS Engineered Products; The Flood Company)</li> <li>Hardwood flood gates BSI and fences (Flood Divert Ltd; FloodStop UK Ltd)</li> <li>Drop-down barrier (Aquobex)</li> <li>Stainless steel swinging floodgate (Lakeside Flood Solutions)</li> </ul>	<p>Structure of building is not a limiting factor.</p> <p>See also Community section for wider area systems.</p>	 <p>IBS flood gate (installer Yorkshire Dampcourse)</p>
Raised porch / threshold	Medium-high to High	<ul style="list-style-type: none"> <li>Property level survey needed to establish appropriate threshold height.</li> </ul>	<p>Unobtrusive, but disabled access may need to be considered.</p> <p>Low flood depths only; waterproof door may also be needed.</p>	
Brick-facing using engineering bricks	Medium	<ul style="list-style-type: none"> <li>Engineering bricks must conform to British Standard BS 3921: Class A (blue) water absorption &lt;4.5%; Class B (red) water absorption &lt;7%.</li> </ul>	<p>Note 'Clay Engineering bricks' are made to a lower standard. More effective than sealing existing wall. Needs good workmanship; below-ground work involved.</p> <p>May just reduce penetration rate. May need planning approval – visually alters building.</p>	

# Temporary resistance

Temporary resistance measures are aimed at keeping floodwater out of a building by putting in place devices that block doors, windows, airbricks, vents and pipes. In order to be protected, these products will need to be installed before flood water arrives. They are designed to lessen the damage that floodwater can do and also to give homeowners extra time to move ground floor contents. The measures may only be effective for a limited time and limited water depth.

These products will only keep water out if they are correctly used as part of a package of measures identified from a property-level flood protection survey carried out by a qualified and experienced surveyor. The products will need to be put into place in good time before flood water arrives and then removed once the flood risk has passed. The products are designed to keep water out for long periods, however seepage is possible (depending upon both workmanship and flood conditions) and the BSi Kitemark standard allows for some seepage. There is a risk to the structure of your home if deep water is held back by the external walls due to the pressure of water. For this reason the products are only suitable for limited flood depths. A structural assessment of the building is recommended where flood depths in excess of 300mm (about a foot) are intended to be resisted.

## Flood plan considerations

These products require activating to make them work and so protection to your home depends upon receiving and acting on a flood warning.

Some training may be needed to correctly operate the products and long term storage of items may be required, in a location that is easily accessed. Routine inspection and maintenance of the products is however essential.

Creating a flood plan is important for protecting people and your property in an emergency. As well as stating who does what when flooding is expected, the flood plan should say what to do in a 'worst case scenario' such as water seepage through flood protection devices, flooding that exceeds the design of the flood protection products, people being trapped in the home with rising water.

## Private flood level alarms

As the devices themselves are permanently installed, details of these products are included in the previous section.

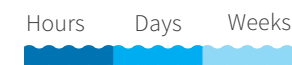
If your home is in an area not served by official flood warnings, you may be able to install a private flood level alarm system. These normally include a water sensor and an alarm unit. The sensor will detect flood water and send a signal to the alarm unit that will make a sound an alert to warn you of the approaching flood risk. The sensor will need to be carefully installed at a location where rising flood water will be detected well before your home is about to flood to alert you to the risk (such as during the night) and to give you time to take action. It is recommended that you obtain expert help choose the right system and correctly install it. Permission from landowners and local authorities may be needed prior to installing the sensor.

Always remember, where the home is attached to others (semi-detached or terraced properties) water may also enter via party walls, unless the neighbouring homeowner takes similar steps.

## Flood depths



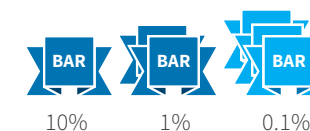
## Flood duration



## Flood onset








## Flood annual probability



## Required input of people





Product type	Indicative cost	Available products/suppliers	Comments	Images
Barriers for doors / windows / garages	<p>Low-medium (single product)</p> <p>Medium-high (whole home package)</p>	<ul style="list-style-type: none"> <li>• 'FloodArk' barriers BSi (Flood Ark)</li> <li>• 'FloodKit® Door panel BSi; FloodKit® FloodSok Door panel BSi (FloodKit)</li> <li>• 'Floodgate' (Aquobex; Crocodile; CSI Flood-products; JTA Flood)</li> <li>• 'Floodguards' (Aquobex)</li> <li>• 'Floodtite' panels (Aquobex; Crocodile; CSI Flood-products; Floodtite Systems Ltd)</li> <li>• Caro barriers bespoke solutions for Listed Buildings (Aquobex)</li> <li>• 'Flood Plan' boards (Stormguard)</li> <li>• 'Floodshield' door barrier (Flood shield; Multi Flood Solutions)</li> <li>• 'HydroGuard' barriers (HydroGuard)</li> <li>• 'FloodDoor' (Snorklevent; Whitehouse Const)</li> <li>• 'Kayron DoorShield BSi' (The Flood Experts)</li> <li>• Nautilus barriers (Crocodile)</li> <li>• 'Hydroshield' barrier BSi (The Flood Company)</li> <li>• 'SL25' stop-log system for homes/small businesses (IBS Engineered Products)</li> </ul>	<p>Many temp barriers require a fixed frame, others do not – e.g. FloodBarriers from Watertight Int; FloodGate.</p> <p>Rapid deployment. Low weight and easily deployed products available.</p> <p>Items require storage space. Some barriers need tools for deployment.</p> <p>Permanent fixings on the building with most products. Deployment may be physically difficult for some individuals. May need measures to deal with seepage.</p> <p>Note – For demountable options (requiring permanent groundworks) see Community section.</p>	 <p>Floodguards (courtesy Aquobex)</p>  <p>FloodArk barrier in use</p>



Product type	Indicative cost	Available products/suppliers	Comments	Images
Covers / barriers for appliance vents / airbricks / pet-flaps	Low-medium (single product)	<ul style="list-style-type: none"> <li>• Airbrick covers BSi (Flood Ark; Aquobex; Floodtite; JTA Flood; Flood Defence Solutions; FloodStop UK; Manthorpe Building Products)</li> <li>• Floodkit airbrick patches BSi/Floodkit airbrick plates BSi (Floodkit)</li> <li>• ‘Other airbrick covers’ (Flood Divert Ltd)</li> <li>• ‘Ventguard’ cover BSi (Aquobex; CSI Flood products; Flood Ark; Floodgate Ltd)</li> <li>• ‘Ventshield’ (Multi Flood Solutions)</li> <li>• ‘Airvent guards’ (FloodGuard UK Ltd)</li> <li>• Air Vent Protector (Flash Flood Doors Ltd)</li> </ul>	<p>Inexpensive and unobtrusive. Needs careful installation and maintenance. May need measures to deal with seepage.</p> <p>Need to choose correct height from range available to avoid overtopping.</p>	 <p>Flood Ark</p>
Free standing barriers for larger areas (e.g. driveways)	Medium-high to Very high (depending on length required)	<ul style="list-style-type: none"> <li>• ‘Rapidam’ (Aquobex)</li> <li>• ‘Ecodam’ (Aquobex)</li> <li>• ‘AquaDam’ (Aquadam Europe Ltd)</li> <li>• ‘Floodstop’ modular barrier (CSI Flood products; Flood Divert Ltd; Fluvial Innovations; JTA Flood)</li> <li>• ‘Water-Gate’ self-inflating barrier (Flood Protection Solutions)</li> <li>• FloodBlock modular Barrier (Fluvial Innovations)</li> <li>• Windermere (modular) barrier; Derwent (aluminium) barriers (UK Flood Defence Alliance)</li> </ul>	<p>Typically designed more for communities rather than individuals, but some smaller barriers designed to can be installed by 1 person.</p> <p>Property protected to design height of product.</p> <p>Structure of buildings is not a limiting factor. Can be installed in water. Needs sufficient warning. May need significant manpower to deploy. Most products need separate storage. May need measures to deal with seepage.</p> <p>Note - for demountable systems (requiring permanent groundworks) see Community pages.</p>	 <p>Rapidam – Aquobex</p>  <p>Water-Gate model WP, occasional use (courtesy Flood Protection Solutions)</p>



# Ancillary products


The following products can be used alongside either resistance or resilience measures – for example, absorbent bags can be placed inside a door protected by Kitemarked barriers to take up any water that may leak through seals (as permitted under the BSI 2014 standard).

Product type	Indicative cost	Available products/suppliers	Comments	Images
Sealing around external doors / windows	Low	<ul style="list-style-type: none"> <li>• ‘Soudal Fixall’ (Available from builders’ merchants/ ironmongers)</li> <li>• Permanently elastic after curing</li> <li>• Remains flexible; contains fungicide.</li> <li>• Floodlock’s ‘Flood-Less’ door strips (Allups Ltd)</li> </ul>	Unobtrusive and inexpensive, but needs careful application. Not appropriate in conjunction with normal doors/ windows, which are not designed to resist high water pressure. May also need measures to deal with seepage.	 <p>An uncovered ‘weep hole’ in brickwork</p>
Sealing cracks / weepholes / service inlets and service entry and exit points; duct sealing products	Low	<ul style="list-style-type: none"> <li>• MD III Duct Sealing System; MD II Duct Sealing System; MD IV Duct Sealing System; CSD duct sealing solutions (Aquobex)</li> <li>• ‘Soudal Fixall’ (Available from builders’ merchants/ ironmongers)</li> <li>• ‘Slipsil’ service entry point seal/plugs (Aquobex)</li> </ul>	<p>Unobtrusive and inexpensive. Needs careful application, using water resistant formula (not standard product). May just reduce penetration rate.</p> <p>Damp problems could result if weepholes are permanently covered.</p>	
Re-pointing	Low-medium	<ul style="list-style-type: none"> <li>• For example, Stormdry Repointing</li> <li>• Additive No.2 (Safeguard Europe)</li> </ul>	May just reduce penetration rate. Unobtrusive. Brickwork needs to be in good condition to be effective. May lead to damp within the walls.	
Bolt-down manhole covers	Bespoke	<ul style="list-style-type: none"> <li>• Bespoke</li> </ul>	May require liaison with local authority/ sewerage agency.	



Product type	Indicative cost	Available products/suppliers	Comments	Images
Flood alarm systems (domestic)	Low-medium / Bespoke	<ul style="list-style-type: none"> <li>• Crocodile; UK Flood Defence Alliance</li> </ul>	<p>24/7 monitoring. Needs careful installation. Needs regular testing/maintenance.</p> <p>May need to obtain permission from landowners/ local authorities.</p> <p>See also Community section for mass warning types.</p>	 <p>Floodsax</p>
Modern versions of sandbags	Low to Low-medium (for multi-packs)	<ul style="list-style-type: none"> <li>• ‘Absorbeez’ (Action Dry Group)</li> <li>• ‘Aqua-sac’ (AET; Flood Divert Ltd; Multi Flood Solutions)</li> <li>• ‘Hydrosacks/Hydrosnakes’ (Crocodile; CSI flood products; Flood Divert Ltd; UK Flood Defence Alliance)</li> <li>• ‘Quickdam’ (Easy Innovations Ltd)</li> <li>• ‘Floodsax’ (Floodsax Direct online); JTA Flood; builders’ merchants (e.g. Travis Perkins)</li> <li>• ‘FloodBag’ (Maynard group; Maris Pumps Ltd)</li> <li>• Floodwater bags (self-inflating) (Murlac)</li> <li>• FloodBags (gel-filled, re-usable) – Flood Management (Amazon online outlet)</li> <li>• ‘Flexible Flood Defence Blocks’/ ‘Mini floodwall bags’ (UK Flood Defence Alliance)</li> <li>• ‘Flood Traps – Door seal booster kits (Allups Ltd)</li> </ul>	<p>Absorbent bags, lightweight, quick to deploy. Can hold tens of litres of water.</p> <p>Sufficient bags must be stored ready for use. Some types of used bags need to be disposed of after use.</p>	 <p>Flexible Flood Defence Blocks in use (Flood Defence Alliance)</p>

Product type	Indicative cost	Available products/suppliers	Comments	Images
<p>Toilet seals / bungs</p> <p>Pipe bungs/ seals</p>	<p>Low</p> <p>Low</p>	<ul style="list-style-type: none"> <li>• 'Panseal' (CSI Flood-products; Flood Divert Ltd; Floodtite; FloodKit; Lakeside; UK Flood Defence Alliance )</li> <li>• 'Flood-Guard Drain Sealer' (CSI Flood products)</li> <li>• Drain/toilet bungs; shower seals; overflow bungs (Crocodile; CSI Flood products; InstantSandbags.com; Flood Management (Amazon online outlet); Flood Defence Solutions)</li> </ul>	<p>No permanent installation required.</p> <p>Need sufficient warning. Requires storage space.</p>	 <p>Panseal – Floodtite</p>
<p>Raised porch / threshold</p>	<p>Low-medium</p>	<ul style="list-style-type: none"> <li>• 'Puddlesucker' and similar models (CSI Flood-products; Whitehouse Const; Flood Protection Solutions; Maris Pumps Ltd and Builders' merchants)</li> </ul>	<p>Must be sized, positioned and deployed correctly. May require ancillary power supply. Will need servicing and maintenance.</p>	
<p>Water-tight covers for furniture / appliances</p>	<p>Low</p>	<ul style="list-style-type: none"> <li>• Flood Management (Amazon outlet, sub-gp of 'IMIJO Ltd'); Flood Possessions Protector (water tight cover for valuables)</li> </ul> <p>Note – these products need to have watertight zip fastenings, unlike ordinary storage bags</p>	<p>Requires occupant to store bags and deploy.</p> <p>Larger items may be difficult to move.</p>	

Product type	Indicative cost	Available products/suppliers	Comments	Images
Steel telescopic/ adjustable trestles	Low	<ul style="list-style-type: none"> <li>Builders' merchants.</li> <li>Can support heavy items above flood level. Also known as builders'/ carpenters' trestles, and 'sawhorses'</li> </ul>	<p>Requires occupant to store trestles and deploy.</p> <p>Larger items may be difficult to move.</p>	
Plastic trestles	Low	<ul style="list-style-type: none"> <li>As above but for lighter items</li> </ul>		
Emergency Flood Kits / 'Grab Bags' (ready-made)	Low	<ul style="list-style-type: none"> <li>Evaq8; CSI flood products; Flood Protection Solutions (community options)</li> </ul>	Requires occupant to store bags and review/replace contents periodically.	
As above – home-made	Low	<ul style="list-style-type: none"> <li>Contents purchased from normal retail outlets</li> </ul>		
Sack trucks	Low	<ul style="list-style-type: none"> <li>Builders' merchants/ DIY outlets</li> </ul>	<p>For moving moderately heavy items to higher locations.</p> <p>Requires occupant to store and deploy safely.</p>	

# Resilience

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Resilience measures are aimed at allowing a building to flood, but constructing the interior from materials that are not damaged by water.

Following flooding, a clean-up will be needed but not major drying and refurbishment. Correctly applied resilience should ensure that no permanent damage is caused, the structure of the building is protected and drying and cleaning are quickened.

These resilience measures are designed to reduce the amount of damage caused when water enters a building. Ideally a package of products should be used to lessen the harm that water does to a building, based on a property-level flood protection survey carried out by a qualified and experienced surveyor. Most resilience measures will, however, reduce the aftermath of flooding **even while you are away from your home**, or if flooding arrives quickly with no warning.

In situations where flood water is expected to arrive very quickly and with high depth and velocity the building structure may still be at risk. In these cases a structural survey is recommended, but resilience up to one metre (over 3 feet) of water is potentially achievable.

## Flood plan considerations

As a few of the methods in this section require you to take action (for example, removing internal doors, or moving valuables to an upper floor) **so the best possible protection for your home and its contents depends upon receiving and acting on a flood warning.**

Pumping systems can be automatic and so no specific action may be required, but, where the pump is not automatic no flood protection will be provided when you are away from your home. Some training may be needed to operate products such as pumps, and no long term storage of items is required (except for free-standing pumps). Routine inspection and maintenance of the resilience measures is however essential.

Creating a flood plan is important for protecting people and your property in an emergency. As well as stating who does what when flooding is expected, the flood plan should say what to do in a 'worst case scenario' such as when flooding is worse than expected and the risk of people being trapped in the home with rising water.





## Private flood level alarms

As the devices themselves are permanently installed, details of these products are included in the first section.

If your home is in an area not served by official flood warnings, you may be able to install a private flood level alarm system. These normally include a water sensor and an alarm unit. The sensor will detect flood water and send a signal to the alarm unit that will make a sound an alert to warn you of the approaching flood risk. The sensor will need to be carefully installed at a location where rising flood water will be detected well before your home is about to flood to alert you to the risk (such as during the night) and to give you time to take action. It is recommended that you obtain expert help choose the right system and correctly install it. Permission from landowners and local authorities may be needed prior to installing the sensor.



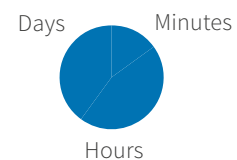
### Flood depths



### Flood duration



### Flood onset

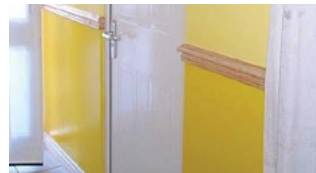







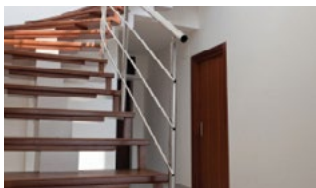
### Flood annual probability



### Required input of people



Product type	Indicative cost	Available products/suppliers	Comments	Images
Water compatible internal walls	Medium	<ul style="list-style-type: none"> <li>• Silicon-mineral/ Magnesium Oxide board (Aquobex)</li> <li>• Technitherm cavity wall insulation (Aquobex/Isothane Ltd)</li> </ul>	<p>Also provides fireproof/thermal insulation.</p> <p>Closed cell cavity insulation.</p> <p>Permanently in place.</p> <p>There are still cleaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work.</p>	
Water compatible flooring	Medium to High	<ul style="list-style-type: none"> <li>• Silicon-mineral/Magnesium Oxide board (Aquobex)</li> <li>• Tiled flooring, rather than fitted carpets/laminate</li> <li>• Concrete floor to replace timber</li> </ul>	<p>Also fireproof/thermal insulation.</p> <p>Permanently in place</p> <p>There are still cleaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work.</p>	
Water compatible kitchen and bathroom fittings	Medium-high to High	<ul style="list-style-type: none"> <li>• Steel kitchen units (Steelplan Kitchens)</li> <li>• 'Sealwise' (Waterproof Construction Board) (Aquobex/Sealwise)</li> </ul>	<p>Products originally developed for hospital/industrial use.</p> <p>Permanently in place.</p> <p>There are still cleaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work.</p>	 <p>Steelplan Kitchens</p>
Sump and pump systems	Medium-high	<ul style="list-style-type: none"> <li>• Suitable pumps include: BPS80A; OMA2 Domestic; VA600 Easy flow; LSC 1.4S Tsurumi (Aquobex)</li> </ul>	<p>Permanently in place.</p> <p>There are still leaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work.</p>	

Product type	Indicative cost	Available products/suppliers	Comments	Images
Raised electrics / meters	Medium-high	<ul style="list-style-type: none"> <li>Local electricians.</li> </ul>	<p>Permanently in place.</p> <p>There is a practical limit to how high electrics/kitchen appliances can be raised. There are still cleaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work.</p>	 <p>Raised electrics/meters</p>
Plinths for kitchen white goods; wall-mounted boiler	Medium	<ul style="list-style-type: none"> <li>Local builders/electricians/gas-qualified engineers</li> </ul>		 <p>Plinths for white goods (Bowker 2007)</p>
Water compatible steps / stairs (concrete / hardwood / steel)	Bespoke	<ul style="list-style-type: none"> <li>Specialist firms.</li> </ul>		 <p>Water compatible steps/stairs</p>
Relocate valuables	No cost	<ul style="list-style-type: none"> <li>Keep/move valuables/memorabilia on high shelves or in upstairs rooms. Raise valuables on tables/plinths.</li> </ul>	<p>Requires occupant to maintain and deploy. Needs sufficient warning.</p>	
Removable internal doors	Low	<ul style="list-style-type: none"> <li>Use quick-release hinges, or avoid painting over door hinges, to permit easy removal; doors may then be placed on top of tables etc. to create storage above water level (in low level flooding).</li> </ul>		

# Community solutions

Where a particularly large property or a number of homes are involved, there are a number of potential solutions available, in both the temporary and permanent categories. For temporary products, the same general considerations highlighted in the previous sections will still apply (such as expected water depth, duration of flood and the human resources needed to deploy the device/s).

For permanent structures designed to protect larger areas, however, obtaining expert guidance is essential. For example, a detailed understanding of the local geological conditions will be of vital importance in designing and building extensive permanent walls, or undertaking the groundworks required for the demountable barrier options, as illustrated in the example.

## Telemetry / mass notification and warning systems

If your area is not served by official flood warnings, specialist companies can install flood level alarm systems with the capability of notifying multiple households, by means such as sirens, or text messages. The sensor will need to be carefully installed at a location where rising flood water will be detected well before flooding commences to alert residents to the risk (such as during the night) and to give them time to take action. Although the initial outlay for such systems may be relatively high, community groups such as Parish Councils may be able to lead on fundraising initiatives whilst the appropriate Regional Flood and Coastal Committees should also be approached to check project eligibility for 'local levy' funding. Permission from landowners and local authorities may be needed prior to installing the sensor.

## Frankwell flood alleviation scheme Shrewsbury

In non-flood conditions, the visible parts of the finished scheme (on the right of the picture) consist of permanent walls, of varying heights, with sockets and mountings for insertion of the removable posts and barriers.

What is not visible here are the underground walls, consisting of steel sheet piling up to 16 meters (over fifty feet) deep, without which water would still be able to flow under the defences. The visible walls themselves are substantial structures, designed to remain safe despite very high water pressure on the river-facing side.







## Landscaped flood walls

Flood defences can be incorporated into private gardens via imaginative design. Where the gardens form part of an active floodplain, the defence should ideally be set back from the river's edge so that loss of floodplain is minimised. The residents retain some garden which is defended, and some which is not. Flood gates can be provided if steps over the defence are not acceptable.

Detailed guidance for professionals engaged in the design and construction of large schemes, is published by the Environment Agency, with Chapter 9 (Flood walls and flood embankments) being of particular relevance:

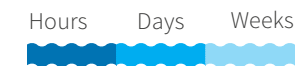
→ [www.gov.uk/government/publications/fluvial-design-guide](http://www.gov.uk/government/publications/fluvial-design-guide)

Photo courtesy Environment Agency

### Flood depths



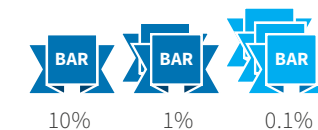
### Flood duration



### Flood onset










### Flood annual probability



### Required input of people



Product type	Indicative cost	Available products/suppliers	Comments	Images
Free standing barriers	Very high	<ul style="list-style-type: none"> <li>• 'Rapidam'; 'Ecodam' (Aquobex/ Floodguards)</li> <li>• GeoDesign AB BSi (GeoDesign Barriers Ltd)</li> <li>• 'K-system floodwall' (IBS Engineered Products)</li> <li>• 'Floodstop' modular barrier (CSI Floodproducts; Flood Divert Ltd; Fluvial Innovations)</li> <li>• 'Alteau' Flood Barrier (AET; Flood Divert Ltd)</li> <li>• 'AquaDam' (Aquadam Europe Ltd)</li> <li>• 'AquaFence' (AquaFence Ltd)</li> <li>• 'Watergate Self-inflating' (Flood Protection Solutions)</li> <li>• Cold Flood Barrier - water filled (Cold Flood Prevention)</li> <li>• Aquobex K50 barrier (Aquobex)</li> <li>• NOAQ Tubewall AND NOAQ Boxwall (Flood Control International)</li> </ul>	<p>Typically designed more for communities rather than individuals, but some smaller barriers designed to be installed by 1 person.</p> <p>Property/ies protected to design height of product. Structure of buildings is not a limiting factor. Can be installed in water.</p> <p>Needs sufficient warning. May need significant manpower to deploy. Most products need separate storage. May need measures to deal with seepage.</p>	 <p>Geodesign Barrier (BSi)</p>  <p>K-System</p>  <p>WaterGate range (Flood Protection Solutions)</p>
Demountable barriers (groundworks required)	Very high	<ul style="list-style-type: none"> <li>• Caro 'WaterWall'/'WaterDoor' (Aquobex Flood Defence Solutions)</li> <li>• Flip-up Barrier (Aquobex)</li> <li>• IBS demountable flood protection system (IBS Engineered Products Ltd)</li> <li>• Demountable stop-log system (Flood Control International)</li> <li>• Aquaburg below ground type (Aquobex)</li> <li>• Neptune demountable barriers (CSI Flood products)</li> <li>• Nautilus demountable barriers (FloodStop UK Ltd)</li> <li>• Coniston and Danube demountables (UK Flood Defence Alliance)</li> </ul>	<p>Unobtrusive in non-flood conditions.</p> <p>Property/ies protected to design height of product. Structure of buildings is not a limiting factor.</p> <p>Needs sufficient warning. Needs significant manpower to deploy. Most products need separate storage.</p> <p>Needs careful design and construction (needs continuity of barrier/roundworks). May need measures to deal with seepage. Security may be needed to prevent barrier theft.</p>	 <p>IBS demountable</p>

Product type	Indicative cost	Available products/suppliers	Comments	Images
Perimeter walls / permanent barrier systems with gates (fixed or demountable)	High to Very high (depending on length required/any groundworks involved)	<ul style="list-style-type: none"> <li>• ‘Spring Dam’ (Aquobex; Littlehampton Welding Ltd)</li> <li>• Pivot barrier/Flip-up barrier (Aquobex)</li> <li>• Glazed barriers (IBS Engineered Products; Flood Control International)</li> <li>• Hinged gates / flip-up barriers / pivot barriers / rising barriers (IBS Engineered Systems)</li> <li>• ‘DriFence’ (Flood Divert Ltd)</li> <li>• ‘FloodBreak’ automatic barriers (Aquobex)</li> <li>• Swing gate (Aquobex; (Flood Control International)</li> <li>• Lift hinge/pivot hinge gates; Flipup/hydraulic gates (Flood Control International)</li> <li>• Polymer Fencing (Crocodile)</li> </ul>	<p>Glazed types minimise visual impact. Property/ies protected to design height of product. Structure of buildings is not a limiting factor.</p> <p>Needs careful design and construction; needs continuity of barrier. May need measures to deal with seepage.</p>	  <p>Spring Dam in raised position (top) and lowered (below)</p>
Telemetry / mass notification & warning systems	Medium to High	<ul style="list-style-type: none"> <li>• Caro ‘WaterWall’/‘WaterDoor’ (Aquobex Flood Defence Solutions)</li> <li>• Flip-up Barrier (Aquobex)</li> <li>• IBS demountable flood protection system (IBS Engineered Products Ltd)</li> <li>• Demountable stop-log system (Flood Control International)</li> <li>• Aquaburg below ground type (Aquobex)</li> <li>• Neptune demountable barriers (CSI Flood products)</li> <li>• Nautilus demountable barriers (FloodStop UK Ltd)</li> <li>• Coniston and Danube demountables (UK Flood Defence Alliance)</li> </ul>	<p>Ideal where there is no formal flood warning service. Round the clock monitoring.</p> <p>Needs careful installation. Needs regular testing/ maintenance. May need to obtain permission from landowners/local authorities.</p>	 <p>Level sensor</p>



04

# Sustainable drainage solutions

# Another piece of the jigsaw: ‘SuDS’

(Sustainable Drainage Systems)

As well as making houses more resilient to flooding from rivers and streams, we are now seeing increasing interest in methods that can slow down the rate at which our drainage systems fill and overflow in heavy rainfall.

No matter how often the roadside gullies are cleaned out by our local authorities, the intense rainstorms we have seen in recent years can quickly overwhelm the surface water sewers and flooding can result. These ‘flash floods’ typically occur and then disappear again in a short space of time, but they can still cause devastation if they get into our homes!

As well as changes in our weather patterns, many of us are unknowingly adding to the problem – for example, by paving over parts of our gardens to make parking spaces, adding conservatories or other extensions to our homes. Each change may be small in itself, but they all cut down the total area of vegetation capable of absorbing rain. Roofs, decking, paving, concrete and tarmac all speed up the rate water enters the roadside gullies, compared with the lawns or flowerbeds that they may have replaced.

This is a complicated topic, but there are a number of things that can be done at the domestic level to help reverse this trend and some of these are shown in the diagram to the right.

There are prices to suit most homeowners’ pockets – for example, creating a ‘rain planter’ is a job within the capability of many DIY enthusiasts, while a 200 litre water butt typically costs less than £25 and is simple to install. (As keen gardeners will already know, if your water supply is metered then saving rainwater can also save money).

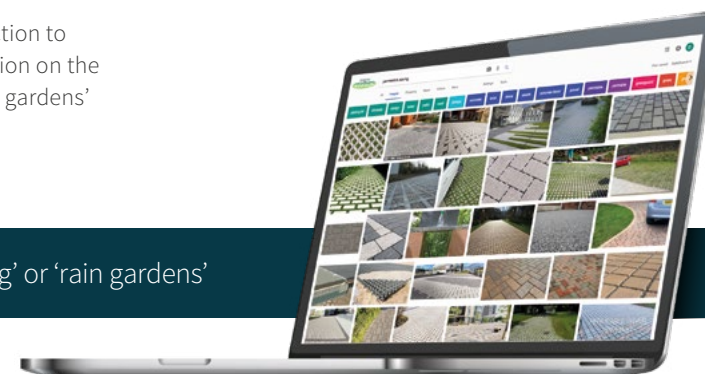
Then when the next torrential downpour arrives, at least some of the water that would otherwise go straight down the drains will now be held back, even if only for a short while until the tank (or trough) reaches overflow level. Every little certainly helps where flooding risk is concerned!



The above is only intended as a brief introduction to the issue, but you can find lots more information on the internet. Just type ‘permeable paving’ or ‘rain gardens’ into your usual search engine.



Search for ‘permeable paving’ or ‘rain gardens’



## Solutions to reduce surface water flooding in your garden



### For the smaller garden



Rain planter for runoff from garage roof

Permeable surfaces on car parking areas

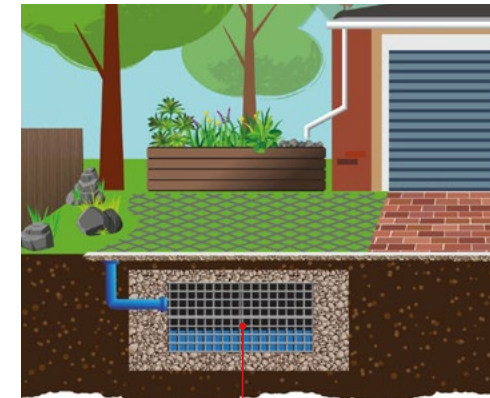
Pathways of gravel over weed-suppressant fabric

Grass rather than paved areas

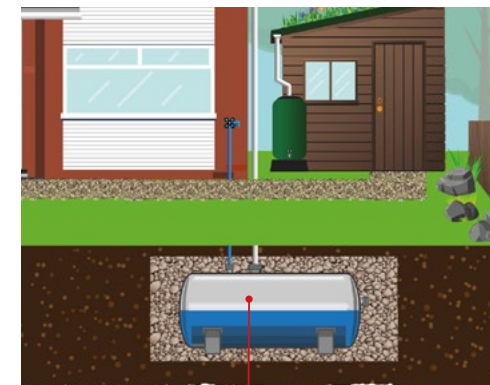
Water butts for collecting rain from roofs

Green roof (lightweight) on garden shed

### For the larger garden



Below ground runoff storage and attenuation crates



Below ground rain harvesting tank





05

Case studies





## Single dwelling case study 5.1

# Resilient home in Buckinghamshire

A Victorian terraced house on four floors, situated on a steeply sloping site with a major river below. The current owners were not been aware of flood risk to the basement area at the time of purchase and laid a new concrete floor creating a living room and kitchen. Experiencing two floods within five years then prompted them to make their home resilient instead.

The kitchen is built from Marine Ply, allowing the cupboards to be washed out and disinfected, and the kickboards are removable, so that under-unit areas can dry out after a flood (Fig 2). The Aga has no damage-prone parts in bottom 4” and is also on a steel plinth, yet looks normal to a casual observer. The internal doors are made from pitch pine and have successfully survived two floods without damage, the stair-carpet has a separate, removable section covering the bottom three steps – this can be taken upstairs when a flood warning is received.

All sentimental items kept upstairs. A non return valve (NRV) has been installed in the foul-water sewer, to prevent backflow of sewage into the downstairs toilet.

The owners make a point of unplugging all electrical equipment is unplugged when a flood warning received, as this prevents short-circuiting damaging any appliances when the water comes in. In the lounge, an automatic pump in a sump is sited in a corner (Fig 4), and this now keeps the floodwater to around 1-2” depth, which does minimal damage.

The sump-pump socket is supplied from the upper floor, so continues to operate when the electricity is disconnected from the basement area. Carpet tiles, which are relatively cheap and can be regarded as ‘sacrificial’, are laid on top of the concrete floor. The owners also chose a sofa that has legs (rather than castors) which can easily be raised on blocks, and the gas fire is also on legs such that the shallow water depth causes no damage.

**“You can’t keep the water out, but you CAN manage the water when it comes in... so it doesn’t cause damage.”**



Figure 1 Kitchen during the flood

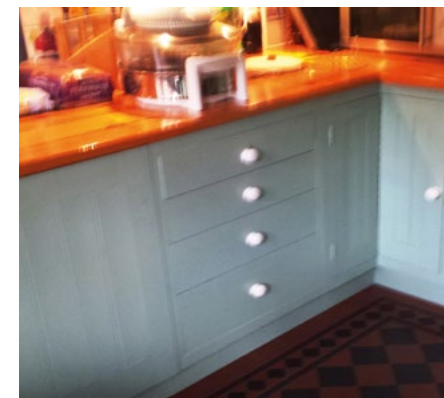


Figure 2 Same kitchen after washing and disinfecting: “one afternoon’s work and it’s done!”



Figure 3 Boiler supplying CH & hot water has been moved upstairs



Figure 4 Sump pump (supplied from upper floor) and sofa on legs in the lounge

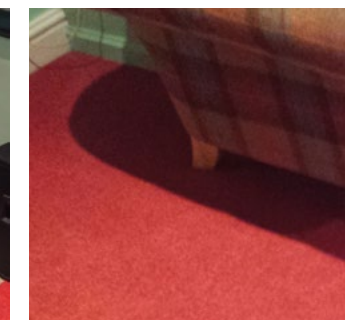


Figure 5 Furniture raised on bricks wrapped in plastic bags – this stops the water seeping up into legs

## Single dwelling case study 5.2

# Resilient terraced house in Cumbria

When Sue Cashmore's home in Cockermouth was flooded to a depth of four feet in 2005, she thought it was going to be a 'one off', as there hadn't been a serious flood in the area for 40 years prior to that.



**Figure 1** The ground floor is tiled throughout, using water resistant cement and grout – it can be hosed down and disinfected after a flood

Then came 2008 (18 inches deep) and Sue began campaigning for flood defences in the hope these would solve the problem.



**Figure 2** The window sills are made of hardwood (instead of the usual easily-damaged softwood)

However, the major flood of November 2009 resulted in seven feet of water invading Sue's home, so she resolved to make some changes which would allow easier recovery in future.



**Figure 3** The fireplace surround is also made from hardwood, and has successfully survived a flood

**“I think the water is the easy bit – the hard bit is the months and months it takes to recover!”**

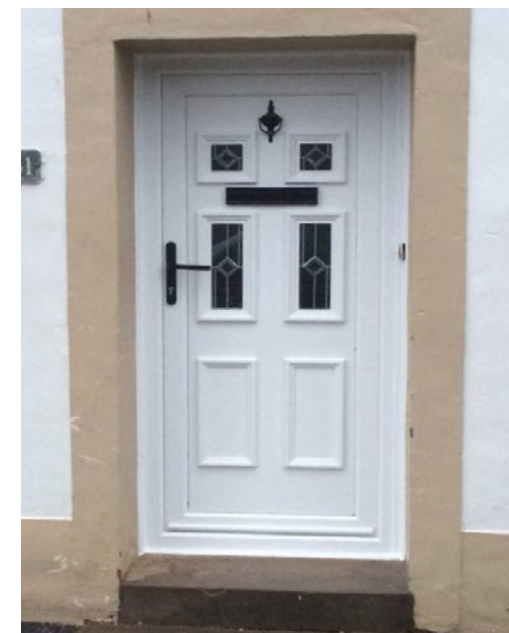
However, after the 2009 event, Sue could no longer get flood insurance – when the 2015 flood occurred, she made use of the government’s £5,000 grant to make some additional modifications. The gas central heating boiler was moved upstairs, so that there is now no loss of hot water or heating in the aftermath of a flood – and a

wood-burning stove fitted downstairs (Fig 3) – both being essential for the drying and cleaning process.

A flood-resistant door was also installed (Fig 5), purely to allow additional time for moving items before the water has to be allowed in. A water-resistant ‘scratchcoat’ was applied to walls with plasterboard to protect them.



**Figure 4** Free-standing stainless steel kitchen with free-standing appliances, which can therefore be moved to safety. The walls are tiled from floor to ceiling, using water-resistant cement and grout; internal door re-hung with hinges allowing it to be lifted off and moved upstairs.



**Figure 5** A flood-resistant door has been installed, which allows additional time for moving items before the water has to be let in.

## Single dwelling case study 5.3

# Resilient Georgian cottage in York (listed building)

The interior of this home in York appears unremarkable at first glance – but a multitude of flood resilient measures are actually present. The owners were well aware of the flood risk when they bought the cottage – not only is it on the bank of the River Ouse, but the Estate Agent made the flood liability quite clear (vendor had experienced five floods in 25 years). Having ‘fallen in love’ with the house they decided to go ahead anyway – and the first flood happened a month after they moved in (2006) with eleven more floods following since then. The first ten of these were relatively shallow (several inches only) and of clean water, but the Boxing Day 2015 event resulted in three feet of murky water inside the house (Fig 1), and some parts remained submerged for ten days. The owners themselves were trapped inside for four days, with provisions being delivered by a family member through an upstairs window.

Some resilience measures had been installed by a previous owner (raised electrics, 6”square quarry tiles with waterproof adhesive on the floors, and tiling on the lower part of the walls) but there were no flood gates or pumps. However, the 2015 flood caused the quarry tiles to ‘pop up’ from the floor, having become detached due to the high water pressure exerted.

As part of the repair process, the owners decided to have the house ‘tanked’ up to dado rail height and much larger tiles laid on the floor, with full tile adhesive (not the ‘dot and dab’ method as used with the previous tiles). In keeping with the age of the house, the owners chose

parquet-effect ceramic tiles for the lounge, and wooden floor-board effect ceramic tiles for the hallway (Fig 9). A solution for the original Georgian bow windows (with the approval of the local Conservation Officer) has been to reinforce the surrounds with concrete, and then have window barriers tailor-made to protect them in future extreme floods (Fig 3). Cleaning products are kept on high shelving, rather than below the kitchen sink - this means fewer items to lift when a flood warning received (and also less bending down needed, which is an added benefit as we all get older!)

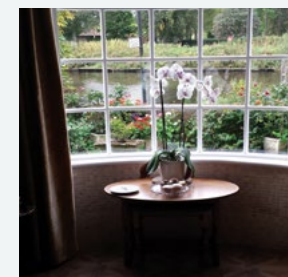
### Other measures include:

- Main sump pump in kitchen, smaller one in lounge, and a third pump kept as a reserve, in case one of the others fails (Fig 3)
- Both electric fire and entire fireplace are removable (Fig 8)
- Quick release hinges fitted to internal doors
- The kitchen units are free standing so can be moved, just the granite worktops stay in place (supported on metal legs) (Fig 5)
- Water resilient paint in utility room
- Large furniture items raised on steel trestles (not plastic)
- Dedicated storage box for barriers, trestles etc. in the garden – not kept in ordinary shed, or they may not be accessible when needed!

**“ We’ve been flooded 10 times by (shallow) floods ... and we are back to normal within an hour!”**



**Figure 1** Hallway during 2015 flood



**Figure 2** Original Georgian window now reinforced with concrete, and has bespoke barriers



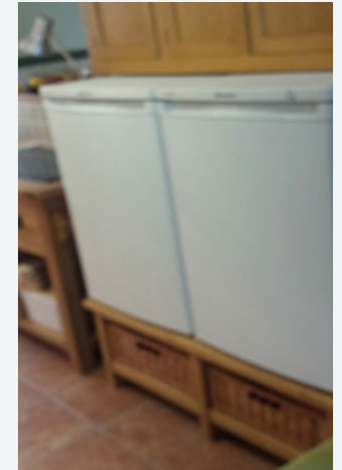
**Figure 3** Pumping water out through the window



**Figure 4** Kitchen and utility room are 6" lower than rest of house



**Figure 5** Removable kitchen – baskets for storage and eye level oven with separate hob



**Figure 6** White goods on raised support with removable baskets below



**Figure 7** Unobtrusive cupboard to house meters



**Figure 8** Completely removable electric fire/ fireplace. The parquet- effect floor tiling, and wall tiles can be seen to the left



**Figure 9** Wooden-floorboard-effect ceramic tiles in hallway and easily removable stair carpeting



**Figure 10** Raised appliances in utility room

## Single dwelling case study 5.4

# Resilient restoration – Leeds

Record breaking floods seem to be happening more frequently in recent years, and in some places the River Aire (Leeds) exceeded its previous recorded maximum by over half a metre on Boxing Day 2015 (Fig 1). As their house had flooded in the past, the homeowners in this case had already received a flood warning and so had put their flood plan into action (deploying barriers, packing overnight bags, collecting up pets and turning off the electricity before evacuating to a friend's home) – but the exceptionally high water level meant that their barriers were over-topped.

As the owners knew the importance of initiating the drying process as quickly as possible, as soon as they were able to get back into the house they used social media to make a plea for help with stripping out the skirtings, lower sections of plasterboard and the flooring. 25 people responded and by the time the loss adjuster arrived next day, all the damaged material had already been successfully removed from the building and the drying process could begin.

To guard against such severe flooding in the future (which they accept is more likely due to climate change) the owners chose a combination of resistant and resilient

measures. This means they can exclude the water for lower-level floods, but are also prepared for more extreme events. All the airbricks have also been replaced using automatically closing airbricks.

**“Intense and immediate drying out really does pay dividends”**



**Figure 1** The house looks out onto the river



**Figure 2** Although barriers were in place, the river had an unpleasant surprise in store



**Figure 3** Garden bench later found stranded high up in a tree



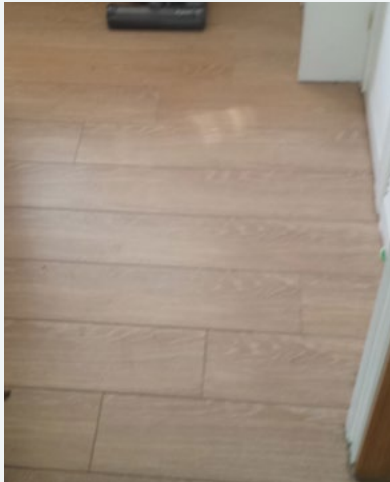
**Figure 4** Sitting room strip-out



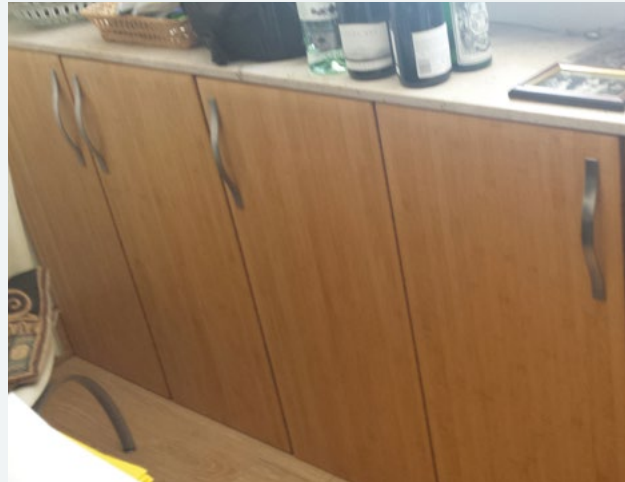
**Figure 5** Channels and membranes with sumps and pumps to remove water



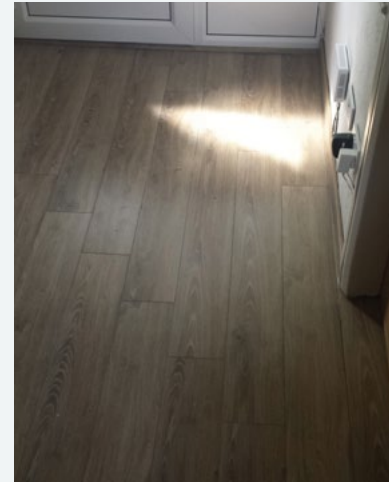
**Figure 6** Closed cell (waterproof) insulation on the floor



**Figure 7** Finished with 'Aquastep' removable plastic flooring and skirtings



**Figure 8** The bamboo kitchen units survived the flood intact (despite being submerged for 17 hours)



**Figure 9** Hallway flooring



**Figure 10** Fitting new (taller but light-weight) barriers

## Single dwelling case study 5.5

# Minimum cost approach in a listed building – Kendal

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Flooding in Kendal during December 2015 affected a property that has a shop and the family kitchen on the ground floor and living accommodation above. The shop is on a busy road, and cars continued to drive through the floodwaters, sending additional waves into the building (Fig 1).

As the location is at a low point within the town, the owners knew there was no point trying to exclude water, particularly as they expect more intense rainstorms to cause increased flooding in the future owing to climate changes.

As this is a listed building, the repair process raised some additional challenges – however, the owners not only chose a flood resilient approach, but also succeeded in keeping the costs down to the minimum, using recycled materials wherever possible.

The owners created a unique solution to replace the standard fitted kitchen units, using a combination of sturdy resilient materials (which can be hosed down) and budget priced wooden units that can be ‘sacrificed’ in future floods (Fig 4). All the electrical sockets were raised, and the cabling to them now drops from the upper floor. The resilient flooring is of wood-effect ceramic tiling.

The flood water reached the fourth tread of the original wooden staircase, causing permanent damage, so this was replaced by a hand-built flight of stone steps, topped with ‘rainbow sandstone’ treads (Fig 6). Housed within the steps is a wood burning stove, providing much-needed heat to assist with the drying-out process (Fig 5).

**“We didn’t pay full price for anything ...  
ex display items, end of lines and off-cuts!”**





**Figure 1** Hallway pictured from original stairs during the flood



**Figure 2** The street outside on the night of the flood



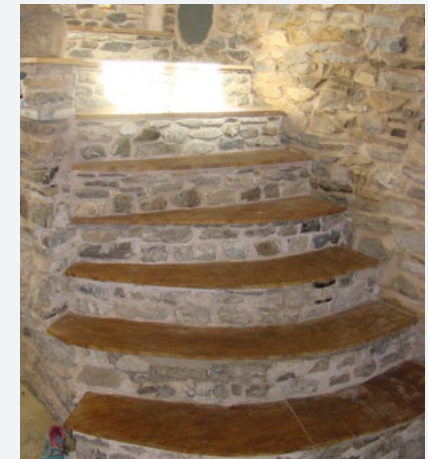
**Figure 3** Shop front, with new flood wall to deflect bow waves' caused by passing vehicles



**Figure 4** Granite topped kitchen shelving, with marble shelves and sandstone window mullions as a framework – some of the materials were found by the river, having been dumped there 18 months earlier!



**Figure 5** Wood-burning stove, housed within body of stone staircase (German 18kw design)



**Figure 6** Resilient (& very attractive) steps to upstairs flat (replaced standard wooden staircase)

## Single dwelling case study 5.6

# Resilient home in Worcestershire

This detached cottage close to the River Severn was not known to have flooded internally since 1947. A few years after the present owners moved in, however, two internal floods occurred in rapid succession in the winter of 2000. As part of the repair process, all the electric sockets were raised with the cabling dropping down from the second floor. It was the even more serious flooding of 2007, however, that prompted them to consider a fully resilient approach. Two further floods (2013 and 2014) have already demonstrated the advisability of this, even though these only affected the garden and patio areas.

A brick 'skin' has been added to the cottage walls (inside and out) with water-resilient paint finished with a sealant coating; a cement-based plaster has been applied internally.

"We were displaced for 8 months after the (2007) flood - and floods are becoming more prevalent"

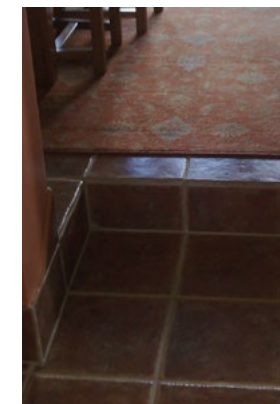
The patio area is drained by a sump pump (which has already worked successfully in the 2014 event). The entire ground floor is tiled, as are the skirtings (Fig 2) – as floodwater enters the kitchen first, this being on a lower level than the rest of the building the tiles have been continued half way up wall behind the kitchen units as additional protection.

A fitted kitchen with plastic carcasses and removable doors has been installed (Fig 4) – this can easily be washed down and disinfected. Due to the very low ceiling, plinths could not be used to raise appliances – instead these are moved to a higher part of the building, and raised on breeze blocks.

The exception is the kitchen range, which is housed in a 'tanked' alcove which can be sealed off with its very own (Kitemarked) flood barrier (Fig 3). All the doorways now have tailor-made barriers to protect them, as the age of the cottage precludes the use of standardised fittings (Fig 1).



**Figure 1** Non-standard doorway with unobtrusive barrier fittings



**Figure 2** Floors are tiled, with removable carpets



**Figure 3** Range in tanked alcove has its own flood barrier



**Figure 4** Fitted kitchen with plastic carcasses and removable doors

## Single dwelling case study 5.7

# Water resistant cottage in Oxfordshire

This 17th century home is subject to repeated risk of flooding from both fluvial and ground water – there have been six floods in fourteen years. After the current owners experienced their first flood they worked with a flood consultant and a local basement water proofing company to make the property resistant.

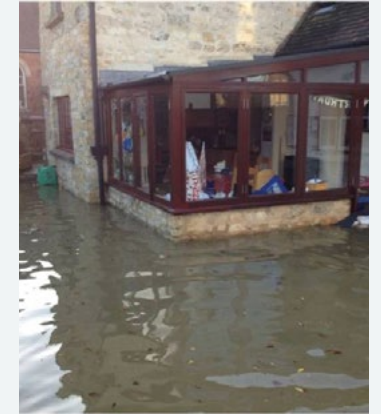
As a result, their home remained dry internally during the following floods – including the severe 2014 event - the floodwater outside the backdoor on that occasion was 43cm deep, which would have caused serious damage prior to the work being done (Fig 2).

The small amount of seepage inside the property was easily evaporated using the under-floor heating, and the carpets and furnishings were able to remain as normal (Figs 1 & 5). Since installing the system, the owners have not had to make an insurance claim.

**“... the lights were on, the children were playing – the only inconvenience was having to use a conservatory window as the front-door !”**



**Figure 1** Life now goes on as normal, even during a severe flood



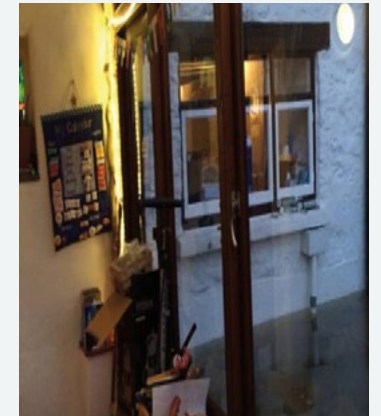
**Figure 2** During the 2014 flood



**Figure 3** Internal walls now covered with a mesh membrane, and floors are covered with a studded membrane



**Figure 4** Two sumps (similar in size to a domestic dustbin) contain pumps designed to operate at different water depths.



**Figure 5** Now – looking out at floodwater

## Single dwelling case study 5.8

# Gloucestershire

The house was known to have flooded once prior to the current owner's purchase, but that had been the 'exceptional' event of 2007 – but it has since flooded twice more, in the space of 18 months! Although the electrics and boiler had already been raised by previous owner, the house was in need of other renovation, so the owners decided to make it resilient as part of the work. This included moving all the airbricks to a higher level.

The ground floor has been tiled throughout with stone skirtings. All the window frames have also been replaced with UPVC, so the house is now draught proof as well as flood resilient.

**“Easy to mop out, and no rot. Well worth (the cost) for the heartache it saves”**

Carpenters' telescopic metal trestles (Fig 3) are used to raise the leather sofa well above flood height, as the owners found the plastic type less sturdy. All the kitchen units are on 150mm high plastic legs (Fig 8), with removable doors, and the kickboards are also removed in readiness whenever flooding is forecast. A non-return valve protects the house from foul-water backflow from the septic tank.



**Figure 1** Sump pump controls are on separate circuit, fixed high above water level



**Figure 2** Chest freezer raised on blocks



**Figure 3** Carpenters' telescopic trestles used to support a heavy sofa above flood level



**Figure 4** Two storey hen-house



**Figure 5** Now - looking out at the floodwater

## Single dwelling case study 5.9

# A single property with a comprehensive range of flood resistance/ resilience measures in Tadcaster

The location is a single house near Tadcaster, North Yorkshire. The house is not within the floodplain of a river and is not shown to be at flood risk on the Environment Agency's flood map. There is no formal data available for flood depth, duration, onset and probability, so an understanding of flood risk must be gained from local knowledge. Flooding has occurred at least 5 times between 2000 and 2007 due to runoff from surrounding hills passing through this location in the village and overwhelming an adjacent drainage ditch (Fig 1). Water depth has typically been approximately 300mm but an internal water depth of up to 900mm has affected parts of the interior of the house (Fig 2).

### The owner of the house privately funded a large range of resistance and resilience techniques:

- The ground floors were originally constructed from stone bedded on to mortar/earth. The original floor was dug up and the exterior walls were tanked. A new concrete floor with water-resistant membrane was laid. Ceramic tiles were used as the final finish on all ground floors.
- Water-resistant cement-based plaster was coated on to internal walls.
- All major joinery was replaced with hardwood.
- Raised electrics.
- New permanent flood defence walls were constructed at front and rear of house.

- Bespoke temporary door guards were obtained for front and rear outside doors and secondary door guards for the internal doorway (Fig 3).
- The floor of the conservatory was raised 300mm.
- Six submersible pumps were installed in the front a rear garden to keep the water level down behind defence walls.
- All through-wall service connections were raised 900mm above the ground floor level.
- Downstairs gravity drained toilet was replaced with a pumped system.
- Silicone sealant was applied to exterior walls.
- A stock of water absorbing bags are kept available to assist with any resistance measure that shows seepage.

It is not known whether a formal flood plan has been produced. A plan will assess the risk to people and provide a clear emergency strategy upon receipt of a warning (the warning is likely to be based upon Met Office information and local observation). The plan will ensure the ongoing effectiveness of the flood protection measures and will be invaluable to new owners of the property.

No flood incident has occurred so far since the measures have been put in place.



Figure 1 Flooding outside the house near Tadcaster



Figure 2 Internal flooding



Figure 3 Door guard fitted to the internal doorway

## Single dwelling case study 5.10

# Judy Gibson – A cottage in Worcestershire badly flooded in July 2007 now with resilience measures

Judy Gibson lives in a small village near the River Severn midway between Upton-Upon-Severn and Tewkesbury.

She has experienced two major floods in 2000 and 2007 (Fig 1), the latter resulting in a two year incarceration in a touring caravan (with no direct water/waste supply), whilst her 16th century cottage was restored.

Such was the damage to the original oak beams uncovered following the removal of all the original plaster that the ceiling, staircase, ingle-nook fireplace and the rear elevation required replacing (Fig 2).

Her insurance company was sympathetic but the enormous amount of time, paperwork and supervision of the builders certainly took its toll!

Judy was determined to ensure that, as her cottage required a complete rebuild, it should be constructed and refurbished to ensure that it was not only flood resilient, but was designed to ensure that everything on the ground floor could be moved to safety as quickly as possible.

She describes her motivation for adopting this approach as very simple: the prospect of needing to live in a caravan again for another two years was definitely not an option!

**As well as the pictures that follow, some of Judy's other changes included:**

- Powder coated steel kitchen (by Steelplan) – the removable kick boards allow thorough drying of space below/behind units (essential to avoid deterioration of the steel) (Fig 6).
- Demountable waterproof radiators (by Jaga)
- Unfixed bookcase for easy removal
- Raised fuse box

**“...not prepared to go through the upheaval and trauma again”**



**Figure 1** Cottage during floods



**Figure 2** Demolition!



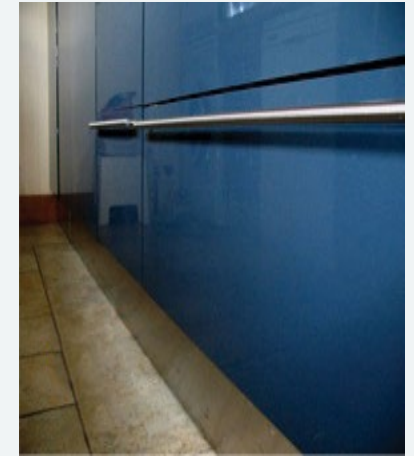
**Figure 3** Fuel oil tank on raised plinth



**Figure 4** Boiler on plinth



**Figure 5** Raised fireplace



**Figure 6** Steel kick boards on kitchen, units by Steelplan



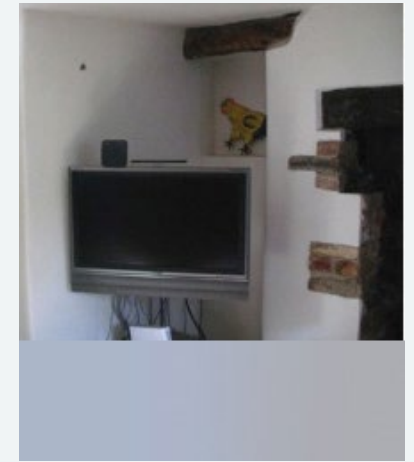
**Figure 7** Kitchen plinth on chrome leg & plastic stools



**Figure 8** Downstairs sink – no vanity unit



**Figure 9** Lightweight settees – easy to lift!



**Figure 10** TV hung on the wall

## Single dwelling case study 5.11

# Single property in West Yorkshire – permanent gate/wall barrier

Northamptonshire County Council engaged Casella Solutions to supply a system for 15 communities at risk of surface water or river flooding. This uses the 'STORM Guardian' rain gauge, which collects rainfall data remotely (Fig 1). The data logger and all the main components are housed together, making for easy installation. The system helps mitigate the risk from the increasing incidence of high intensity rainfall and flash flooding in the communities it covers.



Figure 1 Yorkshire Dampcourse/IBS Engineered products

## Community case study 5.12

# Community flash flood warning system, Northamptonshire

Northamptonshire County Council engaged Casella Solutions to supply a system for 15 communities at risk of surface water or river flooding. This uses the 'STORM Guardian' rain gauge, which collects rainfall data remotely (Fig 1). The data logger and all the main components are housed together, making for easy installation. The system helps mitigate the risk from the increasing incidence of high intensity rainfall and flash flooding in the communities it covers.



Figure 1 Casella Solutions



## Community case study 5.13

# A community pooling resources – Ulverston, Cumbria

A tidal surge in 2000 caused flooding to several of the area's historic homes and, although the sea wall was rebuilt, a wide gap had to be left to allow access which left the houses vulnerable. More flooding occurred in January 2014 when high tides and strong winds battered the Furness coast. One of the residents said: "The whole thing was horrific and I knew it was only a matter of time before the water got in again."

However, those affected by the 2013/14 floods were eligible for small Government grants and the property owners decided to pool their resources to create a community solution to the problem. Following expert assessment of the flood risk, several possible options were identified to prevent further surges from reaching their properties. The community selected a bespoke steel-framed aluminium floodgate (3.2m wide x 1.3m high) which can be ratcheted up, swung closed, and dropped down onto its base within a matter of minutes. It was also judged to be highly cost-effective compared to other possible solutions.

**"They've done a really good job," said one of the property owners. "It's a formidable piece of engineering and we're all really impressed... and at last we have peace of mind."**



Figure 1 Gate open



Figure 2 Gate closed

Images courtesy IBS Engineered Products Ltd

## Community case study 5.14

# Flash flooding solution in Devon

As part of Defra's 'Pathfinder' projects in 2015, a temporary flood barrier was funded for a community in Milton Combe, Devon. Since the problem in this location was flash flooding there was a very limited time in which any defence system could be deployed.

In 2016, the barrier was deployed for the first time and successfully saved a group of around 12 homes from being flooded. Community projects such as this can be extremely cost-effective, as the barrier worked out at around £300 per property.

This type of barrier is self-opening, as it makes use of the floodwaters' own weight: the top of the barrier lifts up, whilst at the same time the base is held down, forming a seal. This minimises the time, effort and number of people required to deploy it. It is also re-usable (unlike traditional sandbags), resistant to chemicals and can even be driven over if necessary, as well as being highly portable and requiring limited storage space.



**Figure 1** Barrier in use 2016  
(Image courtesy of Flood Protection Solutions Ltd)

## Community case study 5.15

# Modular flood barrier testing in Wiltshire

In 2014 many properties in Wilton, near Salisbury, were protected from flooding thanks to the actions of the flood warden and town council, who constructed a 20m sandbag wall to stop the water. Subsequently the Environment Agency, Wilton Town Council and Wiltshire Council came together in a project to enable the local community to use more cost-effective and efficient temporary defences in future floods.

The Town Council will store the new barriers and deploy them whenever the Environment Agency issues a warning based on the river levels upstream of the town.

### Aysha Musson said:

“This was a great opportunity for the community to test the deployment of the defences whilst also testing the response of the Environment Agency and local Town Council Volunteers...”

**“...The day was a great success and the exercise has helped us to ensure the process is as efficient as possible to reduce flood risk to Crow Lane and North Street.”**

(Aysha Musson, Asset Performance Engineer, Environment Agency as quoted in the Salisbury Journal. 12th October 2015).



**Figure 1** Temporary flood barrier deployed during trials in Wilton



**Figure 2** Local community, Environment Agency and Town Council members come together during the trials.

Images courtesy Fluvial Innovations Ltd

## Community case study 5.16

# A car park in Chichester – Installing flood barriers successfully keeps the water out

After the arduous task of clearing seaweed and other debris following a storm surge and wind assisted tidal flood of their car park in 2008, a group of neighbours decided to install a flood barrier (Fig 2). The barrier was installed later the same year and fortunately, it has only been needed once – despite extreme rainfall and the immediate area suffering extensive flooding.

One of the cottage owners commented: “Our home was built around 20 years ago and, whilst it is not susceptible to the flooding that the local area has experienced in recent years, the car park in which I and my three neighbours keep our cars becomes flooded about once every four years. The water rises to about four inches which, although doesn’t necessarily sound as high as flood waters in other areas of the country, with waves on top it is more than enough to cause a real mess with all of seaweed and grass cutting sloshing around in Chichester Harbour being dumped in front of our cottages.”

“Once the flood water finally recedes, the car park is full of debris and is in a terrible mess; it takes hours for us to be able to start using the car park again and is a real nuisance – I can only imagine how utterly terrible it must be for people to experience this in their homes.

“When the car park was at risk of flooding in October 2012, we were delighted to be able to relax after quickly erecting the Flood Control International barrier. The impact has been quite incredible; only a drop of water escaped beneath the barrier and came into our car park. It is quite extraordinary seeing the barriers in action, literally holding back the floods. If I hadn’t seen it for myself I wouldn’t have believed they would be quite so effective.

“It was absolutely money well spent. I have no concerns now whatsoever of our car park flooding, regardless of how high the storm surge is. I wouldn’t hesitate to recommend to homeowners that they install flood prevention and protection measures to their homes; they really do work and can save an enormous amount of heartache, disruption and, if homes are at risk, a lot of money.”



**Figure 1** Flood barrier in action

## Community case study 5.17

# Properties at Eamont Bridge received temporary flood resistance measures

This project involved 45 homes at Eamont Bridge in Cumbria and was partly funded by the Defra funded Property Protection Grant Scheme and also by the Environment Agency. Flooding arises from the River Eamont.

Flooding to properties begins during a 5% annual probability flood event and lasts approximately 24 hours. 45 properties flooded in November 2009 during an approximately 1.33% annual probability flood.

### Property surveys were undertaken and appropriate flood resistance products were fitted including:

- Guards fitted to external doors.
- Air brick covers and automatically closing air bricks.
- The total cost of the project was approximately £190k.
- The Environment Agency provides a Flood Warning Service with 2 hour leadtime for this area, so the equipment can be installed in good time. A Flood Action Group was created in order to pull everyone together and implement a community flood plan.



# The Cumbria Resilience ‘Showcase’ project

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The major flood events of December 2015 saw over 17,000 properties flooded, with the cost of the damage caused estimated to be £1.3bn. Rory Stewart (then Parliamentary Under Secretary of State for Environment and Rural Affairs) set in motion a process which resulted in the ‘Property Resilience Action Plan’ which was published in September 2016: <https://bit.ly/2MezBv3>

As part of putting the plan into action, a project was set up to promote flood resilient repair by creating ‘Showcase’ properties in Cumbria, one of the areas hardest hit by the 2015 storms.

These buildings were repaired using some of the innovative products and techniques now available to make the properties flood resilient. If these properties flood again in the future, they can now be cleaned and reoccupied more quickly, which will significantly reduce stress for their owners, occupiers or users.

The funding for this work came from private businesses with additional financial support from the NW Regional Flood & Coastal Committee; the Environment Agency; and sponsorship from Flood Re and AXA Insurance.

For further details, please see the films made of all the repair and renovation works: <https://bit.ly/2JiTIVx>

**“This is about people and families in their homes, businesses and other organisations, being better equipped in a flood event to reduce the chances of their lives and livelihoods being disrupted; both by stopping flood water entering their properties, and speeding recovery if it does”.**

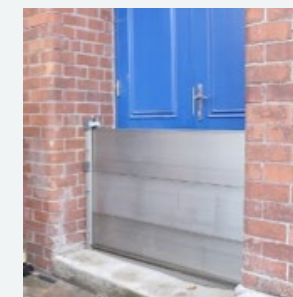
(Dr Peter Bonfield OBE FREng, Chairman of Defra Roundtable)

## Example A – Community Centre

Although parts of the building had already been repaired, the kitchen area was still an empty shell 19 months after the water had receded.

Flood resilient building work was completed by [www.rtcgroup.co.uk](http://www.rtcgroup.co.uk) using materials supplied by [www.safeguardeurope.com](http://www.safeguardeurope.com); flood resistant windows were supplied by [www.thefloodcompany.co.uk](http://www.thefloodcompany.co.uk); self-closing airbricks were donated by [www.jtatkinson.co.uk](http://www.jtatkinson.co.uk); a Puddle-sucker pump by [www.floodprotectionsolutions.co.uk](http://www.floodprotectionsolutions.co.uk) and non-return valves by [www.aquaticcontrol.co.uk](http://www.aquaticcontrol.co.uk).

Other materials donated by [www.jewson.co.uk](http://www.jewson.co.uk); [www.grahamplumbersmerchant.co.uk](http://www.grahamplumbersmerchant.co.uk); and [www.aetflooddefence.com](http://www.aetflooddefence.com)



**Figure 1** Demountable barrier for external door 1 donated by [www.floodtec.co.uk](http://www.floodtec.co.uk)

**Figure 2** Demountable type barrier on external door 2 donated by [www.lakesidefloodsolutions.co.uk](http://www.lakesidefloodsolutions.co.uk)



**Figure 3** Flood resistant side door donated by [www.floodsmartsystems.co.uk](http://www.floodsmartsystems.co.uk)



**Figure 4** Steel kitchen with high level ovens donated by [www.steelplankitchens.co.uk](http://www.steelplankitchens.co.uk)  
Stone work surfaces donated by [www.velstone.com](http://www.velstone.com)  
Tiled floor donated by [www.travisperkins.co.uk](http://www.travisperkins.co.uk)  
Tiled walls donated by [www.ctdtiles.co.uk](http://www.ctdtiles.co.uk)

## Example B – Residential barn conversion

The barn conversion had been completed prior to the floods of winter 2015/16, but the owner had been unable to obtain affordable insurance and so minimal repair work had been undertaken prior to the start of the project. As the building is situated very close to the river, resilient repair was the best option.

A utility installation couldn't be moved from the understairs cupboard (**Figure 5**) – so it was fitted with its very own flood barrier (**Figure 6**)!

Labour to install closed cell insulation, internal walls, tiling, plumbing and electrics by [www.wcjdevelopmentsltd.co.uk](http://www.wcjdevelopmentsltd.co.uk)  
The gypsum frame work was supplied by [www.british-gypsum.com](http://www.british-gypsum.com)  
Survey of floor and supply of Epoxy Resin coating by [www.deltamembranes.com](http://www.deltamembranes.com); application by [www.petercox.com](http://www.petercox.com)

Additional thanks for their support to the project go to: RAB Consultants, Trident, Cunningham Lindsey, BRE, Aquobex and Oxford Brookes University.



**Figure 1** Barn kitchen during work



**Figure 2** Completed kitchen  
Fitted kitchen donated by [www.puustellimiinus.com/en](http://www.puustellimiinus.com/en) and installed by [www.4seasonskitchens.co.uk](http://www.4seasonskitchens.co.uk)



**Figure 3** Detail of 'Sandwich' construction for lower walls during work



**Figure 4** Completed walls  
Walls sealed with Polyurea (donated by [www.adlerandallan.co.uk](http://www.adlerandallan.co.uk)) then closed cell insulation applied (by [www.kingspan.com](http://www.kingspan.com)) and finished with Dragonboard (donated by [www.dragonboard.co.uk](http://www.dragonboard.co.uk))





Figure 5



Figure 6 Floodguard barrier donated by <http://aquobex.com>



A photograph of a flooded town square. The water is deep, reaching up to the knees of people walking through it. In the foreground, two people are walking away from the camera, one holding a leash for a small dog. The background shows a row of multi-story buildings, streetlights, and a traffic light. The sky is overcast and grey.

# 06 Directory of manufacturers

## Directory of flood protection product manufacturers and suppliers featured in this handbook

### Action Dry Group

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PO Box 139  
Upminster  
Essex  
RM14 2YD

**T** 03300 500330  
**E** [info@absorbeez.com](mailto:info@absorbeez.com)  
**W** [www.absorbeez.com](http://www.absorbeez.com)

### AET

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PO BOX 4706  
Sheffield  
S17 9BU

**T** 0114 289 9094  
**E** [www.aetflooddefence.com/aqua-sac](http://www.aetflooddefence.com/aqua-sac)  
**W** [info@aetflooddefence.com](mailto:info@aetflooddefence.com)

### Allups Ltd

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Prospect House, Prospect Street  
Huddersfield  
West Yorkshire  
HD1 2NU

**E** [Online contact form]  
**W** [www.allupsltd.co.uk](http://www.allupsltd.co.uk)

### AquaDam Europe Ltd

---

The Regus Building  
Windmill Hill Business Park  
Whitehill Way  
Swindon  
SN5 6QR

**T** 01793 251 700  
**E** [sales@aquadam-europe.com](mailto:sales@aquadam-europe.com)  
**W** [www.aquadam-europe.com/floodprotection](http://www.aquadam-europe.com/floodprotection)

### AquaFence Ltd

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Europe Sales  
Nedre skøyen vei 3  
0275 Oslo  
Norway

**T** + (47) 69 20 71 70  
**E** [info@aquafence.com](mailto:info@aquafence.com)  
**W** [www.aquafence.com](http://www.aquafence.com)

### Aquaread Ltd

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Bridge House  
Northdown Industrial Estate  
Broadstairs  
Kent  
CT10 3JP

**T** 01843 600 030  
**E** [info@aquaread.com](mailto:info@aquaread.com)  
**W** [www.aquaread.com](http://www.aquaread.com)

### Aquobex Ltd

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Aquobex Ltd [Sales & Admin Office]  
Unit 4, Genesis Building,  
Library Avenue,  
Harwell Science Park  
OX11 0SG

**T** 01923 518 582  
**E** [enquiries@aquobex.com](mailto:enquiries@aquobex.com)  
**W** [www.aquobex.com](http://www.aquobex.com)

### Campbell Scientific

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Campbell Park,  
80 Hathern Road  
Shepshed  
Loughborough  
LE12 9GX

**T** 01509 828 888  
**E** [sales@campbellsci.co.uk](mailto:sales@campbellsci.co.uk)  
**W** [www.campbellsci.co.uk](http://www.campbellsci.co.uk)

### Caro Flood Defence Systems

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Edge Barn  
11 Market Hill  
Royston  
Hertfordshire  
SG8 9JN

**T** 01763 244 446  
**E** [info@caro.co.uk](mailto:info@caro.co.uk)  
**W** [www.caro.co.uk/flood-defence-systems](http://www.caro.co.uk/flood-defence-systems)

### Casella

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Regent House  
Wolseley Road  
Kempston  
Bedford  
MK42 7JY

**T** 01234 844 100  
**E** [info@casellasolutions.com](mailto:info@casellasolutions.com)  
**W** [www.casellasolutions.com/uk/en/products/met/met-environmental/tbrg.aspx](http://www.casellasolutions.com/uk/en/products/met/met-environmental/tbrg.aspx)

### Cold Flood Prevention ApS

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Pastelvej 14  
9850 Hirtshals  
Denmark

**T** +45 6124 6112  
**E** [info@coldflood.dk](mailto:info@coldflood.dk)  
**W** [coldflood.dk/en/](http://coldflood.dk/en/)

### Crocodile Flood Solutions

---

Hamilton House  
9, Hucknall Rd  
Nottingham  
NG5 1AE

**T** 0845 094 1281  
**E** [Online contact form]  
**W** [www.crocodilefs.co.uk](http://www.crocodilefs.co.uk)

### CSI Flood-products

---

3 Dunlop Court  
Deans Industrial Estate  
Livingston  
EH54 8SL

**T** 0800 083 0953  
**E** [Online contact form]  
**W** [www.flood-products.co.uk/index.php](http://www.flood-products.co.uk/index.php)

### Delta Membrane Systems

---

Delta House, Merlin Way  
North Weald, Epping  
Essex CM16 6HR

**T** 01992 523 523  
**E** [info@deltamembranes.com](mailto:info@deltamembranes.com)  
**W** [www.deltamembranes.com](http://www.deltamembranes.com)

### Easy Innovations Ltd

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Unit 6d Thomas Way  
Lakesview International  
Business Park  
Hersden, Canterbury  
CT3 4JZ

**T** 01227 712 833  
**E** sales@easyinnovations.co.uk  
**W** www.easyinnovations.co.uk/products/  
quick-dam

### Environmental Defence Systems Ltd

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PO Box 92  
Huddersfield  
HD7 4WQ

**T** 01484 641 009  
**E** info@edslimited.co.uk  
**W** www.floodsaxdirect.com

### Environmental Innovations Ltd

---

The Innovation Farm  
Sawbridgeworth Road  
Little Hallingbury  
Bishop's Stortford  
CM22 7QU

**T** 01279 600 440  
**E** [Online contact form]  
**W** www.environmental-innovations.biz

### Evaq8

---

Unit 5 Vision Industrial Park  
Kendal Avenue  
London  
W3 0AF

**T** 020 8992 1935  
**E** info@eva8.com  
**W** eva8.co.uk/HOME-FLOOD-KIT-Designed-for-  
Residents.html

### Flash Flood Doors Ltd

---

Unit 6, Bevan Close  
Finedon Road Industrial Estate  
Wellingborough  
Northamptonshire  
NN8 4BL

**T** 01933 770 272  
**E** info@flashfloordoors.co.uk  
**W** www.flashfloordoors.co.uk

### Flood Ark Ltd

---

The Forge, The Street  
Lyng  
Norwich  
NR9 5QZ

**T** 01603 879 977  
**E** info@floodark.com  
**W** www.floodark.com

### Flood Control International Ltd

---

Kilworthy Park  
Tavistock  
PL19 0FZ

**T** 01822 619 730  
**E** [Online contact form]  
**W** www.floodcontrolinternational.com

### Flood Management Company

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(Online Amazon outlet only)

**W** https://goo.gl/xp2yjG

### Flood Smart Systems Limited

---

Unit D13, Meltham Mills Ind Estate  
Huddersfield  
HD9 4DS

**T** 01484 850812  
**E** sales@floodsmartsystems.co.uk  
**W** www.floodsmartsystems.co.uk

### Flood Divert Ltd

---

Unit G7b  
Elvington Industrial Estate  
York Road, Elvington  
York  
YO41 4AR

**T** 01904 360 204  
**E** [Online contact form]  
**W** www.flooddivert.co.uk

### Floodgate Limited

---

49/51 Lammas Street  
Carmarthen  
Wales  
SA31 3AL

**T** 01267 234 205  
**E** sales@floodgate.ltd.uk  
**W** www.floodgate.ltd.uk

### FloodStop UK Ltd

---

**T** 01243 201 100  
**E** info@floodstop-uk.co.uk  
**W** www.floodstop-uk.co.uk

### Flood Fortress

---

Durey Castings South Coast Limited  
Unit 6 Station Road Industrial Estate  
Hailsham  
East Sussex  
BN27 2EY

**T** 01323 441 110  
**E** john@floodfortress.co.uk  
**W** www.floodfortress.co.uk

### Flood Kit

---

166 Worcester Road  
Hagley  
Stourbridge  
West Midlands  
DY9 0PA

**T** 01562 310123  
**E** [Online contact form]  
**W** www.floodkit.co.uk

### Flood Technologies Ltd

---

Unit 5, Fullwood Close,  
Aldermans Green Ind Est,  
Coventry  
CV2 2SS

**T** 012476 610 666  
**E** action@floodtec.co.uk  
**W** www.floodtec.co.uk

### Flood Guards Systems Ltd

---

Building 69, BRE  
Bucknalls Lane, Garston  
Watford  
WD25 9XX

**T** +44 (0)1923 518 582  
**E** sales@aquobex.com  
**W** www.floodguards.com/floodguards.aspx

### Flood Protection Solutions

---

Ash House  
Private Road No.8  
Colwick Industrial Estate  
Nottingham  
NG4 2JX

**T** 0115 9870358  
**E** enquiries@floodprotectionsolutions.co.uk  
**W** www.floodprotectionsolutions.co.uk

### Floodtite Systems Ltd

---

500 The Broadway  
Muswell Hill  
London  
N10 1BT

**T** 0208 442 0872  
**T** 07885 801 802  
**E** [Online contact form]  
**W** www.floodtite.com

### Flowstop Ltd

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1 Kingdom Avenue  
Northacre Industrial Estate  
Westbury  
BA13 4WE

**T** 01373 858 234  
**E** office@flowstop.co.uk  
**W** www.flowstop.co.uk

### Fluvial Innovations

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2-3 Harwell Road  
Nuffield Industrial Estate  
Poole  
BH17 0GE

**T** 01202 678 580  
**E** info@fluvial-innovations.co.uk  
**W** www.fluvial-innovations.co.uk

### Forge Valves

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G Forge Ltd  
The Barns  
Westenhanger  
Near Hythe  
Kent  
CT21 4HX

**T** 01303 261 086  
**E** info@forgevalves.co.uk  
**W** www.forgevalves.co.uk

### Geodesign Barriers Ltd

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1 Chapel Street  
Warwick  
CV34 4HL

**T** 01793 538565  
**E** britt.warg@palletbarrier.com  
**W** www.geodesignbarriers.com

### Ground Water Dynamics

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Furzen Hill Farm,  
Coventry Road,  
Cubbington,  
Warwickshire  
CV32 7UJ

**T** 01926 833146  
**E** info@groundwaterdynamics.co.uk  
**W** www.groundwaterdynamics.co.uk

### Isodaq Technology (part of Hydro International)

---

Old Grammar School  
Church Street  
Bromyard  
HR7 4DP

**T** 01885 483 789  
**E** enquiries@hydro-int.com  
**W** www.isodaq.co.uk/applications/flood-  
warning-systems

### IBS Engineered Products Ltd

---

Unit 7 Brunel Park  
Off Blyth Road  
Harworth  
DONCASTER  
DN11 8NE

**T** 01302 630015  
**E** info@ibsengeeredproducts.com  
**W** www.ibsengeeredproducts.com

### Isothane Ltd

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Newhouse Road  
Huncoat Business Park  
Accrington  
BB5 6NT

**T** 01254 872 555  
**E** [Online contact form]  
**W** www.isothane.com

### John Newton & Co Ltd

---

Newton House  
17-19 Sovereign Way  
Tonbridge  
TN9 1RH

**T** 01732 360 095  
**E** tech@newtonwaterproofing.co.uk  
**W** www.newtonwaterproofing.co.uk

### J T Atkinson & Sons Ltd

---

(Builders Merchants)  
Thornton House  
Cargo Fleet Lane  
Middlesbrough  
TS3 8DE

**T** n/a  
**E** [Online contact form]  
**W** www.jtatkinson.co.uk

### Lakeside Flood Solutions

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Invest House  
Bruce Road, Fforestfach  
Swansea  
SA5 4HS

**T** 020 357 35880  
**E** sales@lakesidefloodsolutions.co.uk  
**W** www.lakesidefloodsolutions.co.uk

### Littlehampton Welding Ltd

---

Riverside Industrial Estate  
Littlehampton  
BN17 5DF

**T** 01903 721 555  
**E** lhw@lhwelding.co.uk  
**W** www.littlehamptonwelding.co.uk/products

### Manthorpe Building Products Ltd

---

Manthorpe House  
Brittain Drive  
Codnor Gate Business Park  
Ripley DE5 3ND

**T** 01773 514 200  
**E** sales@manthorpe.co.uk  
**W** www.manthorpe.co.uk

### Maris Pumps Ltd

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Hill Farm  
Hassocky Lane  
Temple Normanton  
Chesterfield  
S42 5DH

**T** 01246 201111  
**E** 01246 20111  
**W** https://bit.ly/2lhA2lL

### Maynard Technologies

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Robert S Maynard Ltd.  
P O Box 8, Beech Lane House  
Wilmslow  
SK9 5ES

**T** 01625 524055  
**E** sales@robertsmaynard.com  
**W** www.flood-bags.com

### MISSION Rubber UK Limited

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Units 4+5 Atlas Business Park  
Starnhill Close  
Ecclesfield  
Sheffield  
S35 9TG

**T** 0114 257 0040  
**E** sales@missionrubber.co.uk  
**W** www.missionrubber.co.uk/non-return-valves/  
non-return-valves.html

### Multi Flood Solutions

---

[Multi Mac Ltd]  
Southfields  
Boraston Lane  
Tenbury Wells  
WR15 8RB

**T** 01584 819 233  
**E** multimaclimited@aol.com  
**W** www.multifloodsolutions.co.uk

### Safeguard Europe Ltd

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Redkilyn Close  
Horsham  
RH13 5QL

**T** 01403 210 204  
**E** (Online contact form)  
**W** www.safeguardeurope.com

### Sealwise 2014 Ltd

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Unit 5 Mendip Business Park  
Mendip Rd  
Axbridge  
BS26 2UG

**T** 01934 750 084  
**E** info@sealwise.co.uk  
**W** www.sealwise.co.uk

### Snorkel Vent

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8 Station Rd  
Saintfield  
Ballynahinch  
BT24 7DU

**T** 02892 639 995  
**E** ricky@snorkelvent.co.uk  
**W** www.snorkelvent.co.uk

### Steelplan Kitchens

---

Wealdstone Road  
Kimpton Industrial Estate  
Sutton  
SM3 9RW

**T** 0844 809 9186  
**E** sales@steelplan.com  
**W** www.steelplankitchens.co.uk

### Stormguard Floodplan

---

Regency Mill  
Macclesfield  
SK11 8HR

**T** 01260 289 089  
**E** info@floodplan.co.uk  
**W** www.stormguardfloodplan.com

### StormMeister Flood Protection

---

Unit 1.  
West View  
Preston  
PR1 5EP

**T** 01772 704429  
**E** contact@stormmeister.com  
**W** www.stormmeister.com

### Synseal Extrusions Ltd

---

Synseal  
Common Road  
Huthwaite  
NG17 6AD

**T** 01623 443 200  
**E** info@synseal.co.uk  
**W** www.synseal.com/flood-resistance

### The Flood Company

---

Unit 5, Riverside Mills  
Saddleworth Road  
Elland  
HX5 0RY

**T** 0800 999 5355  
**E** [Online contact form]  
**W** www.thefloodcompany.co.uk

### The Flood Experts

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[online only]

**T** 01202 374094  
**E** info@thefloodexperts.com  
**W** www.thefloodexperts.com

### Triton Systems

---

Units 3 - 5 Crayford Commercial Centre  
Greyhound Way  
Crayford  
DA1 4HF

**T** 01322 318 830  
**E** info@tritonchemicals.co.uk  
**W** www.triton-chemicals.com

### UK Flood Defence Alliance

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UK Flood Defence Alliance  
Floodtite Systems Limited  
500, Muswell Hill  
London  
N10 1BT

**T** 0208 442 0872  
**E** [Online contact form]  
**W** www.ukflooddefencealliance.com

### Whitehouse Construction Co. Ltd

---

Blenheim Road  
Ashbourne  
DE6 1JU

**T** 01335 344 000  
**E** (Online contact form)  
**W** www.whitehouseconstruction.co.uk

### Wykamol Group

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Unit 3, Boran Court Network  
65 Business Park  
Burnley  
BB11 5TH

**T** 08454 006 666  
**E** info@wykamol.com  
**W** www.wykamol.com/waterproofing

## Useful contacts

The Environment Agency offers advice on flood protection measures and flood planning and provides many useful guides and templates: [www.gov.uk/government/publications/flooding-what-to-do-before-during-and-after-a-flood](http://www.gov.uk/government/publications/flooding-what-to-do-before-during-and-after-a-flood)

Met Office: [www.metoffice.gov.uk](http://www.metoffice.gov.uk)

The Flood Protection Group of the Property Care Association provides information about flood restoration on their website here: [www.property-care.org/skill/flood-protection](http://www.property-care.org/skill/flood-protection)

The Chartered Institution of Water and Environmental Management (CIWEM) maintain a professionals directory where a list of flood risk consultants can be found: [www.ciwem.org](http://www.ciwem.org)

The National Flood Forum provides support and advice to communities and individuals that have been flooded or are at risk of flooding, which includes the 'blue pages' directory of flood protection products and services [www.floodforum.org.uk](http://www.floodforum.org.uk)

Mary Dhonau Associates (MDA) not only provide advice on flood resilience via their website, but can also offer many years extensive experience of working with communities and individuals at risk, as well as flood-related research initiatives: [www.marydhonau.co.uk](http://www.marydhonau.co.uk)

The Royal Institution of Chartered Surveyors (RICS) has produced a useful guide to flooding for the property owner just follow the link to useful guides on the UK website. RICS also maintain a list of chartered surveyors: [www.rics.org/uk](http://www.rics.org/uk)

RAB Consultants Ltd can provide advice and assistance on flood risk and property-level protection surveys: [www.rabconsultants.co.uk](http://www.rabconsultants.co.uk)

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(MDA) – 2014/15/16/18 updates.

Any errors, omissions and/or anomalies are entirely attributable to the authors.

The authors do not personally endorse any product or measure featured within this guide. This is a living document. Updates and amendments are encouraged from users.

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