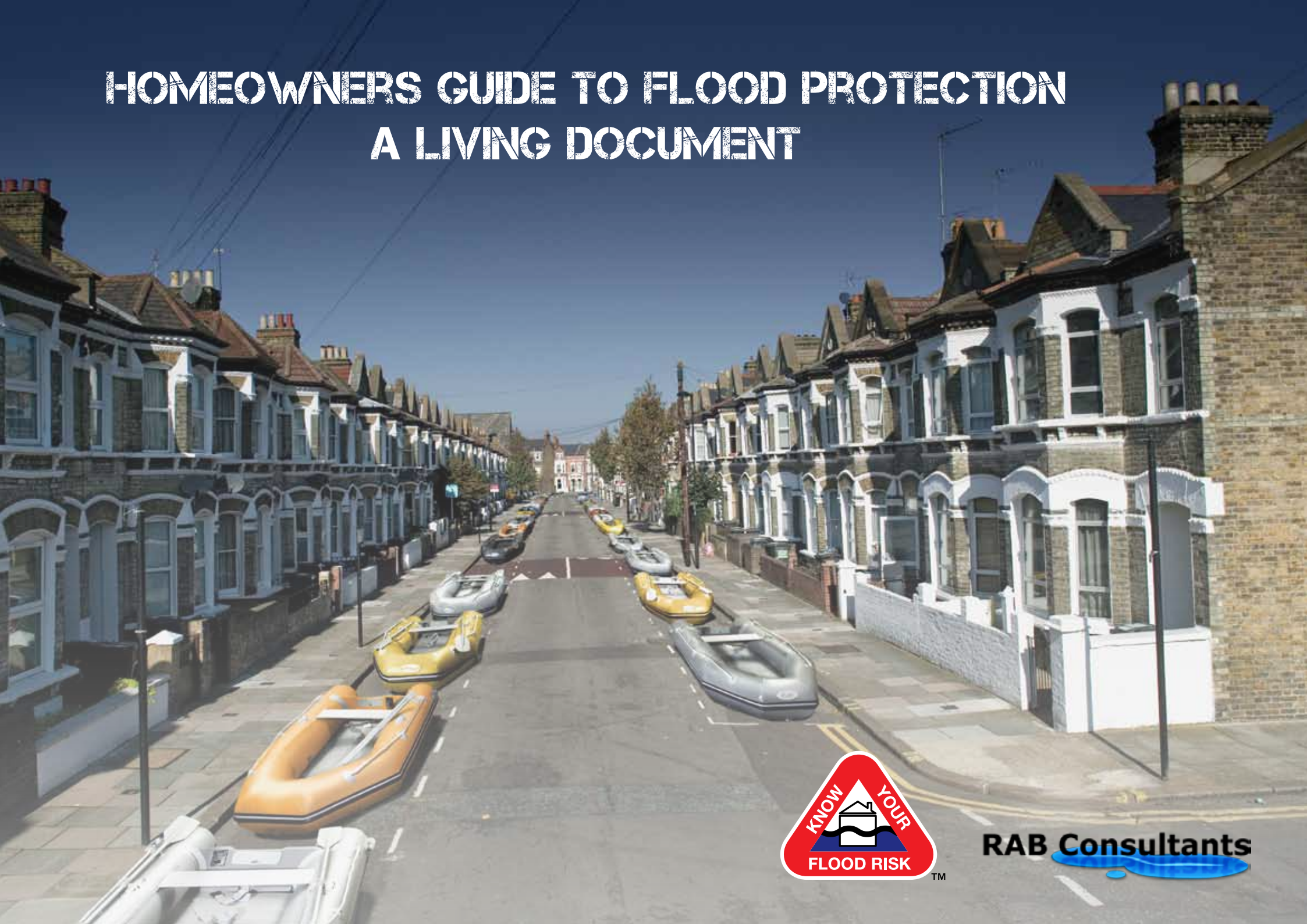


HOMEOWNERS GUIDE TO FLOOD PROTECTION

A LIVING DOCUMENT

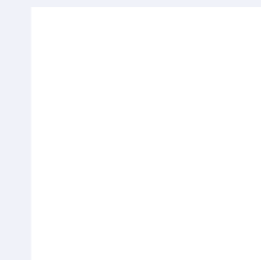
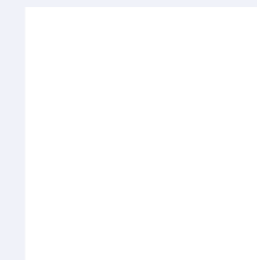


RAB Consultants

Contents

1. Why should I think about flood risk?
2. What is the risk to houses from flooding?
3. How do I find out if my home is at risk from flooding?
4. Should I consider protecting my home from flooding?
5. How best to protect myself, my family and my home from flooding?
6. Where can I find help?
7. The flood protection product information tables
8. Permanent resistance
 - 8.1. Prevent water entering doors/windows
 - 8.2. Prevent water penetrating walls
 - 8.3. Prevent water entering service pipes
9. Temporary resistance
 - 9.1. Prevent water entering doors/windows
 - 9.2. Prevent water penetrating walls
 - 9.3. Prevent water entering service pipes
 - 9.4. Flood warning devices
10. Resilience
 - 10.1. Limit water damage
 - 10.2. Remove vulnerable items from flood risk
 - 10.3. Expel water
11. Case studies
12. Directory of flood protection product manufacturers and suppliers
13. Useful links and references

Foreword



Flooding can have a devastating impact on homes and families. This was clearly shown by the terrible floods which hit so many parts of England and Wales in 2007 and again in Cumbria in 2009.

According to Environment Agency figures, over 5 million people live and work in properties that are at risk of being flooded, with an as yet undefined number of properties also at risk of surface water flooding.

With the withdrawal of the 'Statement of Principles' (a gentleman's agreement between the government and the insurance industry) in 2013, the cost of flood insurance is set to rise hugely. Furthermore, the responsibility to protect their home from flooding will lie directly with the individual homeowner. This prospect is often a baffling one, with many people not knowing how to protect their home other than with the humble and highly inefficient sandbag.

This guide, which is written specifically with the homeowner in mind, aims to reduce the worry about what flood protection products to use, illustrates the variety of ways in which a home can be protected,

demonstrates how the various products can be fitted and explains when it is appropriate to use them.

It is often the case that, when flood water reaches a certain level, it is better to let the floodwater in and adapt your home in order to reduce the devastation the floodwater can have. This hand book includes a section on this too, and features case studies from people who have been flooded but have since taken steps 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, but that we prepare in advance and take steps 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 and we hope that it will help inform you as to what can be done to militate against floods and help to reduce the misery that being flooded brings with it.

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Ron Whitehead (Flood Protection Association).

Royal Institution of Chartered Surveyors (RICS) – A clear guide to flooding for the property owner.

1. Why should I think about flood risk? - 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; 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. If you do not put protective measures in place, you may be unable to obtain flood insurance which may well invalidate your mortgage. Couple that with the emotional effects of being flooded, flood resistance (protection) and resilience (adapting your home so that the flood water does the least damage possible) suddenly seems a highly favourable option.

This extract is taken from the Defra interim report 'Flooding and insurance: a roadmap to 2013 and beyond' and may further incentivise you into protecting your property from flooding.

Flood insurance cover and resistance and resilience

The UK insurance industry currently provides insurance against flooding as a standard feature of buildings and contents insurance. In most cases, household insurance premiums do not, currently, reflect the actual flood risk to properties. The costs of flood damage are often shared between the premiums of all householders, whether or not they are at risk of flooding, although as understanding of flood risk improves so will the ability of insurers to price this risk more accurately.

The current cross subsidy means that many householders living in high-risk properties may not be paying a price which reflects the risk. It is therefore difficult for insurers to provide financial incentives, through insurance premiums and excesses, to promote resistance and resilience as in many cases the premium will not reflect the high risk of flooding to the property. This may change as the insurance market moves towards more risk-based pricing in future.



Mainstream insurers will generally insure properties in flood-risk areas, and will normally continue to provide cover for properties following a flood, albeit that this may be at a higher price. Mainstream insurers may however refuse to take on new properties with a flooding history or in an area deemed to be at significant flood risk. There are specialist brokers and insurers who specialise in insuring properties at high flood risk, who can provide cover in the majority of cases. However, the general public may not be aware of these options, particularly if they rely on price comparison websites which will tend only to show products from mainstream insurers. This is addressed below.

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. These specialist insurers may offer a way for properties at very high risk, with a history of flooding, to maintain access to insurance.

How could this change?

It is possible that in the future, insurers will routinely ensure that the flood risk to a particular property is better reflected in the policy terms, meaning higher premiums for properties in high-flood-risk areas. If the market did develop in this way, we would expect to see an increase in specialist insurance options for properties at high risk, including greater recognition of resistance and resilience measures. Even now, there are a number of steps that could be taken to help insurers better understand the impact of resistance and resilience measures and to promote resistance and resilience to householders at flood risk.

2. What is the risk to houses from flooding?

There are a number of potential sources of flooding that can threaten your home:

- i. Surface water flooding in times of heavy rain.** 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.
- ii. 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.
- iii. 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.
- iv. Coastal 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.
- v. 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 10,000 cubic metres must be registered with the Environment Agency 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.

- vi. 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.
- vii. 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. 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, 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, airbricks 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.



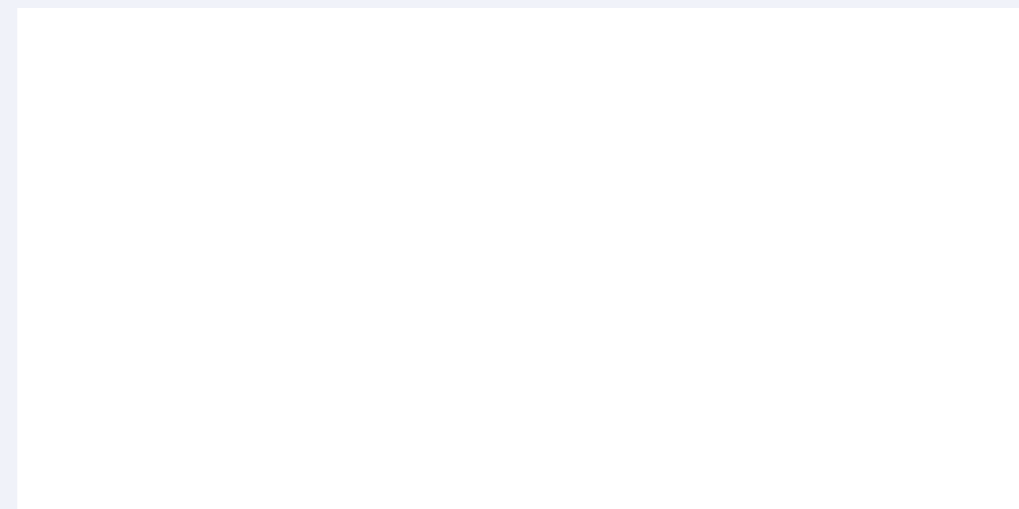
3. How do I find out if my home is at risk from flooding?

The first check that you can do, and which doesn't cost anything, is to investigate whether your property is in a river or coastal flood risk area on the Environment Agency's website. Follow links to 'The Flood Map' on the Environment Agency's website and enter your postcode. The flood map has a drop down box at the top and if 'Risk of Flooding from Rivers and Sea' is selected then the map will indicate the areas at risk of flooding with blue shading, dark blue for the highest risk, lighter blue/green where there is some risk and no shading where the risk is negligible. 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 'low', 'moderate' or 'significant'. The risk of flooding from reservoirs can also be shown, but this time with green shading, by choosing that option in the drop down menu.

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. Also, at the time of writing, the maps do not give any information about the flood risk from surface water or groundwater.

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



and surface water flooding risks which are not currently included on the Environment Agency's flood map. Currently (2011) the VAT exclusive cost of such a search is around £17-£30 for a residential property and around £75-£150 for a commercial property, though bigger properties will cost more. 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 in excess of £200. These are very modest costs when compared with the overall price of your house, mortgage costs and ongoing insurance fees.

4. Should I consider protecting my home from flooding?

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 Environment Agency's flood map (see question 4, How do I find out if my home is at risk from flooding?). The flood map will show the flood risk in the area where you live as 'negligible risk', 'low risk', 'moderate risk' or 'significant risk'.

If there is negligible risk to the property, you may decide to take no further action, though it is very important to note that 'negligible' does not mean zero risk. There may still be risk of flooding from surface or ground water or a raised body of water not shown on the Environment Agency's flood map.

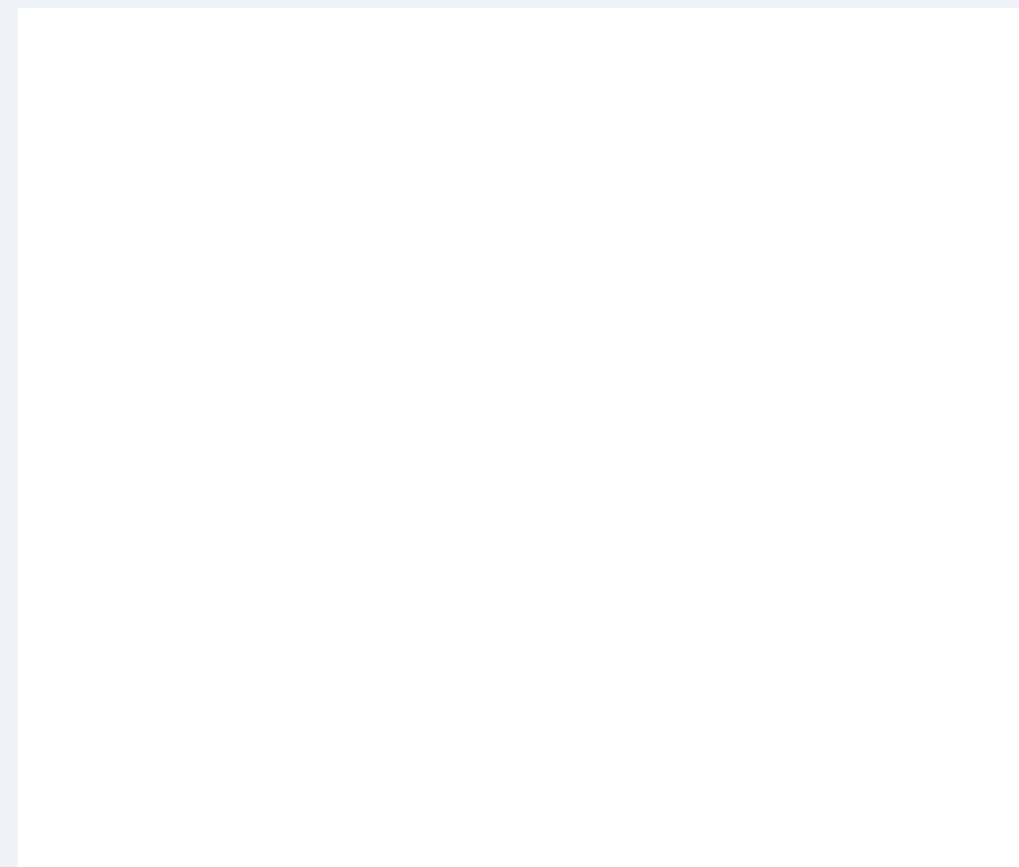
If there is a low risk, usually meaning that the chance of flooding is 1 in 200 in any year (Insurance Band 1 type properties as a broad guide) but the risk is not serious enough to significantly affect the buildings insurance, you should make some plans about how you would deal with a flood if one was 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 moderate, with a chance of flooding between 1 in 75 and 1 in 200 in any year (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 the next question) 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 significant, with a chance of flooding greater than 1 in 75 in any year (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 the next question) 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?



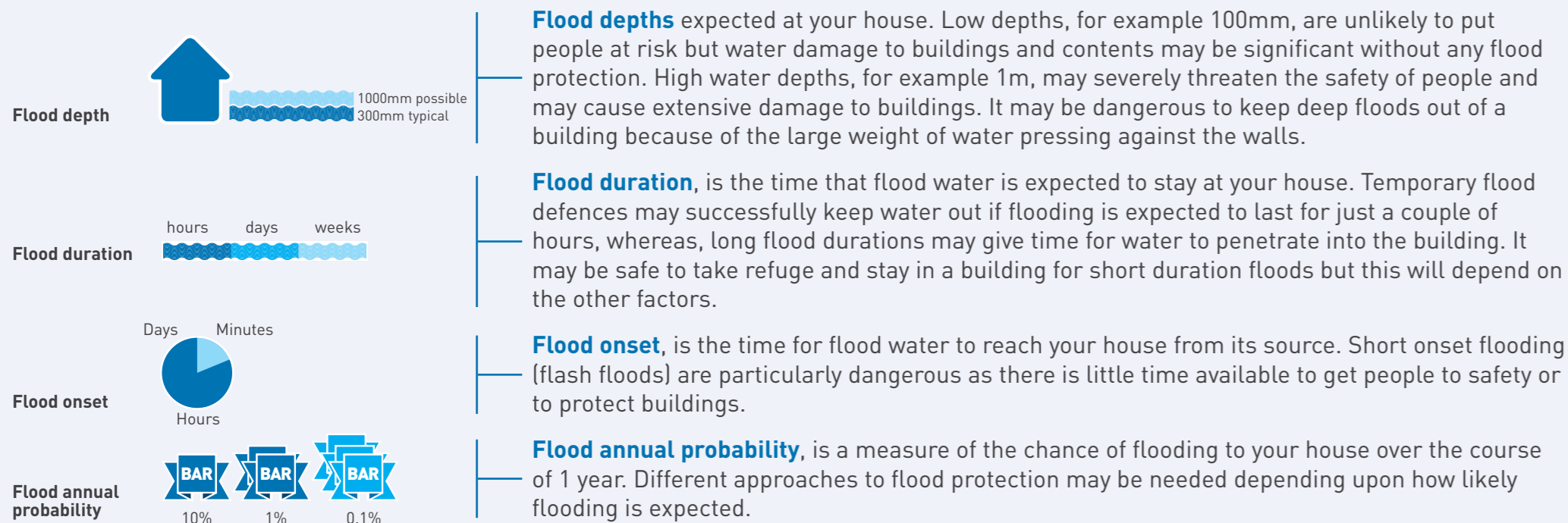
5. How best to protect myself, my family and my home from flooding?

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, mains supply) and the pathways that water will take to reach the site.

Facts about the flood risk

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



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

The above 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.

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 house 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.

Choosing the right flood protection products

Flood protection designed to keep water out of your house are 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 house 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 are vital to trigger the actions within the Household Flood Plan. The Environment Agency issues flood warnings for specific areas. There are three flood warning codes:



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



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.



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.

You should contact the Environment Agency and ask whether your house is covered by the Flood Warnings Direct service and sign up if you can. Floodline Warnings Direct is a free service which sends you a direct message when flooding is expected and may affect your property. Flood warnings will give you time to prepare for flooding which could save you time, money and heartache. You can receive warnings by telephone, mobile, email, SMS text message or fax, whichever you prefer. There are other warning systems that can be used where an area isn't covered by a formal flood warning service, for example the Met Office provides a range of weather warnings which gives an indirect warning of potential flooding. Early warnings are issued up to several days in advance. Flash warnings are issued 2 – 6 hours in advance of an event. Local authorities may also issue warnings to residents. Private flood level alarms are also available for purchase (refer to section 9.4).

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 offer a template to follow on the website.

6. Where can I find help?

There is a list of useful links at the end of this document where you can get further help and advice.

In England and Wales the Environment Agency is responsible for building, maintaining and operating flood defences and for issuing flood warnings to the public, with a particular emphasis on rivers, seas and reservoirs. The Environment Agency has an extensive website covering flood risks and what to do to prepare for a flood, during a flood and after a flood.

Following the floods of 2007, where local flooding effects were shown to have been very important, Lead Local Flood Authorities (LLFA) were established. Your LLFA will be your County, City or Metropolitan Borough Council and their responsibility is to manage local flood risk, with an emphasis on surface water, ground water and less significant watercourses. Your LLFA will investigate flooding incidents in the area

7. 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 indicative costs (for application to a single dwelling), advantages/disadvantages and supplier names. The tables are arranged so easy comparisons can be made between categories of product to help with selection.

and publish the results of any investigation and maintain a register of structures or features which they consider have a significant effect on flood risk. Your LLFA will work with Police, Fire, rescue services and the Environment Agency to coordinate responses during severe flooding and will issue advice to the local area about the incident and what action to take. This may include organising rest centres for evacuated people.

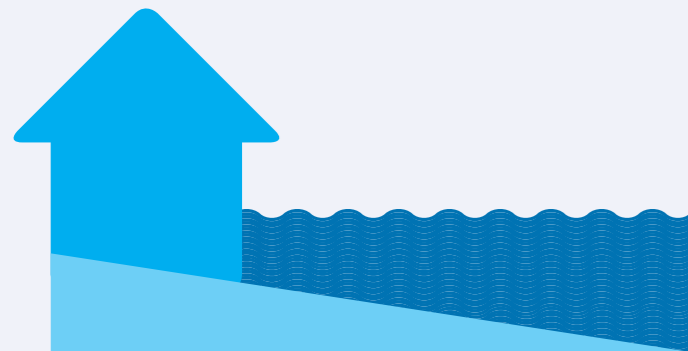
Both the Environment Agency and Lead Local Flood Authority will be able to assistance you with understanding your flood risk and deciding how best to protect yourself. If you are at particular flood risk and have previously flooded your Lead Local Flood Authority may be able to offer some financial assistance for flood protection measures through Property-Level Flood Protection funding or from other local authority funds.

Flood protection products that have been performance tested and have passed the BSi standard making them eligible for a kitemark are indicated by the use of a BSi superscript.

The information contained in the handbook was obtained from a literature review, by consultation with industry experts and a wide range of manufacturers and suppliers of products. It should be noted that a web search was undertaken (January 2011) to provide as wide a range of products, manufacturers and suppliers as possible. No endorsement is given to any products or services listed. The information is simply designed to act as a directory for your assistance. This is a living document. Updates and amendments are encouraged from users, manufacturers and suppliers. Please refer to the foreword for details.

8. Permanent resistance

Resistance measures are aimed at keeping floodwater out of a building. They are designed to lessen the damage that floodwater can have and also give homeowners extra time to move ground floor contents. The measures may only be effective for a limited time and limited water depth. Permanent resistance means that flood protection is permanently in place with no action needed to deploy the device - permanent resistance is a 'fit and forget' approach.



8.1 Prevent water entering doors/windows

8.2 Prevent water penetrating walls

8.3 Prevent water entering service pipes

8.1 Permanent Resistance – Prevent water entering doors/windows

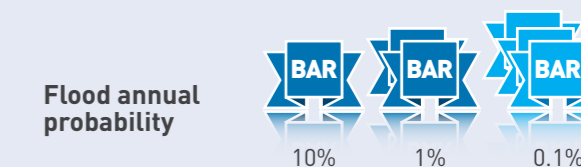
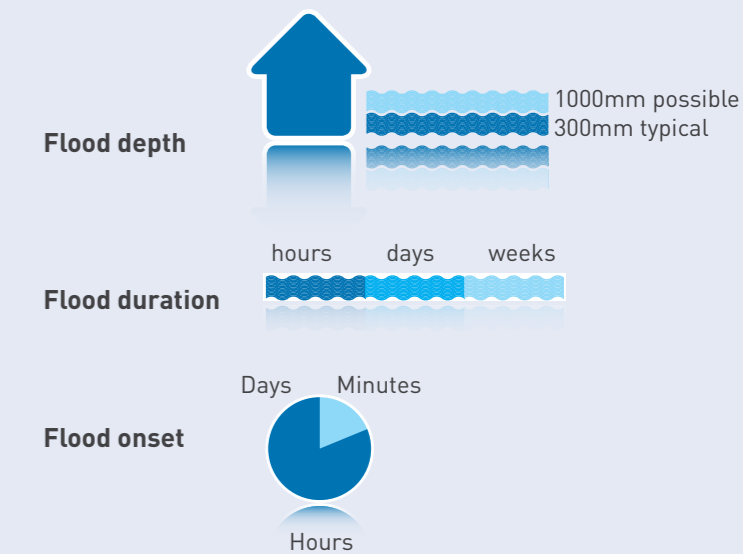
Description

These are permanent resistance products designed to stop water entering your house through doors and windows. 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 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 house 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted.





Flood plan considerations

These products do not require activating to make them work and so protection to your house 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.



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

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Raised porch/threshold	£1.5k (threshold) £5 - £10k (porch)	Unobtrusive. Multifunctional	Low flood depth. Disabled access. May need water-proof door. No quality standard for flood protection.		 Ref: Severn Trent
Auto-barriers Unobtrusive.	£5k to £15k	High flood depth. BSi PAS1188-1	High initial cost. Below ground work. May need measures to deal with seepage.	Autodam from Damfast. UKFloodBarriers self Closing Flood Barrier (SCFB).	 UKFlood Barriers self Closing Flood Barrier (SCFB)
Water-resisting external doors/windows	£0.75k to £5k	Unobtrusive. BSi PAS1188-1	May need measures to deal with seepage. 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.	Flash Flood Doors LtdBSi. Revetment – flood control doorsBSi. WhitehouseBSi. Other products and suppliers include: Defence Doors Ltd. Floodguard UK (FloodProof doors).	 Flash Flood Doors
Sealant around external doors/windows	Very low cost	Unobtrusive. Inexpensive.	Needs careful application. Relies on waterproof doors/windows. No quality standard. May need measures to deal with seepage.	Silicone sealants are widely available.	 Flood Angel Silicone

8.2 Permanent Resistance – Prevent water penetrating walls

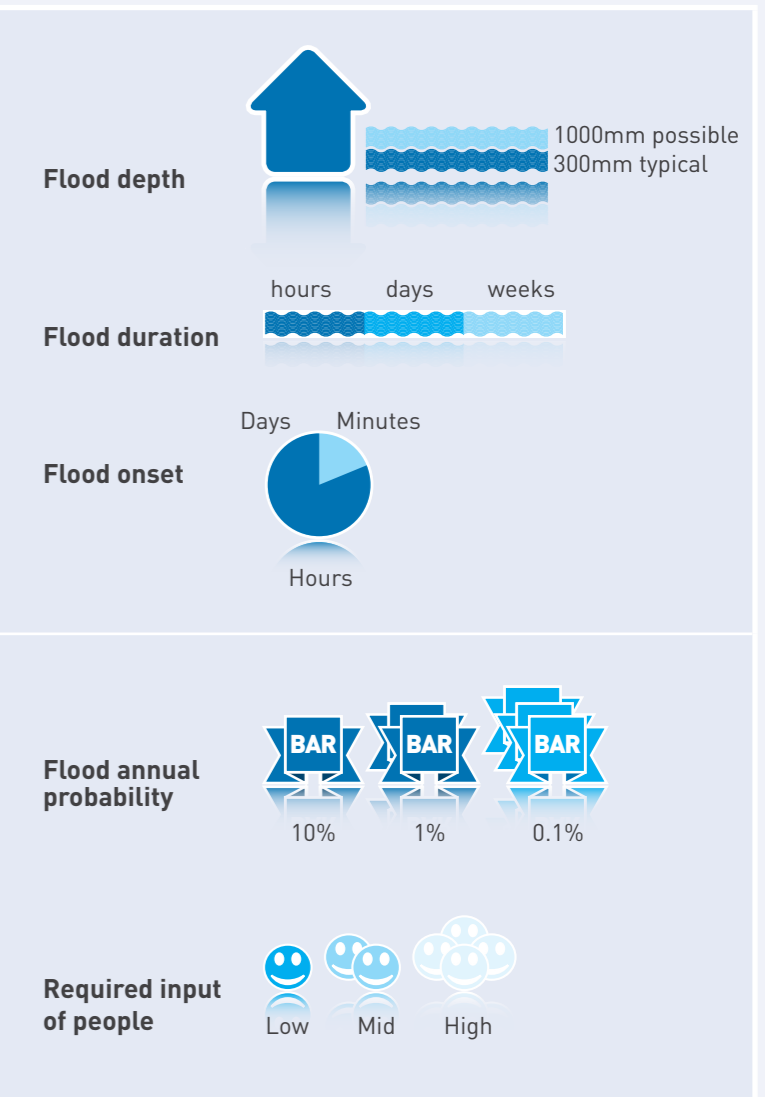
Description

These are permanent resistance products designed to stop water entering your house through walls. 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 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 house 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted.





Flood plan considerations




These products do not require activating to make them work and so protection to your house 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.



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

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Re-pointing Repair cracks in walls Seal service outlets	Low cost	Unobtrusive. Inexpensive.	Needs careful application. Needs water-resistant formula. May just reduce penetration rate. No quality standard.	Correctly applied silicone sealant. UK flood barriers. Stormdry Re-pointing Additive 2 (Safeguard Europe). Watertight International.	
Covering weep holes	Low cost	Unobtrusive. BSi PAS1188-1 may be relevant. BSi PAS1188-3 may be relevant if a building skirt system is used.	Needs good workmanship. No kitemarked products currently available. May cause damp problems if permanently covered.	Flood Angel.	 An uncovered weep hole)
Facing bricks	£1000	More effective than sealing existing wall.	Needs good workmanship. Below ground work. May need planning approval. May just reduce penetration rate. Visually alters building. No quality standard.	Engineering bricks.	 Ref: Severn Trent
Render £2000 Should seal all	£2000	Should seal all cracks even when walls are in relatively poor condition.	Needs good workmanship. Below ground work. May need planning approval. May just reduce penetration rate. May need facing bricks as well. Visually alters building. No quality standard. May lead to damp within the walls.	Kiltox. Revetment – Limebased breathable plaster. Vandex – Safeguard Europe.	 Ref: Severn Trent

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Wall sealant	£500 (materials)	Unobtrusive. Inexpensive. Easily applied.	Needs careful application. May just reduce penetration rate. No quality standard. May lead to damp within the walls. Brickwork needs to be in good condition to be effective.	Drybase liquid applied DPM (Safeguard Europe). Flood Angel – Waterstop (UK flood barriers). Floodblock chemical protection. Floodguards. ICOPAL. Stormdry Masonry Protection Cream. Stormdry (Safeguard Europe). Watertight International. Nanoshell	 Ref: Stormdry – Safeguard Europe
Permanent wall barrier	£3k-£30k	Can use glass to minimise visual impact and allow light through. Wood effect to mimic a fence. BSi PAS1188-3.	Expensive. Needs careful design and construction. Loss of floodplain. May need measures to deal with seepage.	Bespoke options are available from various specialist contractors.	 Ref: National Flood Forum newsletter May 2009
Tanking Expensive. Kiltox tanking render.	£10k-£20k	Designed to completely waterproof. Offers groundwater protection. Significant guarantees and experience.	Needs sump and pump. Vulnerable to damage due to later alterations. Primarily designed to protect against groundwater. ICOPAL.	Revetment – internal tanking. Triton Chemical Manufacturing Co Ltd. UKFloodBarriers tanking polymer. Vandex – Safeguard Europe.	 Ref: Revetment

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Water-resisting airbricks	£0.5k-£1k	Inexpensive. Unobtrusive. BSi PAS1188-1	Needs careful installation and maintenance. May need measures to deal with seepage.	Flood AngelBSi. Other products and suppliers include: Flood Control International. Flood Defender. SMART AirBrick. Snorkelvent. VentSeal.	 Ref: Stormdry – Safeguard Europe
Seal gap between DPC and DPM	Expected £1k-£5k	Unobtrusive.	Needs careful installation.	No quality standard. Safeguard Europe. Triton Chemicals.	 Ref: National Flood Forum newsletter May 2009

8.3 Permanent Resistance – Prevent water entering service pipes

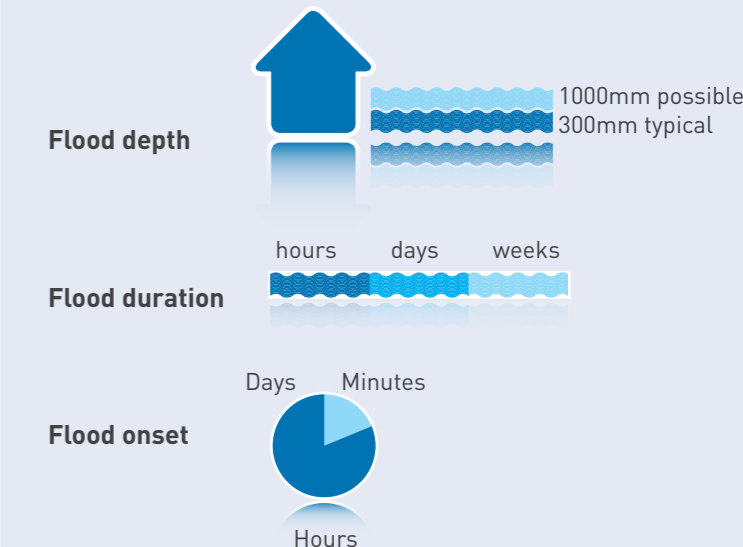
Description

These are permanent resistance products designed to stop water entering your house through service pipes. 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 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 house 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted.


Flood plan considerations

These products do not require activating to make them work and so protection to your house 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.

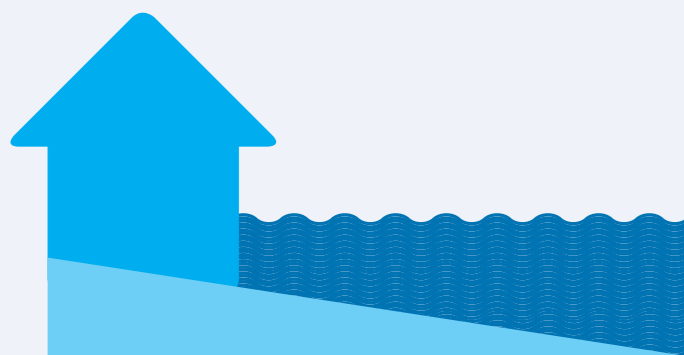


Dark blue indicates strong applicability of products in dealing with flooding, with **light blue** indicating reducing applicability.

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Non-return valves for wastewater pipes and washing machine outlets.	£50 to £500	Unobtrusive. Inexpensive. Easy fit. BS EN 13564.	May need to assess the impact on neighbours. No quality standard.	Watertight InternationalBSi. Other products and suppliers include: Combined Harvesters. FloodAngel. Marley. Mission Rubber. Revetment NRV flusher. UKFloodBarriers – full port backflow valve. Whitehouse.	

9. Temporary resistance

Resistance measures are aimed at keeping floodwater out of a building. They are designed to lessen the damage that floodwater can have and also give homeowners extra time to move ground floor contents. The measures may only be effective for a limited time and limited water depth. Temporary resistance means that products will need to be installed before flood water arrives in order to be protected.



9.1 Prevent water entering doors/windows

9.2 Prevent water penetrating walls

9.3 Prevent water entering service pipes

9.4 Flood warning devices

9.1 Temporary Resistance – Prevent water entering doors/windows

Description

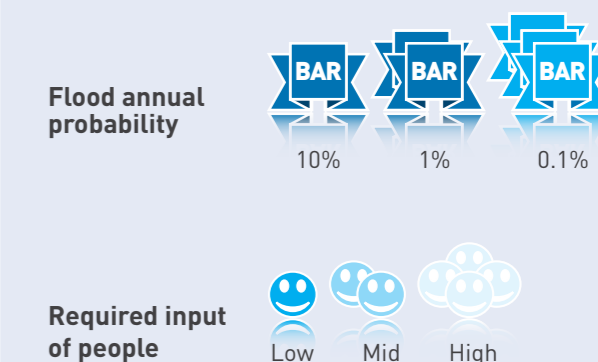
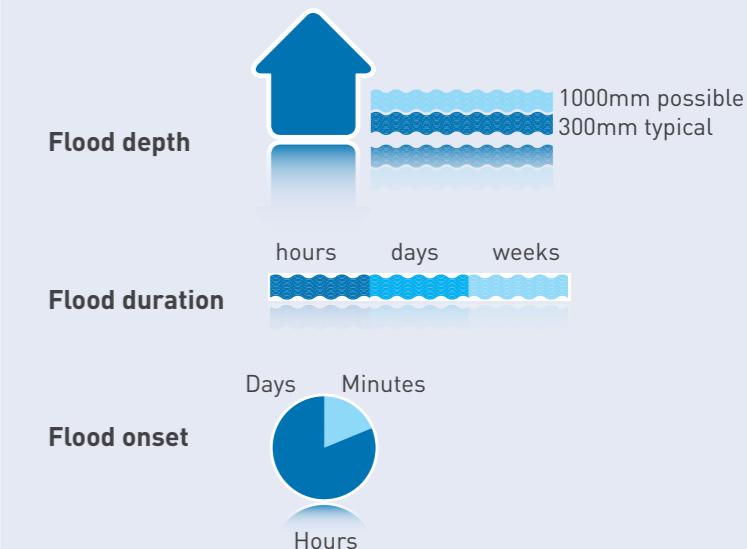
These are temporary resistance products designed to stop water entering your house through doors and windows. These products will only keep water out if they are correctly used as part of a package of measures identified from a property-level flood protection survey by a qualified and experienced surveyor. The products will need to be installed 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted.


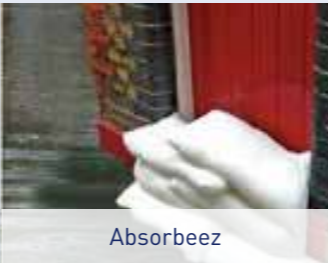
Flood plan considerations

These products require activating to make them work and so protection to your house depends upon receiving and acting on a flood warning. Some training will be needed to correctly operate the products and long term storage of items may be 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.

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



Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Entrance door/patio door/garage door/window barriers	£0.5k to £3k	Rapid deployment. Relatively low cost. Low weight and easy deploy products available. Kitemarked products available (BSi PAS 1188-1). A large choice of products.	Storage of items. Some barriers need tools for deployment. Permanent fixings on the building with most products. Deployment may be difficult for people with special physical needs. No Kitemark for DIY fitted products. May need measures to deal with seepage.	Provided by BSi: Flood Angel - flood defender Flood Ark Floodgate Floodguards Floodtite Flood Wall Revetment – flood guards Watertight International – Flood Barriers Other products and suppliers include: Caro – WaterDoor. Combined Harvesters. DamFast. Flood Angel - waterdoor Floodaway – Multi-Flood Solutions. Floodblock – Flood Wall. Flood Control. Flood Control International. Flood Matters. Flood Plan. Flood Sentry. Fluvial Innovations – Flood Stop. FloodShield. Newlands - Flood Buddy. Total Flood Solutions.	 Floodguards courtesy of Revetment
Sandbags/adsorbent bags	Relatively low cost	Absorbent bags: Lightweight. Ready to use. Quick to deploy. Holds tens of litres of water.	Sufficient bags must be stored ready for use. Used bags need to be disposed. Kitemark does not seem to be applicable.	Absorbeeze. Aqua-sac. FloodBloxx. FloodSax. Sorbarix.	 Absorbeeze

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Pet flap covers	Relatively low cost	Rapid deployment. Relatively low cost. Low weight and easy deployment.	Storage of items. Some barriers need tools for deployment. Permanent fixings on the building with most products. Deployment may be difficult for people with special physical needs. No Kitemark.	FloodDefender. UKFloodBarriers.	 UKFloodBarriers
De-mountable barriers	£10k to £40	Property fully protected. Structure of building is not the limiting factor. Applicable kitemark BSi PAS1188-4. Some products can be stored in situ.	Need sufficient warning. Some knowledge and a certain degree of physical ability is required. Most products need separate storage. Significant loss of floodplain. High initial costs. Groundworks required. May need pumps to deal with seepage. Security may be needed to prevent barrier theft.	Caro – WaterWallBSi. Flood Fence – Multi-Flood SolutionsBSi. Other products and suppliers include: Dutch Dam. Multiple Span Demountable Barriers (Flood Control International). Revetment In-situ barrier. Task Green. TiltDam and SpringDam. Caro – WaterWall	 Caro - Waterfall
Free-standing barriers	£10k to £40	Property fully protected. Structure of building is not the limiting factor. Applicable kitemark BSi PAS1188-2.	Need sufficient warning. Some knowledge and a certain degree of physical ability is required. Most products need separate storage. Significant loss of floodplain. High initial costs. May need significant manpower to deploy. Designed more for communities rather than individuals. May need measures to deal with seepage.	Bauer-IBS KSystem BSi. GeodesignBSi. RapidamBSi. Other products and suppliers include: Aquadam. AquaFence. AquaTube. FloodStop. Fluvial Innovations – Tubewall. WaterGate.	 AquaFence

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
FloodSkirts	£10k to £35k	Property fully protected. Structure of building is not the limiting factor. Applicable kitemark BSi PAS1188-3.	Need sufficient warning. Some knowledge and a certain degree of physical ability is required. Most products need separate storage. High initial costs. May need measures to deal with seepage.	Total Flood Solutions.	 Ref: DEFRA R&D technical report, Pam Bowker, 2007
Perimeter flood wall with gates	£5k to £15k	Property fully protected. Structure of building is not the limiting factor. Kitemark BSi PAS1188-4 may be applicable.	Need sufficient warning. Significant loss of floodplain. Needs continuity of barrier. High initial costs. May need measures to deal with seepage.	Floodguards. Lift Hinge Aluminium Flood Gates (Flood Control International). Swing Hinge Aluminium Flood Gates (Flood Control International). Revetment.	 Flood Control International

9.2 Temporary Resistance – Prevent water penetrating walls

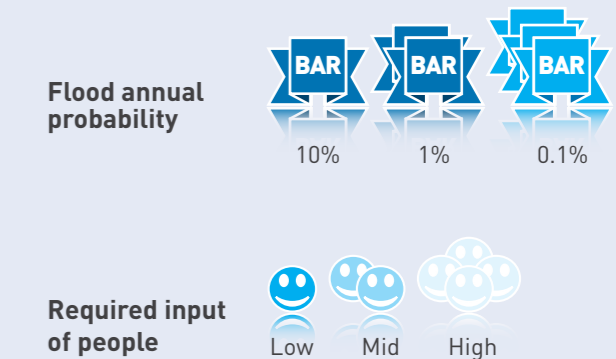
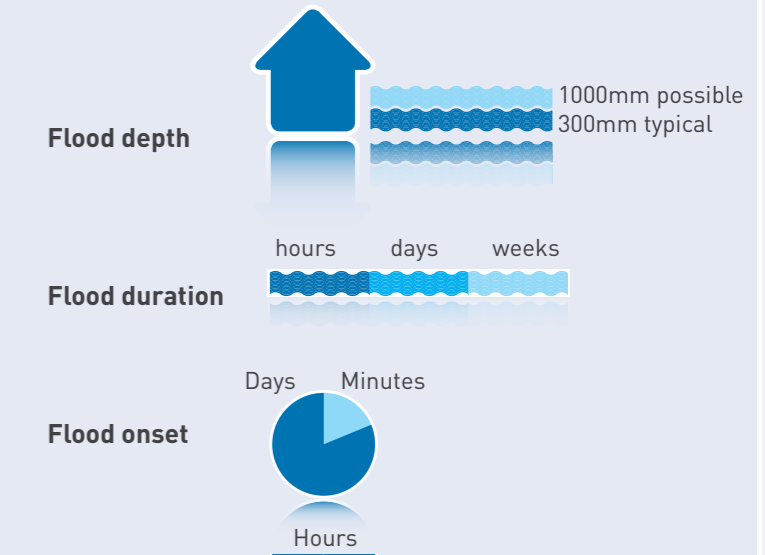
Description

These are temporary resistance products designed to stop water entering your house through doors and windows. 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 by a qualified and experienced surveyor. The products will need to be installed 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted.


Flood plan considerations

These products require activating to make them work and so protection to your house depends upon receiving and acting on a flood warning. Some training will be needed to correctly operate the products and long term storage of items may be 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.



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

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Airbrick covers	£50 to £300	Inexpensive. Applicable kitemark BSi PAS1188-1.	Need sufficient warning. Requires storage and to be easily located after a flood warning. May need measures to deal with seepage.	Provided by BSi: Flood Ark Floodguards Revetment Other products and suppliers include: DamFast. Easifit Ventguard. Flood Control International. Floodgate. Flood Plan. Flood Sentry. Vent Buddy. Watertight International. Newlands - Flood Buddy. Total Flood Solutions.	 Flood Ark

9.2 Temporary Resistance – Prevent water entering service pipes

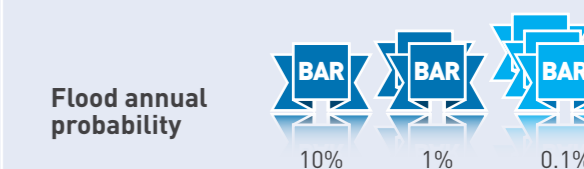
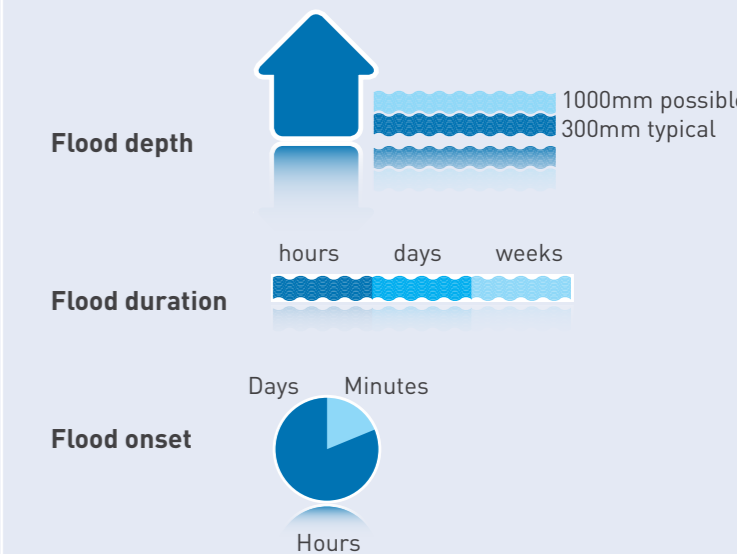
Description

These are temporary resistance products designed to stop water entering your house through doors and windows. 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 by a qualified and experienced surveyor. The products will need to be installed 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 workmanship and flood conditions, in fact the existing BSi kitemark standard allows for some seepage. There is a risk to the structure of your house 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 are intended to be resisted


Flood plan considerations



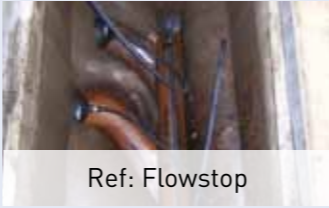
These products require activating to make them work and so protection to your house depends upon receiving and acting on a flood warning. Some training will be needed to correctly operate the products and long term storage of items may be required. Routine inspection and maintenance of the products is 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 exceeds the design of the flood protection products, people being trapped in the house with rising water.



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

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Toilet plugs	£50	Inexpensive. No permanent installation required.	Need sufficient warning. Requires storage and to be easily located after a flood warning. Needs to be correctly deployed. No kitemark	Flood Angel toilet bung. Floodblock. Flood Matters. Floodtite panseal. UKFloodBarriers. UK flood control.	 Flood Angel inflatable U-bend toilet bung

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Bolt-down inspection covers	Inexpensive.	Inexpensive.	Need sufficient warning. Needs to be correctly deployed. No kitemark.	Total Flood Solutions.	
Appliance vent covers	Inexpensive.	Inexpensive.	Need sufficient warning. Needs to be correctly deployed. No kitemark.	Floodguards. Most manufacturers of bespoke door barriers.	 Floodguards
Pipe bungs	Inexpensive.	Inexpensive.	Need sufficient warning. Needs to be correctly deployed. No kitemark.	Flowstop.	 Ref: Flowstop

9.4 Temporary Resistance – Flood warning devices


Flood warnings are vital to know when to carry out the flood plan and install temporary resistance products.

The Environment Agency issues flood warnings for specific areas. You should contact the Environment Agency and ask whether your house is covered by the Flood Warnings Direct service and sign up if you can. Floodline Warnings Direct is a free service which sends you a direct message when flooding is expected and may affect your property. Flood warnings will give you time to prepare for flooding which could save you time, money and heartache. You can receive warnings by telephone, mobile, email, SMS text message or fax, whichever you prefer.

There are other warning systems that can be used where an area isn't covered by a formal flood warning service, for example the Met Office provides a range of weather warnings which gives an indirect warning

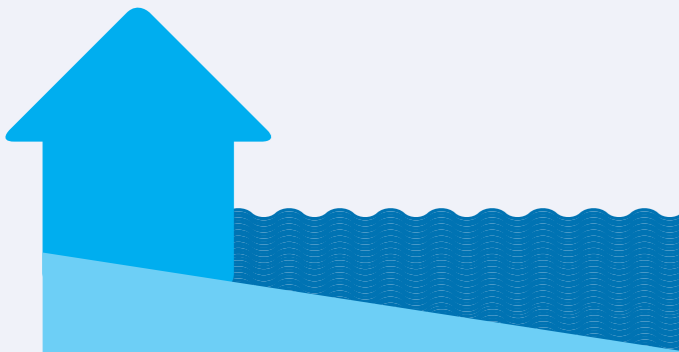
of potential flooding. Early warnings are issued up to several days in advance. Flash warnings are issued 2 – 6 hours in advance of an event. Local authorities may also issue warnings to residents.

Private flood level alarms are also available for purchase. These will 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 house is about to flood to alert you of 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.

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Flood alarm	£	Ideal where there is no formal flood warning service. 24/7 monitoring.	Needs careful installation. Needs regular testing/maintenance. May need to obtain permission from landowners/local authorities.	Revetment – flood alarm system Total Flood Solutions Floodguards Combined Harvesters Isodaq Campbell Scientific Dynamic Logic Hydrologic UKFloodBarriers Flood Safe Flood Alarms Flood Sense Environmental Innovations Ltd	 Hydrologic sensor installed on a bridge over a river.

10 Resilience

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.



- 10.1 Limit water damage
- 10.2 Remove vulnerable items from flood risk
- 10.3 Expel water

10.1 Resilience – Limit water damage

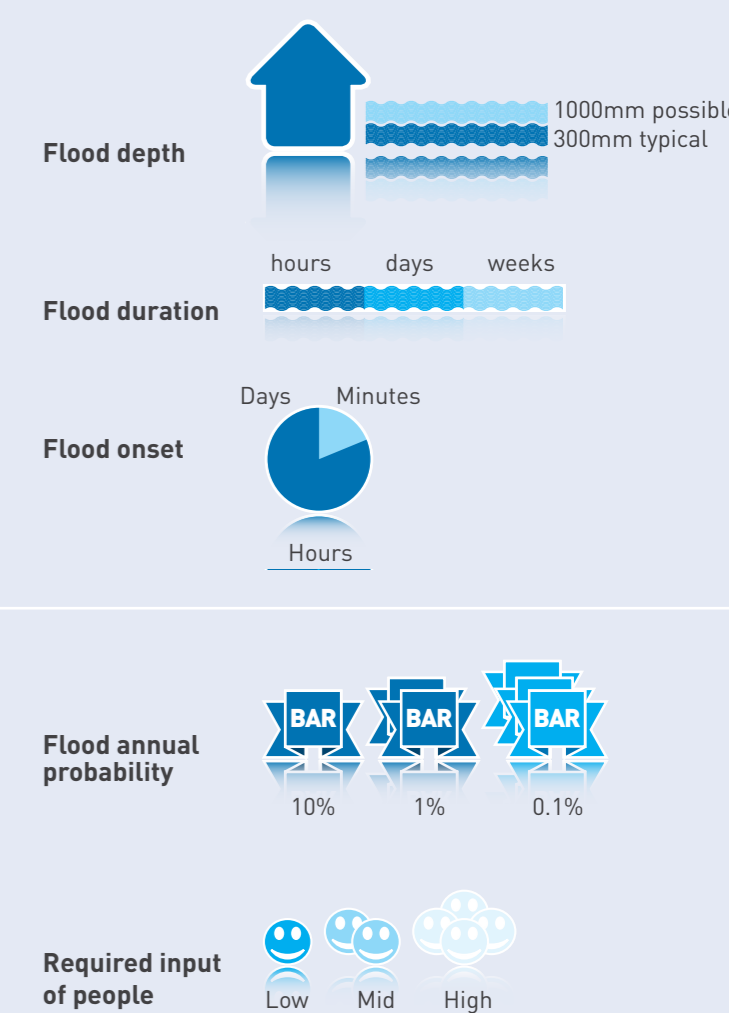
Description

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 from a property-level flood protection survey by a qualified and experienced surveyor. No particular action is required by you to make the product work and so resilience will protect even while you are away from your house and 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 be at risk. In these cases a structural survey is recommended.




Flood plan considerations



These products do not require activating to make them work and so protection to your house 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 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 house with rising water.



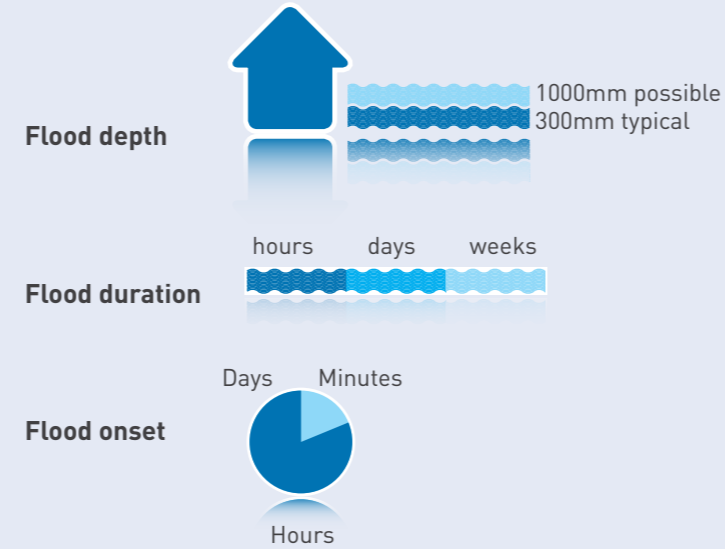
Dark blue indicates strong applicability of products in dealing with flooding, with **light blue** indicating reducing applicability.

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Water compatible internal walls	Approximately 2x cost of traditional gypsum or plasterboard	Permanently in place.	Needs good quality workmanship. There are still cleaning and drying costs following a flood. Probably only cost effective to replace existing as part of flood damage repair work. No kitemark.	Chemical DPC below joists. Closed-cell insulation. Lime-plaster. Property Care Association – waterproof membrane. Revetment – Lime-based breathable plaster. Tiling. Waterproof lining for internal walls and floors from Safeguard Europe: Oldroyd Xv Clear Oldroyd Xp Oldroyd Xv20. Drybase liquid applied DPM from Safeguard Europe.	
Water compatible floors		Permanently in place.	Needs good quality workmanship. There are still cleaning and drying costs following a flood. Probably only cost effective to replace existing as part of flood damage repair work. No kitemark.	Concrete. Epoxy coating. Tiles.	
Water compatible kitchen/bathroom appliances and fixtures.	£100's to £1000's	Permanently in place.	There are still cleaning and drying costs following a flood. Probably only cost effective to replace existing as part of flood damage repair work. No kitemark.	RKB plastic kitchens. Steelplan Kitchens. Cheap carcasses for disposal after flood.	 Steelplan Kitchens

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Water compatible woodwork.	Relatively inexpensive. Approximately £100 per door.	Permanently in place.	There are still cleaning and drying costs following a flood. Probably only cost effective to replace existing as part of flood damage repair work. No kitemark.	Plastic alternatives. Water proof paint.	
Water compatible stairs.	Approximately 2x cost of traditional build.	Permanently in place.	There are still cleaning and drying costs following a flood. Probably only cost effective to replace existing as part of flood damage repair work. No kitemark.	Concrete. Hardwood. Steel.	

Description

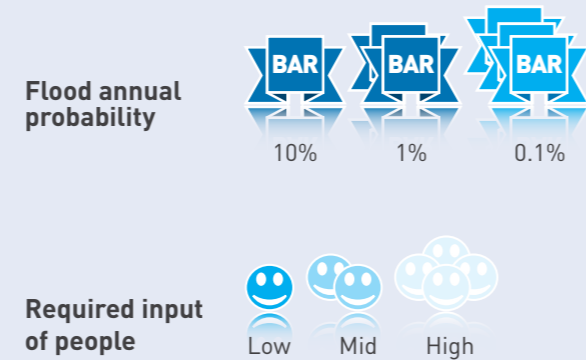
These resilience measures are designed to reduce the amount of damage caused when water enters a building by raising, removing or covering vulnerable items to get them out of the way of flood water. Ideally a package of products should be used to lessen the harm that water does to a building from a property-level flood protection survey by a qualified and experienced surveyor. Some items can be raised and permanently fixed into position once only while others will need action each time flooding is expected. Where action is required no flood protection will be available when you are away from home. In situations where flood water is expected to arrive very quickly and with high depth and velocity the building structure may be at risk. In these cases a structural survey is recommended.






Flood plan considerations

Some of these products require action to make them work and so protection to your house 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. 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 house with rising water.



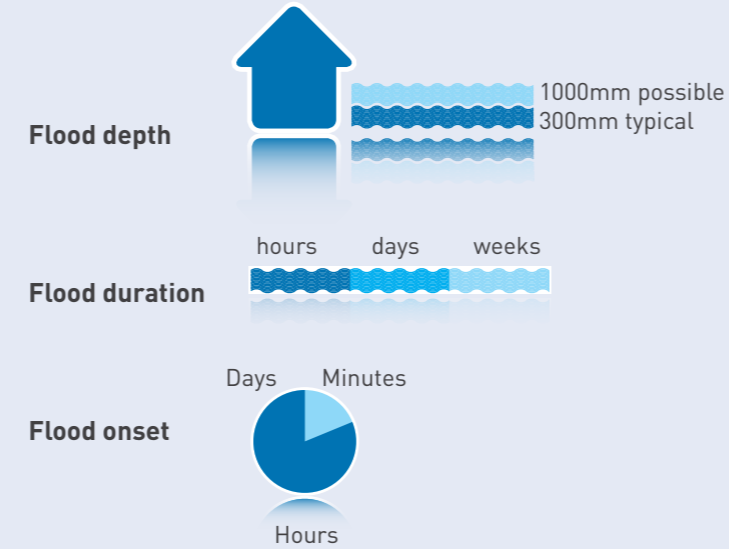
Dark blue indicates strong applicability of products in dealing with flooding, with **light blue** indicating reducing applicability.

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Raised utilities	Cost to rewire a house, £1k - £4k.	Permanently in place.	There is a practical limit to how high electrics can be raised. No flood quality kitemark.	Local electricians	
Raised kitchen appliances.	Rel atively low cost plinths.	Permanently in place.	There is a practical limit to how high appliances can be raised. There are still cleaning and drying costs following a flood. No flood quality kitemark.		 Ref: DEFRA R&D technical report, Pam Bowker, 2007
Removable fixtures and fittings.	Relatively low cost.	Rapid deployment. Inexpensive.	Requires occupant to maintain and deploy. No kitemark.	Quick release hinges for internal doors. Removable radiators from Jaga.	
Relocate valuables	Zero cost.	Rapid deployment. No cost.	Requires occupant to deploy. Large items may be difficult to move.	Move valuables upstairs. Raise valuables on tables/plinths.	
Water-tight cover for values	Approximately £50 per cover.	Rapid deployment. Inexpensive.	Requires occupant to store bags and deploy. No kitemark.	Flood Possessions Protector. MFC Survival – Floodbag.	

10.3 Resilience – Expel water

Description

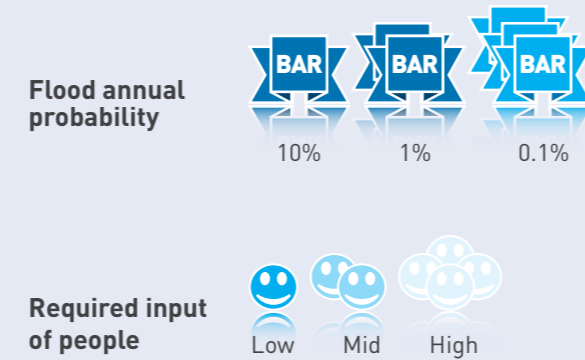
These resilience measures are designed to remove water that has entered your house either to reduce the water depth in the building or to quicken drying when the flooding has ended. Ideally a package of products should be used to lessen the harm that water does to a building from a property-level flood protection survey by a qualified and experienced surveyor. Pumping systems can be automatic and so no specific action may be required. Clearly, where the pump is not automatic no flood protection will be provided when you are away from your home. In situations where flood water is expected to arrive very quickly and with high depth and velocity the building structure may be at risk. In these cases a structural survey is recommended.





Flood plan considerations

Some of these products require action to make them work and so protection to your house 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. 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 house with rising water.



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

Product type	Indicative cost for a single house	Advantages	Disadvantages	Available products/suppliers	Images
Sump and pump	£50 - £2.5k	Rapid deployment. Relatively low cost. Helps where a resistance product leaks. Can remove flood water in an emergency.	Must be positioned and sized correctly. May require ancillary power supply. Will need servicing and maintenance. No kitemark.	Floodblock. Floodguards. Revetment standalone pump. Total Flood Solutions.	 

11. Case Studies

11.1 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 & 2007, 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. 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.

The prospect of needing to live in a caravan again for another two years was definitely not an option! It can be done!



Figure 1
Cottage during floods

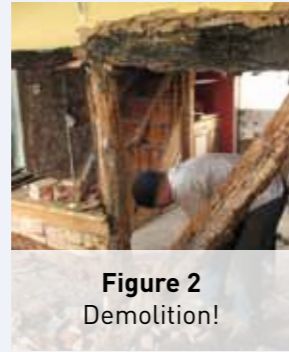


Figure 2
Demolition!



Figure 3
Fuel oil tank on raised plinth

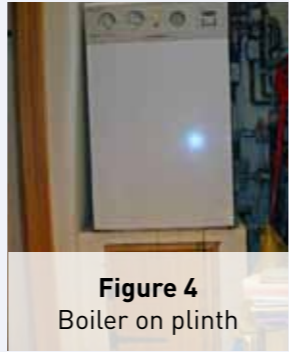


Figure 4
Boiler on plinth



Figure 13
Lightweight settees – easy to lift!

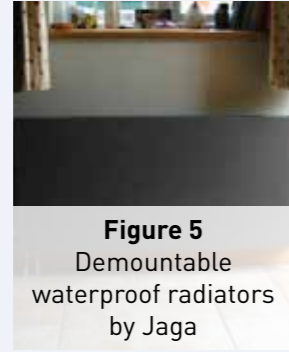


Figure 5
Demountable waterproof radiators by Jaga



Figure 6
Raised fireplace

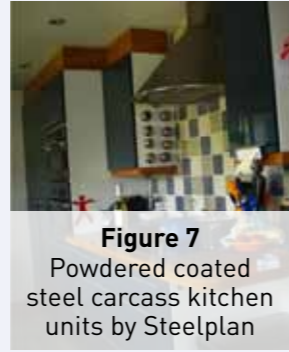


Figure 7
Powdered coated steel carcass kitchen units by Steelplan



Figure 8
Steel kick boards on kitchen



Figure 9
kitchen plinth on chrome leg & plastic stools

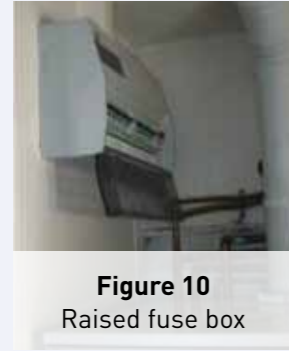


Figure 10
Raised fuse box

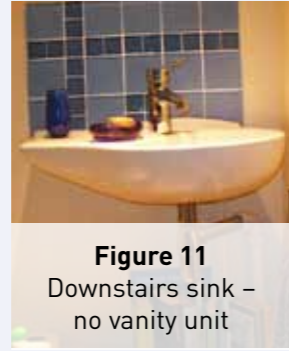


Figure 11
Downstairs sink – no vanity unit

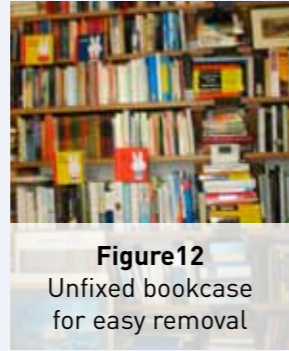


Figure 12
Unfixed bookcase for easy removal



Figure 14
TV hung on the wall

11.2 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 flood plain 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. 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.



Figure 1 Flooding outside the house near Tadcaster



Figure 1 Internal flooding

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.
- Bespoke temporary door guards were obtained for front and rear outside doors and secondary door guards for the internal doorway.
- The floor of the conservatory was raised 300mm.
- New permanent flood defence walls were constructed at front and rear of house.
- Six submersible pumps were installed in the front and rear garden to keep the water level down behind defence walls.
- All through-wall service connections were raised 900mm above the ground floor level.
- A 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 so far occurred since the measures have been put in place.



Figure 3 Door guard fitted to the internal door way

11.3 Properties in Chew Magna received temporary flood resistance measures

Chew Magna is a village in the River Chew valley, south of Bristol and west of Bath. The Chew Valley and surrounding catchments were devastated in July 1968 when a summer storm caused widespread destruction and flooding of at least 88 properties. Despite the flooding, a community wide flood defence scheme could not be justified for the village.

Flooding at Chew Magna comes about from intense local rainfall events causing flooding of the Winford Brook (for the northern part of the village) and from the River Chew (for the southern part of the village). Depths of flooding vary from 0.02m to 1.77m for a 4% annual probability event up to 0.09m to 1.98m for a 0.1% annual probability event. For events with an annual probability of greater than 1%, there are five properties which are predicted to be inundated to a depth of 1m or more. 97 properties were identified as being within the Flood Zone 2 boundary, and 69 of these were targeted for flood protection measures as part of a DEFRA funded Property Protection Grant Scheme.

Surveyors inspected each property and recommended generic measures that were required to protect the properties. Measures that were adopted included:

- Door barriers (screw-in and slide in types). Air brick protection.
- Toilet bungs.
- Sewer / drain non-return valves and mini sink waste non return valves.
- One property was also fitted with a sump and pump system.

The total cost of the project was £325k. A representative of the local parish council was instrumental in driving the delivery of the project forward, liaising with local residents throughout delivery. The same

person was also actively involved in working with the community and managing community flood plans and a local Flood Action Group. The Flood Action Group includes a buddy system to ensure that all measures are deployed at times of floods, providing assistance for example to elderly people who live in a small community within the village, and for people who work away or are away on holiday.



Figure 1
Silver Street, Chew Magna in 1968. The dark line by the porch top marks the water height

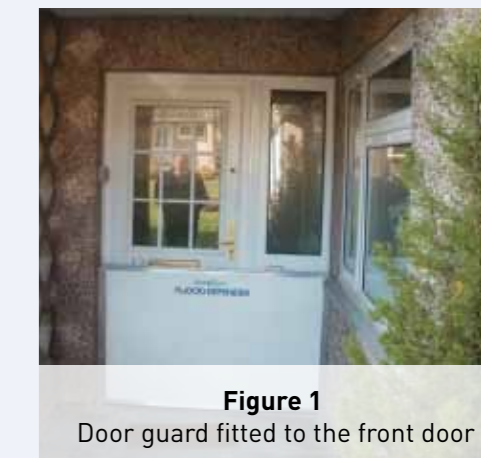


Figure 1
Door guard fitted to the front door



Figure 2
Pet flap cover

11.4 Properties in Dallam received temporary flood resistance measures

This project was undertaken in Densham Avenue and Gough Avenue in the district of Dallam in Warrington as part of a DEFRA funded Property Protection Grant Scheme. 17 properties were identified as being at flood risk as a result of surface water from storms with annual probability of up to 5%. Flooding had previously occurred in this area 5 times between 2004 and 2008 with internal flooding of up to 20 properties.

Property surveys were undertaken and appropriate BSi kite-marked flood protection products were implemented:

- Guards fitted to front and patio doors.
- Automatically closing airbricks.
- Airbrick covers for low level vents.

The cost of the project was £32k. This part of Warrington falls within an Environment Agency flood warning area for high water on Dallam Brook. However, past floods appears to be as a result of local surface water and not directly as a result of the brook. For this reason Warrington Borough Council are looking into appointing a neighbourhood co-ordinator to manage flood warnings to residents in the event of adverse weather conditions.



Figure 1
Flooding in Dallam



Figure 2
Flooding in Dallam



Figure 3
Door guard fixtures
on a house in Dallam

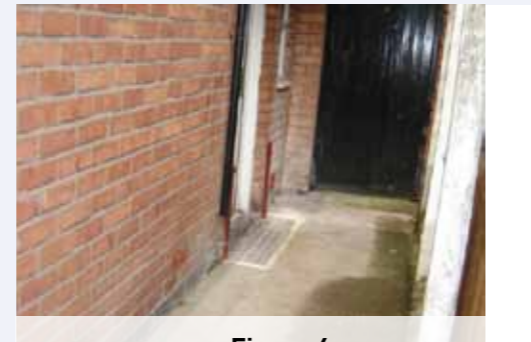


Figure 4
Door guard fixtures and
auto-closing airbricks on
a house in Dallam

11.5 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.
- Airbrick covers and automatically closing airbricks.
- The total cost of the project was approximately £190k.

The Environment Agency provides a Flood Warning Service with 2 hour lead-time 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.

11.6 A single property in Worcester with a range of resistance and resilience products

The project involved a single property on the banks of the River Severn in Worcester that had consistently flooded since its construction. Severe flooding in 2007 saw the water level rise above the ground floor window sills. Over time the original floor slab had become cracked and the damp-proof membrane had failed meaning that there was frequent water ingress into the ground floor whenever the river level rose or during heavy rain.

The owner of the house arranged for a property-level flood survey and privately funded a range of resistance and resilience measures:

- A watertight membrane was fitted behind the floor and walls on the ground floor with cavity drainage linked to a sump and pump system (twin sumps each with twin pumps for high discharge and fail-safe).
- Removable flood barriers across doors, windows and entry points between terraces.
- Non-return valves on service pipes.

The Environment Agency provides a Flood Warning Service for this area, so the temporary flood resistance measures can be installed in good time. An informal flood action group has been created so that local residents can help each other with the flood barriers.



Figure 1 Flooding at the property in Worcester

Figure 2
Water-proof membranes with one of the sumps ready for pump installation

[Source: Triton Chemicals]

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

<p>Absorbeez is part of the Action Dry Group: Action Dry Group PO Box 139 Upminster Essex RM14 2YD E actiondry@mac.com W www.absorbeez.com</p>	<p>AquaFence Ltd. Minerva Mill Innovation Centre Station Road, Alcester Warwickshire, B49 5ET T 01789 761370 E info@aquafence.com W www.aquafence.com</p>	<p>Aqua-sac is part of AET: A E T PO BOX 4706 Sheffield S17 9BU National Sales Number: T 0114 2621706 F 0114 2621706 E info@aqua-sac.com W www.aqua-sac.com</p>	<p>Easifit Ventguard T 01382 779706 E sales@ventguard.co.uk W www.ventguard.org</p>
<p>BAUER Inner City Ltd Dallam Court Dallam Lane Warrington Cheshire WA2 7LT T 01925 428940 F 01925 244133 E info@bauerinnercity.co.uk W www.bauerinnercity.co.uk</p>	<p>CARO FLOOD DEFENCE SYSTEMS Edge Barn 11 Market Hill Royston Hertfordshire SG8 9JN T 01763 244446 F 01763 244111 E info@caro.co.uk W www.caro.co.uk</p>	<p>Combined Harvesters Ltd. Britannia House, Dock Road, Birkenhead, Wirral. CH41 1DF T 0151 639 0880 F 0151 639 2212 E info@combinedharvesters.co.uk W www.combinedharvesters.co.uk</p>	<p>Flash Flood Doors Limited Wanlip Hill Farm Business Park Loughborough Road Wanlip Leicester LE7 4PN T 0116 267 2408 E info@flashfloorddoors.co.uk W www.flashfloorddoors.co.uk</p>
<p>Damfast Barton Mill Earls Barton Northampton NN6 0NR T 01604 810507 E info@damfast.co.uk W www.damfast.co.uk</p>	<p>Defence Doors Ltd Fairways House Thornholme Driffield United Kingdom YO25 4NN T 01262 490 219 E sales@defencedoors.com W www.defencedoors.com</p>	<p>Dutchdam B.V. Boddens Hosangweg 84 - 2481 LA Woubrugge The Netherlands T 0031(0)172-518088 E info@dutchdam.nl W www.dutchdam.com</p>	<p>Flood Angel Unit 1 9a Wassage Way Hampton Lovett Industrial Estate Droitwich Worcestershire WR9 0NX T 01905 799908 F 01905 775037 E info@floodangel.com W www.floodangel.com</p>

Flood Ark Ltd Emmerson Industrial Estate Norwich Road Lenwade NR9 5SA T 01603 879977 F 01603 879964 E info@floodark.co.uk W www.floodark.co.uk	Floodbloxs c/o ProSys International Ltd 60 Cottenham Park Road Wimbledon, London SW20 0TB T 020 8944 7585 F 020 8944 5434 E sales@mopitup.eu W www.floodbloxs.co.uk	Flood Block Unit 7 Durham Road Laindon Essex SS15 6PH T 01268 414243 E info@floodblock.co.uk W www.floodblock.co.uk	Flood Plan 161a St John's Road Congleton Cheshire CW12 2EH T 01260 289089 E info@floodplan.co.uk W www.floodplan.co.uk
Flood Control and Flood Control International Torrington House New Bridge Gunnislake Cornwall PL18 9LH T 01822 832385 E enquiries@floodcontrol.co.uk W www.floodcontrol.co.uk	Flood Defender T 01482 351489 W www.flooddefender.co.uk	Floodgate Limited 49/51 Lammas Street Carmarthen Wales SA31 3AL T 01267 23 42 05 F 01267 23 27 52 E sales@floodgate.ltd.uk W www.floodgate.ltd.uk	Flood Safe Flood Alarms PC-Q Solutions Ltd T/a Flood Safe Cambrian House 1 Cambrian Place Llanidloes Powys SY18 6BX E info@floodalarms.co.uk W www.floodalarms.co.uk
Flood Guards Systems Ltd. Unit D Bridge Farm Reading Road Arborfield Berks RG2 9HT T 0845 500 0077 F 0845 500 0088 E sales@floodguards.com W www.floodguards.com	Floodguard UK Ltd 7 Ormskirk Road Newtown Wigan WN5 0XD United Kingdom T 0800 073 5455 F 01257 255985 E admin@floodguarduk.co.uk W www.floodguarduk.co.uk	Flood Matters Lexham House Hill Avenue Amersham Bucks HP6 5BW T 01494 432222 E info@flood-matters.co.uk W www.flood-matters.co.uk	FloodSense The Workshop Bears Lane Swaffham Norfolk PE37 7QB T 01760 722758 F 01760 724826 E info@floodsense.co.uk W www.floodsense.co.uk

J. T. Atkinson Builders Merchant Ullswater Road Penrith Cumbria CA11 7EH T 01768 865561 F 01768 892341 W www.jtatkinson.co.uk	Kilttox Unit 6 Chiltonian Industrial Estate 203 Manor Lane Lee London SE12 0TX T 08451 66 20 40 F 08451 66 20 50 E info@kilttox.co.uk W www.kilttox.co.uk	Marley Plumbing and Drainage Lenham Maidstone Kent ME17 2DE T 01622 858888 F 01622 858725 E marketing@marleyext.com W www.marleyplumbinganddrainage.com	Safeguard Europe Ltd Redkiln Close Horsham West Sussex RH13 5QL T 01403 210204 W www.safeguardeurope.com
MFC Survival Ltd Naval Yard Tonypany Rhondda Cynon Taff CF40 1JS T 01443 433075 F 01443 420448 E sales@mfc-survival.com W www.mfc-survival.net	MISSION Rubber UK Limited Units 4+5 Atlas Business Park Starnhill Close Ecclesfield Sheffield S35 9TG T 0114 257 0040 F 0114 257 1122 E sales@missionrubber.co.uk W www.missionrubber.co.uk	Multi-Flood Solutions Southfields Boraston Lane Tenbury Wells Worcestershire WR15 8RB T 01584 819233 F 01584 819130 E info@multifloodsolutions.co.uk W www.multifloodsolutions.co.uk	Snorkel Vent is a trading name of Donite Plastics Ltd: Donite Plastics Ltd Prima Business Park 280 Comber Road Lisburn Northern Ireland BT27 6TA T 028 9263 9995 F 028 9263 9996 E info@snorkelvent.co.uk W www.snorkelvent.co.uk
Newlands (for Flood Buddy and Vent Buddy) Newlands Conservatories & Garden Buildings Evesham Road Norton Evesham Worcestershire WR11 4TW T 01386 446089 F 01386 446089 E info@floodybuddy.com W www.m0rad.demon.co.uk	Nanoshell 3 Mary Seacole Road The Millfields Plymouth Devon PL1 3JY Tel: 0845 838 8648 E info@nanoshell.co.uk W www.nanoshell.co.uk	Revetment Flood Protection 7 The Coach Houses Henley-in-Arden Warwickshire B95 5FN T 0844 8044 046 E enquiries@revetment.uk.com W www.flood-guards.co.uk	Steelplan Kitchens Wealdstone Road Kimpton Industrial Estate Sutton Surrey SM3 9RW T 020 8254 2018 F 020 8641 5026 E sales@steelplan.com W www.steelplan.com



<p>Task Green Ltd</p> <p>Q Park Bath Road Woodchester Stroud Gloucestershire GL5 5HT T 01562 852695 E paulcrompton1@btconnect.com W http://taskgreen.co.uk/</p>	<p>Tilt Dam and Spring Dam</p> <p>T 01242524212 E sales@tiltdam.co.uk W www.tiltdam.co.uk</p>	<p>Total Flood Solutions</p> <p>Units 1 & 2, Pontarddulais Workshops Pontarddulais Swansea SA4 8SG T 0845 456 7175 F 01792 883 171 E info@totalfloodsolutions.com W www.totalfloodsolutions.com</p>	<p>Whitehouse Construction Co. Ltd</p> <p>Blenheim Road Ashbourne Derbyshire DE6 1JU T 01335 344000 F 01335 346546 W www.whitehouseconstruction.co.uk</p>
<p>RKB (Kitchens) Limited</p> <p>Units 26-28 Rumer Hill Business Estate Rumer Hill Road Cannock WS11 3ET T 01543 574767 E sales@rkb-furniture.com W www.rkb-furniture.com</p>	<p>Tubewall from: Protectahome Ltd</p> <p>Salisbury House The Square Magor Caldicot Gwent NP26 3HY T 0845 6011980 E sales@Tubewall.co.uk W www.tubewall.co.uk</p>	<p>Triton Systems</p> <p>Units 3 - 5 Crayford Commercial Centre Greyhound Way Crayford, Kent DA1 4HF T 01322 318830 F 01322 524017 W www.triton-chemicals.co.uk</p>	<p>UK Flood Barriers Limited</p> <p>9a Wassage Way Hampton Lovett Industrial Estate Droitwich Worcestershire WR9 ONX T 01905 773 282 F 01905 775 037 E info@ukfloodbarriers.co.uk W www.ukfloodbarriers.co.uk</p>
<p>VentSeal from: IFDP Ltd</p> <p>2nd Floor Offices 16 Mere Street Diss IP22 4AD T 01953-861101 F 01953-861101 E enquiries@ifdp.co.uk W www.ifdp.co.uk</p>	<p>Watertight International Ltd</p> <p>North Lane Foxton Market Harborough Leicestershire LE16 7RF T 01858 546 810 E enquiries@watertightinternational.com W www.watertightinternational.com</p>		

13 Useful links

The Environment Agency offers advice on flood protection measures and flood planning and provides many useful guides and templates.

www.environment-agency.gov.uk

DEFRA has funded several research projects into flood risk mitigation

www.defra.gov.uk

The insurance company AVIVA have produced a website that gives useful advice for property level flood resilience.

www.floodresilienthome.com

The Flood Protection Association promotes the interests of manufacturers and installers of flood protection equipment.

www.floodprotectionassoc.co.uk/flood_protection_association.php

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.uk

Mary Dhonau has produced a website that provides advice on flood protection products and methods

www.marydhonau.co.uk

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

The Property Care Association provides information about flood restoration on their website.

www.property-care.org

Flood Plan UK is a website that provides advice on protecting your home and planning for flooding.

www.floodplanuk.org

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

RAB Consultants Ltd can provide advice and assistance on flood risk and property-level protection surveys.

www.rabconsultants.co.uk

KnowYourFloodRisk the campaign with a mission to help raise awareness of the issue of flood and encourage practical guidance and support to help protect homeowners and property professionals against the risks.

www.knowyourfloodrisk.co.uk

CIRIA have produced useful guidance and advice on their website on what to do in the event of a flood and home to minimise the risk of damage to your property

<http://www.ciria.com/flooding/>

RICS have produced a free to download 'Consumer Guide to Flooding' giving clear guidance for property owners

http://www.rics.org/site/scripts/download_info.aspx?fileID=7656

The National Flood Forum's 'Blue Pages' provides an independent directory of flood protection products and services.

www.bluepages.org.uk/

