Improving the flood resistance of your home

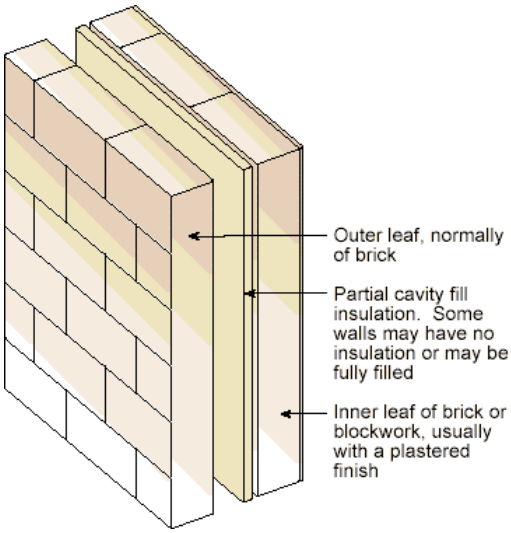
Advice sheet 4: Flood-resilient walls.

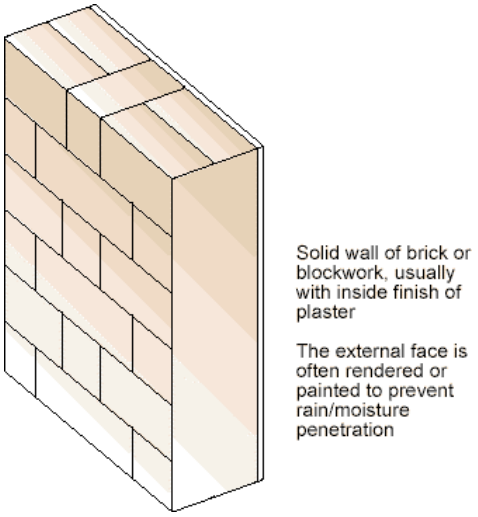
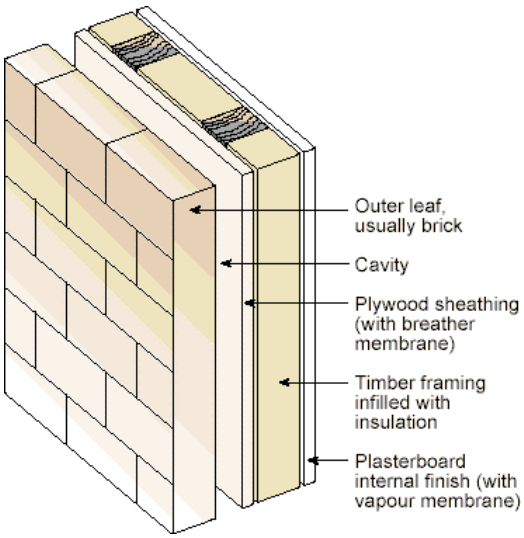
This sheet provides guidance on identifying different types of wall, and reducing the flow of floodwater through them by sealing cracks, joints and brickwork and applying suitable treatments. Particular attention should be paid to the section on *Important Considerations* before carrying out any work.

Types of walls

It is important to know the type of wall in your property and the consequences this has during flooding, before carrying out flood improvement measures. There are three common types of wall construction in UK homes:

- Cavity walls with bricks and/or blocks
- Solid brick or masonry walls
- Timber framed walls.

Type of wall	Description	Issues
Cavity walls	• Present in almost all modern houses, common after about 1930. • Have an air gap (typically measuring between 50 and 100mm wide) between an inner wall and an outer wall. • The walls are constructed of blocks, bricks or stone (each typically about 100mm thick) and the inner wall may be of different material to the outer. 	• Floodwater can pass through the outer leaf of the cavity wall, through cracks and gaps. • Floodwater can seep through the bricks, blocks and mortar. • Floodwater can build up in the cavity, saturate the insulation, and soak into the inner leaf. • Cavity allows water to migrate along the walls and can make it difficult to dry out.

Solid walls	• No cavity. • May consist of closely spaced bricks or blocks or stone inner and outer faces with a rubble infill.  	• Floodwater can pass through the solid wall, through cracks and gaps, • Floodwater can seep through the bricks, blocks and mortar. • Will dry out from the internal and external faces, but thick solid walls may take a considerable time to dry. • Will only dry out from the internal face if the wall finishes allow. • Some solid walls have a rubber infill in the centre; this will delay drying considerably.
Timber-framed walls	• Outer face of timber-framed walls is normally made of brick or masonry • May have a render coating.  	• Floodwater can pass through the outer leaf through cracks and gaps. • Floodwater can seep through the bricks, blocks and mortar. • Water can build up in the cavity and soak into the inner timber frame construction. • Exposing the frame and the outer leaf to replace damaged boards and internal finishings can assist in drying after flooding if necessary.

How to find out the type of wall

The types of walls vary with the age and style of construction. If the type of wall is not stated in your building survey, or not known by your neighbours or local builder, you will be able to find out what type of walls you have by looking at the inside and outside surfaces and making some small, drilled holes.

Wall surfaces may be covered which can hide the main wall material. The following methods can be used to identify the type of material your property is made of:

- If the outside of the wall is fair-faced (without further coating) it should be obvious if the wall is of brick or stone.

- If the outside of the wall is coated with render, pebbledash or paint, obscuring the main wall material, you should check at the base of the wall, and at any cracks or damaged parts of the coating, to see if the underlying material is exposed.
- If you are unable to determine the material using the above methods you can use an electric drill to make a hole through the render outside and the plaster inside to find out what material lies beneath it.
- A final technique is the use of a boroscope to look inside the cavity. This may require the removal of a brick or block to allow access.

Once you have determined the material your property is made of you should then be able to determine what wall type it is:

What to look for	**Wall type**
• Outside is made of full-length brick • Property is modern (after about 1930) • If wall is about 275mm thick	Cavity wall
• Outside is of stone • Property is old (before about 1930) • Traditional bonds with overlaps of approximately 55mm. • Has half bricks in some or all courses • If wall is about 225mm thick	Solid wall

How to find out the type of brick

The type of brick your property is constructed of may affect the amount of water that soaks through the walls.

Generally soft bricks will be porous. If you can easily scratch the surface of the brick with a nail this is an indication that the brick is soft and will absorb floodwater.

Dense bricks (e.g. engineering bricks) tend not to be porous but it is important to ensure that the joints around the brickwork are correctly sealed, water resistant and undamaged.

Important considerations

Before carrying out any works to improve the flood resistance of your walls you should first consider the following issues and consult the relevant bodies where necessary.

Limits of protection
It should be noted that the water being held back by a water resistant wall will exert a strong force against it. Most walls will be strong enough to resist floodwater up to a depth of 0.9m above ground level; carrying out water resistant measures above this height may cause damage to the structure during a deeper flooding. A qualified surveyor, architect or engineer should be consulted if you wish to install measures to resist floodwaters above 0.6m above ground level.

You should remember that in semidetached and terraced houses, floodwater might seep through adjoining party walls.

Damp
Note that use of water resistant treatments both internally and externally may result in moisture being trapped and building up inside the wall, and might cause dampness, particularly in solid masonry walls. These walls perform best when they have no water resistant coatings and water vapour can escape from the inside and outside faces. This

makes them particularly prone to flood water penetration, but enables more rapid drying thereafter. The best course of action should be decided on a case-by-case basis and specialist advice may be necessary from a qualified surveyor, architect or engineer.

Historic buildings
Historic buildings can be particularly vulnerable to flood damage of stonework, brick and mortar walls, timber frames, wattle-and-daub panels, timber boarding and panelling, earthen walls and floors, plaster, ceilings and many decorative finishes. Specialist advice may be necessary before carrying out flood resistant measures. For Listed Buildings it may be necessary to obtain a Listed Building consent before any work is carried out on the property.

Further advice when considering work to walls:

The following organisations can be contacted for advice on installing measures to resist floodwaters above 0.6m above round level:

- The Royal Institution of Chartered Surveyors on www.rics.org.uk/index.html or 0870 333 1600.
- The Institution of Structural Engineers on www.istructe.org.uk or 020 7235 4535.
- The Royal Institute of British Architects on www.riba.org or 0906 302 0400.
- The Institution of Civil Engineers on www.ice.org.uk or 020 7222 7722.

You can contact English Heritage for advice on the protection of historic buildings on 0870 333 1181 or visit their website www.english-heritage.org.uk

What you can do to a wall to improve its flood resistance

To answer this question, you will need to consider:

- What can be done to the outside of the wall?
- What can be done to the inside of the wall? and
- What can be done with the insulation within the wall?

There are several measures to improve flood resistance of a wall using mortar, sealants and fillers. These measures include applying waterproof sealant to the outside face (ideally a breathable sealant), raising the damp proof course, injection of fillers, closing cavities and filling cracks and voids in brickwork.

Maintenance and repair
Cracks to walls, within the brick or blockwork or mortar joints, or render, provide a direct path for floodwater to enter a property. Cracks below the expected maximum flood level should be repaired. Repair should be carried out by filling the crack as fully as possible with a material that is water resistant and will adhere to both crack surfaces.

The following table highlights the different types of damage for which you should assess your wall and the relevant methods for repair.

Damage	Repair
Wide cracks (>6mm)	Mortar made with cement* and/or hydrated lime* mixed with sand (see cracks within mortar below) can be used, but care must be taken to place or push the mortar deep into the crack.
	A proprietary foam gap or cavity filler can be injected into the gap if the product is suitable and the crack surfaces can be prepared in the manner described for the product. Excess foam will need to be removed and the external faces raked out to allow a solid (mortar) finish to be applied.
Narrow cracks less than 6mm wide	Cracks can be widened (by cold chiselling or angle grinder**) and repaired as for wider cracks
	Cracks can be sealed with an appropriate sealant or filler, applied by hand or injected with a spring-loaded gun.
Cracks that are too fine to fill effectively	Cracks can be widened (by cold chiselling or angle grinder**) and treated as wider cracks
	Crack can be injected under pressure with a resin, emulsion or cementitious* grout. Injection can be carried out by specialists but the apparatus and materials may be available for hire for DIY purposes. Follow the manufacturers safety instructions for the material used.
Cracks within mortar	Can be treated by removing the mortar**, to a depth of about 20mm, and repointing. Repointing can be done with a pre-bagged mortar from a DIY store or mixed by hand using the proportions 1 part cement*: 1 part lime: 6 parts builders sand. The area for re-pointing should be dampened with a garden spray or wet cloth and the mortar pressed firmly into the joints by hand or using a pointing trowel. When the mortar has set hard enough to take a thumbprint, it can be finished to match the style of the surrounding joints.
Weak mortar	Should be replaced by using the method for cracks within mortar.
Gaps in mortar	Should be filled by using the method for cracks within mortar.
Cracks within exposed brickwork that is not to be painted	Can be filled with mortar or sealant but may look untidy.
	To avoid untidy finish, the brick can be replaced with a new matching brick. This is done by carefully breaking** out the mortar around the damaged brick and removing it. The opening should be dampened, mortar placed on the base and one side, and the replacement brick placed with mortar on the top and the other side. The pointing can be completed to match the surrounding joints.
Hairline cracks in render	If the outer surface is to be coated you do not need to repair the crack. You will need to choose a coating capable of bridging the cracks and follow the manufacturers instructions.
Wider cracks in render	Should be repaired. This is done by widening or 'raking out' the crack using a cold chisel**; alternatively, an angle grinder** can be used. The surfaces to be repaired should be dampened and then infilled with mortar with proportions 1 part cement*: 2 parts lime: 9 parts builders sand.

**Safety note: cement and hydrated lime is very alkaline and should be kept off the skin. Gloves should be worn when working with this material at all times. If it does get on your skin, wash it off quickly and thoroughly and if you get any skin reddening or irritation, seek medical advice.*

***Safety note: eye protection should always be used when cutting and chiselling brickwork and stonework.*

Tanking (sealing and rendering)

'Tanking' is the application of a layer of material to a wall or floor to increase its resistance to water entry. Tanking is most effective when applied to the outside of walls or to the underside of floors, but this is not always possible. Water resistant paints and coatings should be applied to a height of 0.5m above maximum flood level. This will help to prevent soaking of the wall and allow it to dry out more quickly. The applied material must be compatible with the existing wall materials and must be 'breathable' on at least one face of the wall to allow water vapour to escape from the wall in future (see *Important considerations*).

Before applying the tanking, the surface should be prepared thoroughly, treating loose, dusty, or cracked surfaces and removing vegetation and algae, and allowing the wall to dry out. If your property has been flooded it is important to ensure that the walls and floors are returned to pre-flood condition before any surface treatment is applied.

Tanking can include rendering and brush, roller or spray applied paints or coatings. Water resistant coatings can be bought from DIY shops; apply the coating as instructed by the manufacturer. Only coatings that are specifically recommended for the treatment of your wall material should be considered. Care must be taken not to increase the possibility of damp build-up and frost damage.

Render can be of cement and/or hydrated lime and sand, with or without a waterproofing additive. You should consider the suitability of the render mix for the application and substrate. A lime render can be applied in two coats with proportions of 1.5 parts hydrated lime to 3 to 4 parts sand for the first coat of 6-19mm thickness and 1.5 parts hydrated lime to 1.5 to 2 parts sand for the second coat of 3-6mm thickness.

You can also use:

- liquid membranes
- polymer/cement coatings
- mastic asphalt (not breathable and best used externally – if used internally the floodwater pressure may cause it to de-bond from the wall)
- pre-formed sheet membranes (not breathable and best used externally – see mastic asphalt)

Caution is required if tanking is applied to the internal face of the wall. This should reduce the amount of water soaking into the wall from the inside but if water does penetrate the tanking then this may reduce the time taken for the wall to dry out. Internal tanking materials are similar to external tankings, but will need to be compatible with the finishing coat or decorations. Render consisting of lime and/or cement, and a waterproofing additive, with sand, can be used with a lime plaster finishing layer and/or vapour permeable paints. Care must be taken not to penetrate the tanking layer with nails and screws, so skirting boards should be bonded rather than nailed. Consult a specialist if you wish to install tanking more than 0.6m above ground level (see Important Considerations).

Injection damp proofing

Injection damp proofing can be carried out to solid and cavity walls and involves injecting, under pressure, 'chemicals' into the voids and tiny cavities in the wall materials. The chemicals produce a layer or zone that is very solid, contains very little water and allows very little water to pass through it. Normally this is intended to stop damp rising from the ground level up the walls, but the same principle can be used to stop water passing into the wall from the outside or inside faces. This can be carried out by damp-proofing contractors but the necessary equipment and materials are also available for hire for DIY use and as kits for purchase. If your property has been flooded it is important to ensure that the walls and floors are returned to pre-flood condition before any surface treatment is applied.

Flood resistant finishings

Excluding water will help reduce damage to the internal fabric of the building and its contents. If water does enter the house, flood resistant building materials will reduce the effects of the water and can reduce the cost of repairs. Before replacing any wall or floor finishings with a more flood resistant finishing it is important to ensure that the walls and floors are returned to pre-flood condition if flooding has previously occurred.

Finishing	**Resistance to flooding**	**Methods to improve flood resistance**
Modern gypsum plaster	Can be damaged by floodwater and is often removed to allow the underlying brick, block or stone to dry out.	Consider using internal finishing materials that are more flood resistant: • water resistant render • lime plaster finish • hydrated lime coatings • ceramic tiles These finishes should be applied to a height of at least 500mm above the expected flood level.
Lime plaster and hydrated lime coatings	Dry out quickly after flooding and are less damaged by exposure to flood water.	Cannot be further improved.
Ceramic tiles	Protect the wall from water ingress from inside of building.	Should be applied to a level sand/cement layer using a water-resistant grout. Tiles should not be applied over layers of gypsum plaster, which can be damaged by floodwater.
Plasterboard over solid walls and cavity walls (also known as 'dry lining')	When exposed to flood water, will normally need to be replaced.	Two options to improve flood resistance: • Replace with a more water resistant finish, as described above. • Replace the plasterboard sheets horizontally rather than vertically to reduce the number of sheets needing replacement. You will need to consider the dimensions of the boards and the maximum height of flooding to make this worthwhile.
The internal lining of timber-framed walls	Linings generally need to be removed after a flood to allow the timber frame to dry out.	Difficult to make more flood resistant because of the need to remove the linings after a flood. Consider using water resistant boards (for example marine plywood) with demountable fixings, with sacrificial joints and a lime-based finishing layer.
Skirting	Solid timber boards will normally need to be removed temporarily to allow board to dry out. Untreated wood may distort and need replacing. MDF boards are likely to require	More flood resistant options are: • Plastic skirting that will not be affected by floodwater. • Glued on skirting rather than nailed so that it can be easily removed if flooding is

	replacement.	predicted. • Treated wood skirting that is painted on all sides. • Skirting boxed out from the wall to enable easy drying out.

Insulation

Insulation material, particularly lightweight blown-in materials, may be damaged by exposure to flood water. Removal of insulation from traditional cavity walls is very difficult; prolonged drying time may be the only solution for timber framed walls.

Replacement insulation should be water resistant, low absorption material such as expanded polystyrene sheets or self-draining mineral wool slabs that will not collapse on wetting. Cavity walls may be filled with closed-cell foam. This can reduce the amount of water penetration through a cavity wall, and should not be damaged by flooding, but will probably extend the drying time for the wall following a flood.

Note: the Figures in this sheet are from 'Preparing for Floods' published by the Office of the Deputy Prime Minister.