

How Flood Sense Have Helped Other People

“We would like to take this opportunity to thank Kevin Williams and Floodsense for helping us to alleviate the fear of being flooded again in the future by installing barriers to our home.

Kevin has researched every possible prevention into future flooding and with his book you will find it very informative and will help to explain the "Great" importance of flood protection. This book has allowed us to move back into our home with peace of mind.”

Dave & Lorraine Fowler, Walcott

“We own a cottage and busy workshop on the North Norfolk coast in an area affected by flooding in 1953. Although several concurrent weather conditions are needed to recreate a tidal surge of the impact of 1953, our coastal sea levels are rising and East Anglia has its own peculiar downward tilting as a result of continental uplift in Scotland. We decided to put flood defences in place following an alarming tidal surge in December 2013. This book would have been extremely helpful when we were starting out and we intend to keep it close by as a reference guide for the future.”

Mr and Mrs Hamond, Morston, North Norfolk

“I hope I never have to test the flood defences that I have had to have fitted! but I have had great advice and very helpful men doing the work.

This book is and will be an invaluable reference aid for the future.”

Mrs Sheila Case, Burnham Overy Staithe

We have lived in the Old Custom House on the East Quay in Wells next the Sea for 30 years and for 29 of them our flood defences were never seriously tested. The Storm Surge on the 5th December 2013 overwhelmed them and flooded our home and business to a depth of 1m. What we learned in those 3 hours, waist deep in cold North Sea can be summarised as follows:

- Take expert advice – the North Sea found several weaknesses in our defences that we just hadn't thought about*
- A flood defence which is too low or ineffective is no use at all*
- Be prepared well in advance to defend against the next flood, it could be tomorrow*
- Defend to the highest level that is practical and safe for your property and have contingency plans for higher flood levels*
- Remember that your highest priority must be to save life*

This book is full of essential information and we plan to use it as an aide memoire to help to keep us prepared and defended against the next flood.

***Peter & Maddie Rainsford, The Old Custom House,
East Quay, Wells next the Sea***

KEEPING IT DRY!

The quick, easy, and uncensored
secrets to keeping floods at bay
despite downpours, deluges,
torrents and devastating storms

Kevin Williams

Keeping It Dry!

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www.floodsense.co.uk

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Flood Sense is the registered name of the company, but is referred to as Floodsense throughout the book.

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Introduction

If you, or someone you know, have been a victim of flooding, then you are very aware of the emotional and physical effects it can have. It doesn't just wreck homes and businesses, it can have long term psychological effects that can take years to overcome.

The UK has seen more flooding in the last 10 years than ever before, and as weather patterns are changing, flooding is becoming more and more common, with devastating results. The government is slowly responding, but like anything to do with bureaucracy and additional funding, this takes time. So instead of waiting for someone else to fix the issue, why not implement strategies now, to your home and business, which will help you protect your property in the event of a flood?

Having worked in the flood defence and restoration industry for over 15 years, we have seen what works (and what doesn't) in protecting your property – and this book is written to guide and educate anyone who lives or works in a high flood risk area. However, it's not enough just to read this book, you also have to take action and be proactive in getting your property 'flood ready'. Don't put off what you read in these pages, do your due diligence by finding out if you live in a flood prone area. The boundaries are changing, and the old adage "*it won't happen to me*" is foolhardy.

This book is not only for home and business owners, it's also for local planners, architects, designers and stakeholders. It's a comprehensive guide for all those who

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could be affected by the damage of flooding (and those that protect against it), and it gives comprehensive advice on how to protect yourself from the damage floods cause.

Throughout the book you will find useful links to further help you, as well as up-to-date information on current legislation. It is advisable to make your own list of emergency numbers and to get a comprehensive plan in place – I can't stress enough the importance of forward planning and double checking insurance (what you are and aren't covered for). Thousands of homeowners, residents and business owners have lost millions because of incorrect insurance coverage. Can you afford for it to happen to you?

Lastly, I wish to stress the most important factor in protecting yourself from a flood. If you are to do one thing as a result of reading this book, it should be to enlist the services of a specialist company that can advise on what to do and how to protect yourself and your property from the effects of flooding. I've seen so many incidents of home and business owners suffering the damage, heartache and stress that a flooding event causes, when all it takes to prevent or minimise this is a bit of pre-planning.

Be action orientated and make a plan. Get everything in place, and check your insurance. If you are in any doubt about how to go about this, then simply give us a call. We're here to help you defend yourself against any unnecessary stress and cost associated with flood damage. Don't wait – **do it now!**

Kevin Williams
MD, Flood Sense UK Ltd

Section One

**Flood Defence for
Residential and
Commercial Buildings**

Introduction to Flood Defence for Residential and Commercial Buildings

You may be reading this book because you are in an area subject to flooding problems. Flooding affects many residents and commercial businesses of the UK. Some experience fast moving floodwaters, others have frequent, but slow-moving runoff water problems during local downpours. Some have had repeated floods, while others have yet to be impacted.

Regardless of what you have seen, the next flood could be worse. We cannot ignore our flood risks. Floods take lives and damage property. They can be emotionally devastating to you, your business and your family, both while they are happening and later when you have to deal with the aftermath.

The governments and councils of the United Kingdom are working together to reduce the threat of flooding by building and maintaining flood protection works. However, flood control projects are very expensive, take years to complete, and will not offer 100% protection. There are various flood monitoring and warning programmes (provided by local councils and the Environment Agency) that provide advance notice of a pending hazard. New developments are closely regulated by local councils to reduce the impact of flooding.

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While they are doing what they can, there are things that you can do, too. You can prevent future damage by flood proofing your building or buildings and making personalised flood plans. You can learn important flood safety rules and health precautions, and minimise your losses during flood recovery.

This section is designed to help you do all of those things. If followed, the guidelines will go a long way towards protecting your family, home or business from the next flood.

It contains general information based on current research and comments from experienced professionals. This book is not intended to replace professional advice. The reader must assume responsibility for adapting this information to fit his or her specific conditions and is advised to seek professional assistance to evaluate or to repair extensive building damage, including related electrical components.

Chapter 1

The Dangers of Floods

Many people think that if they have not been flooded yet, they never will be. They are wrong! Some areas of England and Wales have experienced the worst flooding for decades.

This chapter reviews flood hazards and how a flood, worse than any you may have already experienced, could affect you. It outlines the various hazards that are associated with flooding and, hopefully, highlights the very real dangers that it causes - especially to the ill-prepared.

Flood Hazards

Causes of Flooding

Flooding occurs when the amount of water arriving on land (from rainfall, snow melt, surface flow, flow in watercourses or inundation by the sea) exceeds the capacity of the land to discharge that water (by infiltration, surface flow, piped drainage or surface

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watercourses). It can occur on any level or near-level areas of land, but the main concern is with areas which are adjacent to watercourses (fluvial flood plains) or low-lying ground next to the coast (coastal flood plains).

The limits of floodplains cannot be defined precisely because floods with similar probability can arise from different combinations of events that will have different impacts. They are often delineated by the estimated peak water level of an appropriate flooding event on the watercourse or at the coast.

On **rivers**, this has generally been taken to be the flood with a 1% annual probability (the 1 in 100-year return-period flood) or the highest known water level.

In **coastal areas**, because of the generally more dynamic nature of coastal flooding, the 0.5% annual probability (the 1 in 200-year return-period flood) or the highest known flood is generally used.

It is recognised that if floods of greater magnitude than these occur, such floods constitute extreme events. Locally, flooding may occur due to groundwater overflowing, overland sheet flow or run off exceeding the capacity of piped drainage during periods of heavy or prolonged rainfall. Such localised flooding can only be addressed on a site-specific basis.

The principal cause of river flooding is excessive rainfall or snow melt within a limited period, which overwhelms the drainage capacity of land, particularly

Chapter 1 - The Dangers of Floods

when the ground is already saturated or when channels become blocked. Inundation by the sea is largely due to combinations of *high tide*, *storm surge* and *wave activity*, but it may also be associated with structural failure of existing defences. Some areas are subject to combinations of tidal and river impacts.

Impacts can be aggravated by:

- The growth of built development in catchments and other changes in land use, which increase the rate and volume of run off.
- Sediment movement that has changed river cross-sections and affected flood levels.
- Lack of maintenance of flood defence systems, watercourses, culverts (including the flood relief areas around them) and road gullies, particularly where this leads to channel blockage.
- Canalisation, modification and diversion of rivers and watercourses, which increase the rate of flow and decreases the time taken for water to travel within a catchment. Building of structures, such as embankments, which restricts the flow over historical floodplains, creating additional flood risks, both upstream and downstream.

Flooding is, therefore, a combination of *human activity* and *natural physical conditions*. In determining the risk posed by flooding, account needs to be taken of the

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likely depth, speed and extent of inundation and the potential for anticipatory action to be taken as a result of flood warnings. Rapid flows, due to flash flooding or inundation by the sea following failure of defences, pose a greater risk to life than a steady rise in water level. The consequences also vary with land use. For example, overtopping and possible failure of a flood defence that is defending a densely populated urban area is an extreme risk; the same event affecting agricultural land is unlikely to involve a serious threat to human life.



To book your **FREE** flood assesment, simply go to;
www.keepingitdry.co.uk/freefloodassessment

Impact of climate change

There is mounting evidence that the global climate is changing as a result of human activity. Sea levels will rise globally as a result of the thermal expansion of the oceans, meltwater from alpine ice and snow and from polar ice caps in Greenland and Antarctica. The current best estimate is for a 210mm rise between 2000 and 2050. However, this estimate is very uncertain and it could be as low as 100mm or as high as 550mm, depending on the future level of greenhouse gas emissions and the sensitivity of the climate system. The best estimate sea-level rise is based on central estimates of each of these. To the climate-induced sea-level rise has to be added the movement of land, which is generally falling in the south-east and rising in the north and west. UK Climate

Chapter 1 - The Dangers of Floods

Impacts Programme scenarios, which include both sea-level rise from climate change and land movement, estimate a rise of 410mm in East Anglia and 210mm in west Scotland by 2050.

Impact of flooding

If you have not personally experienced a flood, it is hard to envision the severity of damage that it can cause. Flooding affects people and their property in many ways:

- Flooding presents a safety hazard to people and animals.
- Flooding causes health problems, both physical and emotional.
- Flooding damages buildings and landscaping.
- Flooding damages the contents of buildings.

Safety Hazards

Moving water causes more safety problems than standing water. Anything that is stored outside, and not securely anchored to the ground, can be carried away by floodwaters. This includes: toys, firewood, fuel tanks, structures, tools or vehicles. Floods become much more forceful as they accumulate debris. The debris can batter or impale people as well as structures.

Floodwaters can conduct electrical currents and hide

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debris. Be sure to look for potential electrical sources and stay away from any water in contact with them. Floods may structurally damage floors and stairs, making them unstable.

Experiments have shown that a person is less able to stand up in a flood as depth or velocity increases. They showed that a 6ft tall adult would be knocked over in four feet of water that is moving at a velocity of only one foot per second, or in one foot of water that is moving at four feet per second. Smaller people will have trouble in even shallower and slower floodwaters.

More people are killed trying to drive on flooded streets or bridges than in any other single flood situation. Cars can float in as little as 18 inches of water, and flooding may hide a washed-out road with what appears to be only a few inches of water.

Health Hazards

Floodwaters are not clean. They carry mud, silt, road oil, and even sewage. Food, cosmetics, medicines, stuffed animals, baby toys - and any similar items that contact floodwaters - become contaminated and must be thrown out. Clothes and dishes need to be washed thoroughly in clean water with soap to disinfect them. Mould spores and bacteria grow in damp areas and are difficult to remove completely. If a potable water system becomes contaminated, the health department recommends boiling all water to be used for drinking and domestic cleaning.

Chapter 1 - The Dangers of Floods

Floods also take a toll on people's *mental health*, caused by both the immediate dangers as well as future concerns. The stresses caused by flooding are aggravated by fatigue during clean-up and anxiety over lost income, health risks and damage to irreplaceable items. Children and the elderly are especially susceptible to negative impacts from stress.

Flood Damage

Building/Exterior Damage

Standing water can seep through building walls, soak wood, dissolve drywall and contaminate insulation. Electrical components may short when flooded, creating a fire or shocking safety hazard. If improperly dried, wet wood will warp and plywood will split, requiring replacement of stairs, flooring, and the like. Mould is a big source of property damage, as well as being a health risk during floods.

As the water gets deeper, it puts more pressure on walls and floors. A flood that is over a metre high may crack or break a standard house wall. Even very shallow flooding on the surface can put over seven feet of water pressure on a below grade basement wall or floor, causing cracks, leaks, or even buckling.

As discussed previously, moving water can transport debris from the ground surface as it flows downstream. This debris acts as a battering ram, and is capable of

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damaging or dislodging large structures, such as buildings and bridges. It scours the ground, removing grass and plants and eroding channel banks. The flood becomes more destructive as it moves downstream.

Contents Damage

Wet wooden furniture may be so badly warped that it cannot be used. Other furnishings, such as upholstery, carpeting, mattresses and books, are usually not worth the cost of drying them out and restoring them. Kitchens manufactured from medium density fibreboard or chipboard will start to break down very quickly. Mould and mildew will quickly spread through the remaining debris. Flooded electrical appliances will not work safely until they are professionally dried and cleaned.

In conclusion, I hope that I have outlined the causes of flooding, although what I have given is not an exhaustive account, it will give you a very good idea of where flooding can come from, including the safety and health hazards associated with it. I've also explained the dangers that floods can cause, and how they can affect you, and your family. The UK has recently seen some of the worst flooding since records began and there is mounting evidence that the weather patterns are changing, which could result in even worse flooding.

Nevertheless, having the knowledge to deal with situations like those above will make you, the reader, more prepared if you find yourself in a severe flooding event.

Chapter Two

Flood Preparedness

This chapter covers the importance of being prepared *before a flood occurs*. Safeguarding your home is critical and this chapter covers how to do just that, including why you need to know about flood insurance, (see page 31). It also explains the different flood warnings that the government issues, and what to do if those warnings come into effect.

Current law requires that people purchasing a flood-prone property should be advised, in writing, of the potential flood hazards.

Appropriate websites and numbers can be found on the contacts page of this book. You are advised to record *your own* important phone numbers and contacts on the pages provided at the end of the book.

Government Flood Warnings

The Environment Agency (EA) will issue warnings to show how dangerous the situation is.

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The three types of warning are:

1. Flood Alert
2. Flood Warning
3. Severe Flood Warning

1. Flood Alert

Flood Alert means flooding is possible. You should:

- ✓ Check local news and weather forecasts. Check water levels near you.
- ✓ Be prepared to put into action any plans you have made to deal with flooding in your area.

2. Flood Warning

Flood Warning means flooding is expected. Immediate action is required. You should act now by:

- ✓ Moving cars, pets, food, valuables and important documents to safety.
- ✓ Putting flood protection equipment in place.
- ✓ Turning off gas, electricity and water supplies if it is safe to do so.

You should try to stop any water from getting into your home by:

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- ✓ Putting plugs in sinks and baths and weighing them down with sandbags, pillowcases or plastic bags filled with garden soil or heavy objects.

If you don't have valves fitted that allow the flow of water in one direction (non-return valves), you should:

- ✓ Plug water inlet pipes with towels or cloths.
- ✓ Disconnect any equipment that uses water (such as washing machines and dishwashers).

3. Severe Flood Warning

Severe Flood Warning means flooding and danger to life. You should:

- ✓ Collect the things you need for evacuation.
- ✓ Stay in a high place with a means of escape, avoid electricity sources and walking or driving through floodwater.
- ✓ Cooperate with the emergency services
- ✓ Call 999 immediately if you are in danger.

In the event you are evacuated:

If the emergency services tell you to evacuate, you should follow their instructions and leave your home. Refusing to leave on their advice will put you, your family and those trying to help you at risk.

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You'll be taken to an evacuation centre run by your local council. Free food and bedding will be provided but you should bring spare clothing, essential medication and baby care items if you need them.

Most evacuation centres will let you take your pets. You should put cats and small animals in a pet carrier or secure box and bring enough food for them.

The people who run the centres are trained to give you support and advice. They will help you through the stress of a flood and prepare you for what to do afterwards.

Warnings no longer in force

The '*warnings no longer in force*' message means that no further flooding is currently expected in your area.

You should:

- ✓ Keep listening to weather reports and only return to evacuated buildings if you are told it is safe to do so.
- ✓ Beware of sharp objects and pollution. Floodwater may still be around for several days after the flood.
- ✓ Contact your insurance company and seek advice before starting to clean up your property or damaged belongings.

The 4 Key Steps For Maximum Flood Preparedness

The time to protect yourself from flooding is *before the flood*. This section covers four ways to do that: flood preparedness, knowing your flood hazards, flood response planning, and your flood survival kit. (Having the correct flood insurance for your property is also critical, this is covered at the end of this chapter.)

Flood preparedness for *buildings* is discussed in greater depth in chapter 3 - *Flood Protection*.

Personal Flood Preparedness

Many preparations can be done *prior* to the next flood. The following checklist will help you prepare for protecting yourself and your possessions.

1. Determine how bad flooding could be in your property. Lists of resources and contacts are provided at the end of the book.
2. Be familiar with official warning and evacuation procedures (outlined on page 22 and 23).
3. Purchase your own water alarm if your flooding comes from sewer backup or basement. The alarm can give you precious extra time to minimise potential property damage. A water alarm is similar to a smoke alarm; it beeps when water touches it.

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4. Talk to your insurance agent about your home owner's insurance coverage. Consider separate flood and sewer backup insurance policies.
5. Prepare a list of emergency telephone numbers, including the number for your insurance agent. Make copies and keep them in your car, at work, or at another safe location away from your home.
6. Assemble the supplies you will need for clean up and recovery and put them in a safe place, above the expected floodwater elevation, (listed later in this chapter).
7. Make a record of all your personal property. Go through your house room by room and make a household inventory. Take photographs or make camcorder records of indoors and outdoors. Inventory forms are available free from most insurance companies, or you can make your own.
8. Put photocopies of inventory records, insurance policies, deeds, logbooks, wills, telephone numbers, bank and credit card account numbers, and other valuable papers, at a location away from your house, such as a safe deposit box.
9. Check out the appropriate flood proofing options for your house, (see page 35).



To find out more about what has been listed above, and for further resources, visit; www.keepingitdry.co.uk/resources

Know your flood hazards

Ask your local authority the following questions:

- How high would the 100-year flood be in my neighbourhood?
- Can I expect fast-moving water, or water filled with debris?
- How much warning time can I expect?
- How will I get the flood warning?
- What streets are likely to be flooded or barricaded near my neighbourhood?

Flood response plan

Preparing a flood response plan will help you think through all the details that demand attention after a flood watch or warning is issued. Walk through your home or business with this publication, and make notes on how to adjust these instructions to your own situation. Writing it down will help you remember everything, which is especially important when everyone is in a hurry and excited because of an imminent flood. Be sure to include important phone numbers in your plan.

The flood response plan needs to be based on your own property's flood risk and how much lead time you have following a flood watch or warning. For example, if you

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are warned of a life-threatening flash flood, you should get out of the area immediately, without worrying about the backup power supply to your sump pump. Your plan should be a checklist of steps to take before floodwaters reach your home or business.

Write a flood response plan and *keep copies in your car and at work*, near the utility meters, or other prominent places. The Environment Agency can provide a sample flood response plan to get you started.

Keep a copy of your response plan with this book too.

If you only have a *few minutes following a Flood Warning*, these activities might be on your flood response plan:

- Monitor local radio or TV stations for flood information and evacuation instructions.
- Pre-plan two places where family members or staff can meet if you are split up; one place in close proximity and another place that is out of the flood area. These places could be at another business premises or a friend's house on higher ground.
- If you leave, take your pets, medicine and any other things you will need if you can't return home or to your business for a day or two. Leave a note explaining where you have gone, when you left and how to contact you.

Chapter 2 - Flood Preparedness

- If you leave, lock your home or business premises.

If you have *15 to 30 minutes following a Flood Warning*, include additional flood response activities like these:

- Read the safety precautions in chapter 3, *During the Flood* - page 51.
- Install flood protection equipment and any other prepared flood proofing measures. (Outlined in the next chapter - *Flood Protection*.)
- Turn off the electricity and water if you anticipate that they might be flooded. If you are able to, turn off the electricity to only the area that will be affected, such as a basement (if you have one), the ground floor, or both, leaving you with power to the rest of your home or business. When you prepare a response plan, mark your fuse box breakers to show the electrical circuits that serve these areas.
- If you turn off the gas be sure to relight your pilot light. You must determine if shutting off the gas is necessary. Fortunately, you can pre-plan your intended response to different conditions when you prepare an emergency response plan.
- Test the backup power supply to your sump pump if installed.
- Move the most valuable or damage prone

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contents in your home or business to above the flood level or to another safe place. These include small carpets, lower drawers to cabinets, and cleaning fluids or hazardous chemicals. They can be moved to the upper floors of your home or business or placed on top of cabinets, if the floodwaters will not be that deep.

While you are working on a flood response plan, think about the other types of emergencies you might face, such as fires. *The Environment Agency* can help you with ideas to include in a flood/disaster response plan.

Flood Survival Kit

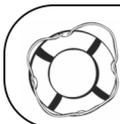
Prepare as much of your *Flood Survival Kit* as possible *now* and store it away in a suitable and accessible location. Spare blankets can be stored in space bags that cost only a few pounds and will keep them dry. For other items, we recommend plastic storage boxes with lids.

Here are some ideas of what you can include in your survival kit:

- Important documents in a waterproof wallet or container
- Torch and spare batteries
- Blankets and warm clothing
- Waterproofs, including rubber gloves

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- First-aid kit, including waterproof plasters/dressings
- A list of useful telephone numbers
- Your mobile phone (and spare battery or battery operated charger)
- Supply of bottled water
- Stock of non-perishable food items, a camping stove and a tin opener
- Portable radio and supply of batteries (or a wind up radio)
- A portable pet carrier for each of your pets, and emergency pet supplies



To find out more about what has been listed above, and for further resources, visit; www.keepingitdry.co.uk/resources

Flood Insurance

Whether you know or not if your area is at risk of flooding, your insurance company - as for most other UK insurers - is likely to have copies of the Environment Agency's flood risk mapping.

Being aware and taking action to reduce the risk of flooding to your property may even bring your insurance premiums down.

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You can access the information that is available to insurance companies by using the *Environment Agency's Flood Map*. The *Flood Map* allows you to find out what the likelihood of flooding from rivers and the sea is in your local area. This website can be found on the *Bibliography Section* at the back of the book, under 'websites'.

If you are finding it difficult to get insurance, you could try:

- Talking to one of the brokers who specialise in properties that are difficult to insure. You should be able to find these brokers in the Yellow Pages. You can also find a broker on the British Insurance Brokers' Association website or by calling its broker helpline on 0870 950 1790.
- Contacting the ABI. They can provide you with details of possible insurers.
- Contacting the National Flood Forum (NFF), which may also be able to help. The NFF is an independent, grassroots organisation, which offers support to those affected by flooding. For more information, visit the National Flood Forum website or contact the National Flood Forum on 01299 403055.

Tips on Insurance Claims:

- You are supposed to be reimbursed fairly for your loss, but you are not supposed to profit from a disaster.
- You cannot collect more than the face value of your policy, or for uninsured items, such as landscaping.
- There are no financial incentives to encourage the adjuster to give you a small claim payment.
- Your adjuster will probably be from out of town. Get his or her name, company and telephone number.
- In most cases, you will be reimbursed for the actual cash value of an item, not its replacement cost.
- Your policy should list an office and telephone number to call with questions.



To find out more about what has been listed above, and for further resources, visit; www.keepingitdry.co.uk/resources

Chapter Three

Residential Flood Protection

Before the Flood

Flood proofing your building

Before you invest too much money in flood-proofing, talk to an engineer or architect, or an experienced contractor like Floodsense to get comprehensive advice on your property.

This section covers changes that you can make to your building to prevent or reduce damage by floodwaters.

Flood preparedness for buildings

Different flood-proofing techniques are appropriate for different types of buildings and flood hazards. Use the following guidelines to select applicable techniques. These are listed in the grey box starting on page 37.

- If you have a **basement**, read about *basement cracks, sump pumping, sewer backup, barriers and wet flood-proofing*

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- If your house is on a **slab foundation** and the 100-year flood is estimated to be less than three feet deep on your first floor, read about *barriers* and *dry flood-proofing*.
- If your house is on a **crawlspace** and the 100-year flood is estimated to be less than three feet deep on your first floor, read about *barriers*, *wet flood-proofing* and *elevation*.

It is important for people to understand that the predicted 100-year flood elevation is only an *estimate* based on current technical standards for hydrology. Many times the floodwater elevation is *higher* than anticipated due to larger storms, saturated ground from prior storms or large volumes of debris in the water.



To book your **FREE** flood assesment, simply go to;
www.keepingitdry.co.uk/freefloodassessment

Flood Proofing Techniques

Basement Cracks

Groundwater can seep into your basement around pipes, or through cracks in the walls or floor. The path may be difficult to determine if the walls have been covered with panelling or other finishing. The best way to deal with a groundwater problem is to waterproof the walls and relieve the water pressure through a footing drain system and sump pump. (See the next section on Sump Flooding.)

Cracks can be repaired and the walls can be waterproofed from inside or outside.

Waterproofing on the outside is more effective because groundwater pressure forces the sealer into the foundation. The best technique is to dig a ditch around the basement wall so that you can apply a commercial sealant to the exterior walls. This can be done by a handy person (many home maintenance manuals have instructions for this), or a commercial waterproofing company.

Precaution

Waterproofing alone is recommended only for groundwater problems. Surface water will put much more pressure on the building's walls and can even break them. If the building will be affected by surface

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flooding, the owner should also install a barrier and an underground drain. There have been many instances of disreputable contractors doing basement waterproofing. Because the work is hidden, sloppy work may not show up for several years. Therefore, ask the waterproofing supplier or company to provide references of buildings in your area that have used their material or technique. Do this before you sign a contract.

Cost: £10-£10,000 or more

A homeowner can seal up cracks from the inside with a tube of sealant. Using a commercial waterproofing company to completely seal the exterior of all the basement walls will cost more.

Costs should be used as estimates only, as they can vary widely depending on location, size and the complexity of the work.

Sump Flooding

Basement flooding caused by saturated ground can be corrected by installing a footing drain around the foundation. The drain collects groundwater and directs it to a sump. When the sump fills, water is pumped out to a drainage-way or on to the ground away from the building. Depending on local conditions, the drain and pumping system may have to handle large volumes of water.

If the pump is blocked with debris, is overloaded or loses power, the system designed to keep groundwater out of your basement can act as a conduit to bring water in. You can prevent sump flooding by doing one or more of these flood-proofing projects:

- Clean the pump intake to remove blockages.
- Install a larger sump pump, or add more pumps.
- Connect the pump to a backup power supply, like a battery system or generator.
- Disconnect the downspouts from the footing drain, or redirect the downspouts and sump pump discharge further away from the house.

Precaution

When the basement is full of water, it is hard to tell how it got in. It's a good idea to check for cracks in the walls and to install sewer backup protection, too. Turn off the electricity before entering a flooded area. If your backup source of electricity is a generator, be sure it is set up outside or vent it to the outside in order to exhaust deadly carbon monoxide fumes. Set the backup power supply above the expected flood level.

Cost: 0-£650

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A homeowner can redirect the downspouts and sump pump discharge in a few minutes at no cost. An additional sump pump will cost around £100, a battery backup system, including a marine-style battery, is £350-£450, and a standby generator can cost up to £550. (Prices are approximate.)

Sewer System Back-up

WCs, baths, showers, sinks and washing appliances, such as washing machines and dishwashers, generally drain to a main sewer in the street.

Some properties may not be connected to the main sewer but have their own septic tank system.

During a flooding event, excessive amounts of water can enter these areas, causing *backups* into the house or overloading of the treatment facility.

Sewer system backups can be caused by events not related to storms or flooding. Individual service lines can be plugged by grease, waste, tree roots and breaks in the pipe or improper disposals. The owner or occupier can fix or prevent these problems by using proper maintenance, disposal procedures and planning. For example, plant trees and shrubs at least 10 feet away from sewer lines to minimize potential root damage.

There are ways to stop sewer backup: The following 4 measures describe ways to deal with *sewer or*

septic tank backup that occurs when the main system is overloaded.

1. Non Return Valves

One of the keys to flood-proofing your property is knowing your location in relation to the sewer system that serves your building or home. A Non Return Valve can make the difference between having your basement (if you have one) or ground floor flooded knee-deep with raw sewage, or staying high and dry.

A properly operating a Non Return Valve allows flow to only go in one direction (out), preventing wastewater from entering your building during flooding, regular sewer system maintenance or accidental sewer system backups.

Cost: £120 - £470+

Backwater valves range from £120 to over £400, depending on what type of sewer system you connect to and whether you have easy access to it.

2. Inflatable Textile Bladders

The U bend toilet bung is an example of a simple, inflatable device used to prevent sewage backflow coming back up the toilet under flood conditions. Essentially, the U bend toilet bung is a strong rubber bag attached to a hose with a Schrader valve on the

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end. The bung is normally supplied with a hand pump.

To use the valve, gently push the deflated bag down into the toilet under the water level and into the U bend at the bottom of the toilet. The hose, which is attached to the rubber bag, goes under the toilet seat and rests to the side of the toilet.

Connect the valve of the hand pump to the valve on the hose and simply pump up the bag until it is totally inflated and firm to the touch, being careful not to over pump. (This works using the same method as pumping up a bicycle tyre.)

At the maximum inflation, the sealing area will be severely restricted, reducing the maximum allowable back pressure.

Once the threat of sewage backflow has subsided, simply deflate the bag by applying pressure to the pin on the valve of the hose. This can be done by pushing your finger or thumb on to the pin of the valve to let the air escape from the bag. Remove the bag and hose from the toilet and rinse off using a mild detergent. Allow to dry and store away.

Cost: from £50

The cost for this type of inflatable textile barrier starts from about £50, and includes of a pvc bung, a hose with a Schrader valve and a hand pump.

3. Check Valves

A check valve, non-return valve or one-way valve is a mechanical device, that allows fluid to flow through it in only one direction.

Check valves are two-port valves, meaning they have two openings in the body, one for fluid to enter and the other for fluid to leave. There are various types of check valves, which are used in a wide variety of applications. Check valves can be installed on washing machines, dishwashers, sinks, baths, showers, etc., to prevent sewage backflow. They are available in a wide range of sizes and costs. Check valves generally are very small, simple and inexpensive. They work automatically and most are not controlled by a person or any external factor. Accordingly, most do not have a valve handle or stem. The bodies (external shells) of most check valves are made of plastic or metal. An important concept in check valves is the cracking pressure, which is the minimum upstream pressure at which the valve will operate.

A swing check valve or tilting disc check valve is a check valve in which the disc - the movable part to block the flow - swings on a hinge, either on to the seat to block reverse flow, or off the seat to allow forward flow.

Cost: from £5.00

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Due to the various makes and sizes on the market, we can only give you an indication of how much you can expect to pay.

4. Check/Ball Valves

A ball check valve is a check valve in which the closing member - the movable part to block the flow - is a spherical ball. In some ball check valves, the ball is spring-loaded to help keep it shut. For those designs without a spring, reverse flow is required to move the ball towards the seat and create a seal. The interior surface of the main seats of ball check valves are more or less conically-tapered to guide the ball into the seat and form a positive seal when stopping reverse flow. Ball check valves are often very small, simple and cheap and, like the above, can be installed on to outlets leading from washing machines, dishwashers, sinks, baths and showers, etc.

Cost: from £5.00

Due to the various makes and sizes on the market we can only give you an indication of how much you can expect to pay.

Flood Protection Barriers

A flood-barrier is a secondary flood-proofing system to be used when the design elevation of the building is below the Base Flood Elevation. The purpose is to form a watertight seal in front of all building

openings in order to prevent floodwaters from penetrating the structure.

This system is to be removable and should only be used at a time of storm or flood warning, and in conjunction with other flood-proofing design criteria. A form of flood resistance, flood-barriers come in many different formations. The correct barrier should be fitted depending on potential flood requirements.

In cases of severe flooding (where floodwater rises above 1 metre), keeping water out of your property can be more harmful than letting it in. The stress on the building caused by that amount of water can damage its structure and foundations. Therefore, you should never block doors, windows or airvents over 1 metre in height.

Cost: from £0 - £500+

A simple flood protection barrier can be made from a sheet of ply board cut to fit an opening and fixed in place with batons, screws and mastic sealant. After market products can range in price, from a few pounds to a few hundred, depending on the type of opening product required. More information on these can be obtained from contacting Floodsense.



Get in touch! If you're wanting any more information on any of these techniques, drop us a line by emailing us on info@floodsense.co.uk

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Dry Flood-Proofing

This term covers several techniques for sealing up a building to ensure that floodwaters cannot get inside it. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows and vents) are closed, either permanently, with removable shields, or with sandbags. A sewer backup protection measure is installed.

All of the previously described flood protection methods belong to this category. Many dry flood proofed buildings do not look any different from those that have not been modified.

Dry flood-proofing is most appropriate for buildings on concrete slab floors (without basements), with no cracks, and subject to less than three feet of water. To ensure that the slab is watertight and sound, a careful inspection is recommended. A subsurface drainage system with a sump pump is needed in areas where waters will stay at flood stage for more than a few hours.

Precaution

A dry flood-proofing project may require planning approval from your local authority. Footing drains should be designed and inspected during installation by an engineer. Check with the planning department

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of your local authority to ensure that your project does not violate any legal requirements.

A building should not be dry flood-proofed if floodwaters may be more than three feet deep, or move faster than five feet per second. It is very tempting for the owner of a dry flood-proofed building to try to keep the flood out, even if floodwaters get deeper than two or three feet. This can result in collapsed walls, buckled floors and danger to the occupants.

Basements should not be dry flood-proofed if the floodwater will touch the walls. This is because of the potentially destructive water pressure on the walls and floors. Basement walls can be waterproofed to protect them from high ground-water, if a footing drain is installed to keep the water pressure from building up. See the following section on Wet Flood Proofing to protect sub-grade foundation walls and floors.

Many commercial waterproofing compounds are made to protect wood from rain, but they will not withstand the pressures of standing water. Some deteriorate over time, so check with the supplier to be sure that the waterproofing compound is appropriate for sealing your basement walls from water. Closing openings depends on having adequate warning time and having someone present who knows what to do.

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Cost: £100 - £20,000

Dry flood-proofing costs can range from £100, when a handyperson simply applies a waterproofing compound, to £20,000 or more for a more secure and attractive approach that works even when no one is home.

Wet Flood-proofing

If floodwaters in the vicinity are touching the property, they are probably also seeping down between the soil and the exterior of the basement walls. Even if the outside water is only a few feet deep at the ground surface, it is putting pressure on the basement walls and floor equal to that of a standing body of water seven or more feet deep; about 750 pounds of pressure per square foot. A similar depth of dry soil exerts less than a 100 pounds per square foot.

Most walls and floors are not built to withstand that kind of pressure. As a result, waterproofed basement walls and floors can be cracked, buckled, or broken by the pressure of floodwater.

Instead of just a wet basement, you may end up with both a wet basement and broken walls. One way to deal with this is to remove everything that could be damaged by a flood, and let the water in. This is called wet flood-proofing. Several modification

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methods can be used to minimize potential damage to the building and its contents if floodwaters are allowed inside. These techniques range from moving a few valuable items to higher elevations within the house, to rebuilding the floodable area.

In the latter case, structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The boiler, washing machine, tumble dryer, etc., are kept on the higher floors of the property. Another approach is to raise these items on blocks or platforms, where the flooding is not deep.

Many people wet flood-proof their basements, crawlspaces, garages and accessory buildings simply by **relocating** all hard-to-move valuables, such as heavy furniture and electrical outlets. Vents can be placed on the foundation walls to ensure that floodwaters can get in and out of the crawlspace to equalize water pressure on walls and floors.

Wet flood-proofing has one advantage over the other approaches: no matter how little you do, you will reduce your damages. Simply moving furniture and electrical appliances out of the floodprone area can prevent thousands of pounds in damage.

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Precautions

Moving contents is dependent on adequate warning time and the presence of someone who knows what to do. Flooding an area where there is electricity, paint, or other hazardous materials, can create a safety hazard. There will still be a need for clean up, with its accompanying health problems.

Cost: £0-£20,000

You can accomplish some wet flood-proofing just by moving valuables and hazardous materials out of the floodable area. Reconstructing a floodable area with water-resistant materials and relocating utilities can be much more expensive.

Elevation

When a house or property is properly elevated, the living area will be above all but the most severe floods. Several elevation techniques are available. In general, they involve: (1) lifting the house and building a new one, or extending the existing foundation below it or, (2) leaving the house in place and either building an elevated floor within it, or adding a new upper story.

During the elevation process, most houses are separated from their foundations, raised by hydraulic jacks, and held by temporary supports while a new or extended foundation is formed below. The living area is raised and only the foundation remains

exposed to flooding. This technique works well for houses originally built on basement, crawlspace and open foundations. When houses are lifted with this technique, the new or extended foundation can consist of continuous walls or separate piers, posts, columns or pilings. Masonry houses are more difficult to lift, primarily because of their design, construction and weight, but lifting these homes is possible.

This is a very specialised job and obviously needs the advice of structural engineers and architects. Also, this type of retrofitting is ideally suited to detached properties, although another option is to use one of two alternative elevation techniques, in which the house is left on its original foundation.

Technique one is to remove the roof, extend the walls of the house upwards, replace the roof, and then build a new elevated living area inside.

The second technique is to abandon the existing lower enclosed area (the level with the slab floor) and move the living space to an existing or newly constructed upper floor. The abandoned lower enclosed area is then used only for parking, storage, and access to the house.

A recent example of this method can be seen here: <http://dailym.ai/1AH8tGY>

During the Flood (safety precautions)

Turning off your Utilities

Turning off your utilities could prevent greater damage if your building gets flooded.

Electricity

The most important utility to turn off is the electricity.

Gas

Floodwaters may knock out pilot lights and silt may get into burners if you have a floor standing boiler. If there is a chance that the pilot light could be flooded, you should turn off the gas before you leave to prevent a fire or a potential explosive safety hazard.

After the flood, contact a gas safe registered plumber to check your appliance (if there are signs it has been in contact with floodwater).

Fuel Oil Tanks

If you have a fuel oil or propane tank, turn off the fuel valve on the tank if the pilot light might be inundated or the supply lines broken by a flood.

Make sure that your outdoor fuel tanks are securely anchored to the ground in flood prone areas. Propane tanks usually belong to the fuel supplier; ask them how to properly secure the tanks.

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After the flood, contact an OFTEC / gas safe registered plumber to check your appliance (if there are signs it has been in contact with floodwater).

Water

Since your sinks are usually turned off, you shouldn't worry about turning all the water to the house off during shallow flooding. However, if your washing machine is in the basement, for example, or if the floodwaters around your property could be several feet deep, the floodwaters could get into the water lines through the appliance.

Planning can help you to develop an informed, well thought out response to potential hazards – before they happen. If you have the time, turn off the water supply to the appliances or the property. There is usually a valve near the water meter or where the service line enters the house. The water valve has a handle, similar to an outside tap. Turn it all the way clockwise.

5 top tips to stay safe during a flood

Listen to and act on the advice of the emergency services and follow these simple steps:

1. Put people before property. Move your family and pets upstairs, with a means of escape.
2. Gather essential items (like water, blankets, a torch, a first aid kit, essential medication and

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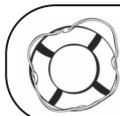
food) and put them out of the way of floodwater to keep dry.

3. Listen to the local radio for updates or call the EA Floodline on 0845 988 1188.
4. Put plugs in sinks and baths. Weigh them down with a sandbag, a pillowcase a plastic bag filled with garden soil, or a heavy object to avoid water backing up through drains into sinks and toilets (if you do not have any sewage backflow prevention).
5. Turn off the gas, electricity and water supplies when floodwater is about to enter your home, if safe to do so. DO NOT touch sources of electricity when standing in flood water.

Flood water can rise quickly, stay calm and reassure those around you. Call 999 if you are in danger.

After The Flood

If you've been flooded you should get a copy of *Repairing your home or business after a flood* which is published jointly by the Association of British Insurers (ABI) and the National Flood Forum.



To get hold of a downloadable version, visit www.keepingitdry.co.uk/resources

This section outlines the three steps you should take during the first few days after a flood. Additional steps are explained in the report, mentioned above.

Step 1 - Take care of yourself

You and your family have been through a disaster. It has disrupted your life, and you must allow time for things to return to normal. You should recognise that the flood can take its toll on you, as well as your property. You need to look after yourself and your family while you focus on cleanup and recovery.

Your hidden enemy is stress. Watch for signs of trouble such as short temper, getting upset over little things, having difficulty sleeping, bad dreams, aches, pains, stomach problems, apathy and depression. These are the ways in which your body tells you that times are difficult. Reactions to stress are common and usually temporary. Here are some things you and your family can do to relieve your tension.

- ✓ Keep the family together. Togetherness provides mutual support.
- ✓ Discuss your problems. Talk to family and friends. Share your anxieties. Let others talk to you to help release tension. Crying is a natural response to a disaster and can release pent-up emotions.
- ✓ Rest often and eat well. You are more likely to suffer from stress and health problems when you are weak.

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Health hints:

- Wash your hands thoroughly. This is especially important before eating, cooking or smoking.
- Confirm that the water is clean and safe.
- Don't drink the water or wash dishes in it, until you're sure.
- Disinfect dishes and all items that the floodwaters touched.
- Watch out for fatigue. When your body is tired, you are more prone to accidents, back strain and depression.
- Report health hazards. Call your local Environmental Health Department if there are animal carcasses, rats, dangerous chemicals, or other health hazards on your property.

Step 2 - Give your home first aid

Numerous people have died over the years through flooding in the UK. Many of these fatalities were due to electrocution or other accidents that occurred after the floodwaters had gone down.

Your first job is to make sure everything is safe *before* you enter the area. Follow these tips:

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- ✓ **Stay tuned to a radio or TV** to find out when you can go back home.
- ✓ **Check with your insurance agent** to find out what cleanup and repair work is covered. This will help you to prepare a plan to restore your property.

Most insurance companies have 24-hour emergency helplines, which can advise on the next steps and arrange repairs as quickly as possible.

As the UK Government advises, ask the building and contents insurer the following:

- 】 When will the loss adjuster visit?
- 】 Will they organise and pay for redecorating and cleaning?
- 】 Will they help pay for repairs that will reduce potential flood damage and therefore lesson the costs if it happens again?

- ✓ **Check the foundations for cracks or other damage.** Examine porch roofs and over-hangs to be sure its supports are structurally sound. Look for gaps between the steps and the house. If

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you see obvious damage, have a qualified builder or surveyor check the house before you go in. For help, call the local building control officer from your local or county council.

- ✓ Walk around the outside of your house and **check for loose electrical powerlines and gas leaks.**
- ✓ **Gas:** You can detect leaking gas by the putrid, rotten egg smell of the chemicals that have been added to make a gas leak noticeable. Report gas smells or a gas leak (from a safe place outside) to the national gas emergency number, 0800 111 999. Turn off the gas only if necessary.
- ✓ **Go inside carefully.** It may be easier to enter your house through a window if the door will not open easily. Look carefully at the ceiling before you go in, to be sure that it is not ready to fall. *Do not smoke, use candles or other open flames* until the house has been well ventilated. Turn on a torch before entering, to reduce risk of explosion.

DO NOT ENTER AN AREA IF YOU SMELL GAS FUMES. Alert someone outside the house that you intend to enter, and ask them to call for help if you do not return or answer their call.

- ✓ **Electricity: Turn off the electricity** at your house, even if your local energy company has turned off

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the main supply line (they may turn it back on when you're not ready). Call an electrician if you need to go through water to get to your fuse box, if the boxes are wet, or if you are not comfortable with electrical matters. Call 0800 404090 to report electrical power lines or other such hazards.

- ✓ **Photograph** the flood damage for insurance reimbursement purposes, prior to beginning cleanup operations.
- ✓ **Rescue the most valuable items.** Find and protect the 'irreplaceable,' like money, jewellery, insurance papers, photographs and family heirlooms. Wash the mud off before it has a chance to dry. Wrap wet photographs and important papers in plastic bags and temporarily freeze them (until you have time to clean and dry them). Put sturdier items in a safe, dry place, for instance, inside a plastic bag, or take them to a friend's home for safekeeping.
- ✓ **Keep the damage from getting worse.** Open the windows and doors (if weather permits) to reduce the interior humidity and ventilate any odours or gas fumes. Check the basic structural integrity of the building before attempting to cover holes in the roof, walls or windows with boards, tarps or plastic sheeting to keep out the wind and rain. *Save labour and material receipts for insurance reimbursement.*

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- ✓ **Repair sagging floors or roof sections.**
Use 4 x 4s or other heavy lumber to brace weak areas. If you are uncertain how to shore up floor or ceiling joists, call a local builder. Save labour and material receipts for insurance reimbursement.
- ✓ Remove tree limbs or other trash that may have landed on, or floated into the house. Save disposal receipts for insurance reimbursement.
- ✓ **Check for broken or leaking water pipes.**
If you find any, cut off the water supply by turning off the mains tap. If the water pipes are not leaking, you can use your tap water for hosing things down and cleaning.

Do not drink or cook with tap water until your water provider declares it safe.

- ✓ If you have one, **drain your basement slowly.** The water in saturated ground puts tremendous pressure on your basement walls and floors. The water inside your flooded basement is counteracting this pressure. If you do not follow the instructions for emptying the basement gradually, your walls and floor may lose the support they need to counteract the pressure from the outside water. The weight of the saturated earth could then cause the walls to crack and collapse, buckling the floors and seriously

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damaging your home. Follow the checklist of steps provided to safely drain your basement.

- ✓ **Get rid of the mud and silt.** Most of the health hazards brought by a flood are in the mud and silt that is left after the water drains away. Therefore, it is very important to clean it out as soon as possible. This is more effective if you do it before the mud dries out.

Things to take with you, when it is safe to do this:

- Flashlight and batteries
- First aid kit
- Battery-operated radio
- Waterproof boots or waders
- Hard hat, boots with hard soles
- Camera or video camera to record damage
- Tools: crowbar, hammer, saw, pliers, etc.
- Drinking water
- Trash bags
- A wooden stick for turning things over and scaring away small animals!

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Cleaning supplies:

- Shovels
- Buckets, hose
- Rubbish bags
- Mops, brooms, brushes, rubber gloves
- Rags
- Cleaners and disinfectants
- Lubricating oil

How to drain a basement:

1. Make sure the electricity is off.
2. If there is no floodwater on top of the ground, start pumping the water out of the basement.
3. Pump the water level down two to three feet. Mark the level and wait overnight.
4. Check the water level the following morning. If the water went back up, it is still too early to try to drain the basement.
5. Wait overnight. Then pump the water down two to three feet again. Check the level the following day.
6. When the water stops going back up, pump

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down another two to three feet and wait overnight. Repeat steps 4 through 6 until all the water is pumped out of the basement.

Mud removal tips:

- First of all, shovel out the mud and move furniture and debris outside.
- Make sure the electricity is turned off.
- Remove all light bulbs from sockets that have been flooded. Disconnect and throw away flooded wall switches and outlets. They should be replaced later with new ones.
- Hose the house down, inside and out. If you have an attachment that sprays soap, wash and then rinse the walls and floors. Hose the opened electrical outlets, the switch boxes and any light sockets.
- Do not let the water sit on the floor for too long, especially if your floor is made of particleboard or another wood product that falls apart when wet.

Step 3 - Get organised

Before you try to clean up and repair everything, you need to **assess your damage** and develop a **recovery plan**. Follow the steps below to make the best use of your time and money.

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Call your insurance provider. How much of your loss is covered will depend on your policy. Your provider will also tell you what to throw away, and what to save for the adjuster to examine. Find out if your insurance covers living expenses while your house is being repaired. If you do not have coverage, your provider can still advise you where to get help with cleanup and repairs.

Check for structural damage. Broken basement or foundation walls, shifted stairs or slanted floors and walls could mean that these items will have to be rebuilt from the ground up. Repair safety hazards, such as broken stairs, before you proceed any further.

If you have structural damage, contact your local or county council department of building control or/and a local surveyor or builder before you start any reconstruction.

Ask the big question. Odds are that the area where you live will flood again. Before you spend a great deal of money and effort repairing and rebuilding, ask yourself, *“Do I really want to be flooded again?”* Study the flood proofing options in this handbook.

Start listing the damage. List the damage, room by room. If possible, take pictures or video recordings of the damaged items as you clean up. Keep receipts for cleanup supplies, equipment rental, hired help and temporary housing expenses. Keep a sample of items, such as a piece of carpet, to show the value of what you have thrown away. Good records are needed for insurance claims.

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Make a recovery plan. A recovery plan is simply a list of jobs that need to be done. Planning can help you save time and money. Besides, being methodical and keeping everyone busy can ease tension. You will start seeing progress as you finish each project.

Start making lists. Begin with the projects such as *'replace boiler'* and *'dry the walls'*.

Decide what you can and cannot do yourself. You can save money by doing much of the cleanup and repair work yourself. However, jobs like shoring up foundations and replacing electrical boxes are best left to the professionals. Save all receipts for material, equipment rental, labour and disposal fees for insurance reimbursement records (if covered).

Decide if you need financial assistance. After a flood, Extra sources of help are usually available for the uninsured who need to replace items or hire a professional. Check the local newspaper, radio and TV stations for notices about Red Cross, church and government assistance. Even if you are insured, or think you can cover all your expenses, it makes sense to take advantage of whatever additional help is available. In the case of government assistance, you have already paid for it with your tax payments and deserve a share of the funds set aside for disaster aid.

Keep the windows open as much as possible to begin drying things out.

Chapter Four

Commercial Flood Protection

Before The Flood

As a business, a flood is one of the worst things that can happen to you. Not only do you have to deal with the damage flooding causes and its associated costs, but there is the loss of business, the loss of customers due to being unable to meet requirements, and the loss of market share. There is also the added stress that is inflicted on both the business owner and the staff, which can lead to health problems and additional time off work.

There are ways to minimise these issues. The 8 point checklist below can help you be prepared in the unlikely event of a flood.

1. Find out your flood risk level on the Environment Agency Site (England) or the SEPA website (Scotland).
2. Register your business for the Environment Agency or SEPA flood warnings, (if they are

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available to you) and make sure you designate a key member of staff to receive the calls.

3. Create a business flood plan. Templates are available from the EA.
4. Prepare a flood kit and be sure to include important documents, e.g., insurance contact details, etc..
5. Contact your local authority to find out what help is available for businesses should the worse happen.
6. Contact the National Flood Forum for advice on flood resilience and resistance, a list of flood protection product retailers, or for help in the formation of an action group.
7. Ensure that you have adequate insurance cover in place, not just for building and contents insurance, but for business interruption cover as well.
8. Make an investment in improving the flood resilience of your land and property. The cost of making your commercial property better able to deal with flooding is likely to be a lot less than clearing up after flood.



To book your **FREE** flood assesment, simply go to;
www.keepingitdry.co.uk/freefloodassessment

After The Flood

The most important thing to do after a flood is to find out if it is safe to return to your premises (if you were evacuated because of flooding).

You will be told when it's safe for you to return either by someone from the emergency services, your insurance company, your local council or your water and sewage company. However, take care as structural damage may have occurred and there may be contaminated water.

Insurers

Contact your property (buildings and contents) insurer and your business interruption insurer (if you have one) as soon as possible after a flood.

The Association of British Insurers, the Construction Industry Research and Information Association, the Environment Agency and Scottish Environment Agency, among others, offer practical advice in terms of what to do during a flood beyond simply contacting insurers' floodlines for businesses affected by flooding.

Insurance Claim

As it is discerned in the specialist historic building restoration and repair industry, as much as it is necessary to use specialist craftsmen for building

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restoration, it is sensible to select a specialist insurance broker to advise on flood damage claims.

The UK Construction Centre provides a comprehensive directory of UK wide loss adjusters.

Before contacting your insurer(s), you should check your buildings, contents and business interruption insurance policies to ensure they are valid for the time of the claim and to make sure you're covered for flooding.

As a business, you probably rent your property from a commercial property owner. If you do rent, contact your landlord and find out what insurance cover they have in place on the property. Finding this out will help you determine what protection you need in the event of a flood.

If you do not hold insurance, ask your local council for information on grants or charities that can help you.

Make your own record of the flood damage. You can do this by taking photos, making notes or videos. You should also make sure you keep a record of everything related to your claim (letters, receipts and telephone calls to and from the insurance company).

The Association of British Insurers (ABI) states that:

"...Business insurance policies will cover storm damage to premises and stock..."

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“...Business interruption cover (which may be included or purchased separately) will cover additional costs, such as hiring temporary premises, if needed.

“...Many businesses are not fully covered by flood or business interruption insurance and many never recover from being flooded...”

The possible effect on the health of commercial property owners and tenants as a result of flooding should not be underestimated either, as flooding can lead to long term anxiety and health problems.

Alterations and Repairs

Make sure you contact your business insurer *before undertaking any work* to find out what work can be paid for under your policy.

Your business insurer will usually pay for 'like-for-like' repairs, restoring your commercial property to a similar state to how it was before the flood.

The *UK Construction Centre* provides a list of UK wide suppliers of flood related products and services, as well as comprehensive information on repairing flood damaged property. Look for their articles which can be found under the heading, *'Repairing Flood Damaged Property.'*

Their advice for discovering any structural issues is reiterated here. A major alteration or repair item could incur sizeable costs as well as being a key health and safety issue.

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Structural assessment of the building can be carried out by:

- Checking roofs - roofs are a very good indicator of the presence of structural damage. Look at the ridge of the roof and assess whether it has changed - this should be viewed from a distance rather than close up.
- Checking the walls to verify that they are as before - this can normally be done by sight, or with a spirit level.
- Looking for bulging or dislodged sections of the building's fabric/structure.
- Looking for deep scouring, which has led to the foundations being exposed.
- Checking for any new cracks bigger than 5mm above doors or windows.

If any of these features are observed, a building professional must be called in to assess the property. It is important to make regular checks for damage (at least once a day), as it may take a while for some damage to become apparent.

The *British Damage Management Association* is the certification authority for flood recovery specialists. It warns that incompetent flood recovery work can lead to health risks and irreparable damage to building structures. It recommends using an experienced flood

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recovery specialist and advises checking their credentials and taking insurers recommendations first.

Beyond this it describes methods of repair and alterations to the following generic areas:

- Brickwork
- Floorings and Floors
- Glass and Windows
- Plaster and Drylinings
- Wall coverings
- Insulation
- Wood
- Electrical Systems
- Gas Systems
- Water Systems
- Sewers

It can be easily understood that significant costs - not just to the built fabric and stock, but in terms of loss of production or trading ability - start to be incurred from the moment you contact someone at the onset of a flood, to the completion of the final postflood repair, regardless of the size of your property.

New Building Regulations

The UK government and local authorities have adopted specific regulations to help ensure that new construction will not make our flooding problems worse. These are described more fully in chapter 7, *Flood Defence for Stakeholders*.

Chapter Five

Flood Defence Methods

What is flood defence?

Flood defence is the visible sign of flood risk management, which aims to reduce the impact of flooding to property near the coast or rivers.

It can be defined as either **'hard'** or **'soft'** flood defence (employing either 'hard' engineering solutions and products, 'soft' engineering solutions and products or a combination of the two).

These will include: *flood avoidance*, *flood resistance* or *flood resilience* measures to varying degrees of sustainability, innovation, visual appeal and cost.

Why are flood defence measures needed?

National and local government flood control projects are very expensive, take years to complete and will not offer 100% protection.

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The committee for Climate Change Progress report (CCG) Titled: “*Adaptation Sub- Committee Progress Report - July 2011, Adapting to climate change in the UK - Measuring progress*”, are fourfold and it states the following;

“...The UK land-use planning system should enable more transparent assessment of climate change assessment against other shorter term priorities.

There is a risk that the move to more localised planning could make emerging strategic approaches to considering long term climate risks less effective, although the forthcoming duty to cooperate has the potential to play an important role.

National planning policy guidance on river and coastal flood risk has resulted in significant uptake of adaptation measures at property level.

The capacity of local authorities and statutory agencies is a potential barrier...”

How can flood defence systems be made?

'Hard' options can have a significant visual and physical impact on the surrounding landscape and are often considered as the 'traditional' solution.

However, recent innovations attempt to mitigate the physical and visual impact of this, with defences either being demountable, possessing automated mechanisms or an increased variety of size and/or colour options (for any permanent fixtures forming part of them).

Flood avoidance

Flood avoidance measures are flood defence measures that are permanent in nature and generally form part of a wider landscaping and land use strategy.

Flood resistance

Flood resistance measures are defined in the UK Planning Portal as:

“...those measures taken at building level to re-vent floodwater entering the building and damaging its fabric. For example, these measures can include the use of materials with low permeability...

They can probably only be effective for short duration, low depth flooding (under 0.3m). They include the use of low permeability materials that reduce the rate of water ingress into a property...”

Flood Resilience

Flood resilience measures are defined in the UK Planning Portal as:

“...sustainable measures that can be incorporated into the building’s fabric, fixtures and fittings to reduce the impact of floodwater on the property.

This allows easier drying and cleaning, ensures that the structural integrity of the building is not compromised and reduces the amount of time until the building can be re-occupied...”

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and:

“...resilience measures on their own are not suitable for areas with a potential combined risk of high flood discharge rates, rapid rising levels and/or where speed of flow is likely to be high and dangerous to the stability of buildings and the safety of people...”

Many of these measures are temporary in nature and rely on occupants to store, install and maintain them effectively over time.

‘Hard’ Flood Defence Measures

High flood risk areas

These can be considered for developments in locations of **high flood risk** and generally form part of a wider landscaping and land use strategy. This is because they are permanent in nature and include:

- **Embankments** (artificial levees / bunds or contouring).

Embankments are raised banks and they effectively make the river deeper so it can hold more water. They can incur significant cost, are visually unnatural and if breached can cause significant damage, sometimes requiring electrically operated pumps to protect from this and rainwater, but they do protect the land around them if sized appropriately.

- **Permanent Flood Walls**

Permanent flood walls can be built around residential developments in locations of flood risk. They are often lined with concrete, rendering them unsightly, although effective, natural stone linings can improve the effect (but depletes this natural resource). They must be professionally designed to accommodate different water pressures, which vary with floodwater depth and any damage caused by debris.

- **Revetments**

These are permanent flood walls built at a low angle to make them more attractive and restrict bank erosion. Additional land needs to be available for them.

- **Culverts**

These are semi-circular, smooth covered channels which can extract water away from residential areas as quickly as possible. They need to be sufficiently sized, particularly around the culvert entrance, to avoid localised flooding when in use around the entrance.

- **Temporary Flood Walls**

Sandbag walls have been traditionally employed as demountable flood walls, but they have a detrimental effect on the environment with the

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need for transporting and dredging sand and associated carbon dioxide emissions. They require significant time and labour to install as walls.

Modular demountable lightweight flood wall and flood fence systems are now available. They suit a variety of locations, offering protection to the private house owner right through to an entire residential development. They are able to block off entire streets or surround entire communities.

- **Dams, Reservoirs and Pumping Stations**

Dams and reservoirs are significant engineered interventions to control river flow dynamics and flooding. They require significant cost and maintenance but have the potential to be associated with leisure activities and or biodiversity protection.

- **Straightening**

Straightening a part of a river is also called channelising a part of a river. This allows it to carry more water and so reduces the likelihood for it to flood. It alters the ecosystem and the natural appearance of the river, and as the water can pass through faster, it can lead to flooding further downstream.

- **Dredging**

Dredging involves underwater excavation to keep a river free of sediments; it will increase the

Chapter 5 - Flood Defence Measures

velocity of the water and can reduce flooding. However sediment, the dredged material, has to be disposed of appropriately and maintenance dredging carried out. Ideally, such disposal sites form additional leisure areas, enhanced natural habitat areas or are reserved for agricultural or horticultural use.

- **Diversion Channels and Basins**

Overflow diversion channels and basins take surplus water out of a river in times of flood. They can be effective if there is suitable land available for this within commercial and agricultural developments, but they can be a costly intrusion.

- **Dry Washlands**

Low risk flood areas

These can be considered for developments in locations of average and **low levels of flood risk** and include the following:

- **Flood Barriers**

Sandbags have also been traditionally employed as flood barriers up against building openings, with the same disadvantages as when used to make walls.

Fixing timber boards to openings is another traditional approach.

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Demountable PVC flood barriers using 'a dam engineering' convex form approach are now available to residential owners to protect doors and windows in the event of a flood. Only a minimum of permanent fixture is required to support them and these can be colour-coordinated.

- **Non-return Valves**

These are intended to stop sewage backflow to below ground drainage sewer pipes.

- **Airbrick Covers**

These can be easily clipped on to existing airbricks and removed after a flood event. A fixed, visually discreet airbrick surround plate can be colour coordinated to match an existing property wall.

- **Smart Airbricks**

Smart airbricks are now available for new-build or retrofit residential applications, which automatically seal in the event of water entering them.

- **Damp Proof Course**

This is when a layer or coating of material is placed in a wall to resist the passage of moisture from the ground.

- **Damp Proof Membrane**

This is when a layer or sheet of material is placed beneath or within a floor to prevent the passage of moisture.

To be fully effective, it should be lapped to the damp proof course in the surrounding walls.

- **Seals and Mastics**

External and internal damp proofing seals and mastics are available for application in all sorts of residential properties.

Some internal methods and coatings require specific dry lining techniques to house electrical wiring installations. This can reduce floor area, and in the case of historic or listed property, prove awkward to detail or be unacceptable from the heritage perspective, thereby reducing the potential use of a space.

External applications may seem preferable; however, there are visual implications and again in the case of historic or listed property this may be unacceptable.

- **Sumps and Pumps**

A sump pit and electrically operated pump to a residential property provides an artificially lowered water storage area for floodwater to run

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to, and then be pumped and extracted out of. These may be internally located and are costly items. They can also take up a sizeable under floor area that can impact other under floor located services or pipework layout, causing additional noise when in operation and consuming additional electricity.

‘Soft’ Flood Defence Measures

High flood risk areas

‘Soft’ flood defence avoidance measures can be considered for developments in locations of flood risk, and they generally form part of a wider landscaping and land use strategy as they are permanent in nature.

They include the following:

- **Planning Policy Strategies**

Local authorities have planning policies to control proposed residential development, in terms of its location, size and nature, and whether it’s close to or on river floodplains or coasts.

The aim of these policies is to reduce the risk of flooding and any associated damage to property. There can be resistance to restrictions on proposed residential developments in areas where there is a shortage of housing.

The best approach to flood risk management is avoidance.

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Ideally, this would mean building outside of areas known to flood (or likely to flood). If this is not possible, it can be achieved by building above the flood level, or preventing floodwater from reaching a building by site layout.

Following the 2007 widespread urban floods, some local authorities have specific policy restrictions in place for individual property owners, governing, for example, the way people can use their front gardens for parking.

Planning policy can provide the justification for working more with natural processes. Planning Policy Statement 25 supports the process of restoring rivers to their natural function:

The government's *Making Space for Water Strategy* by the Department of the Environment, Food and Rural Affairs (Defra) says that:

"...the concept of sustainable development must be firmly rooted in all flood risk management and coastal erosion decisions and operations..."

and it:

"...seeks proposals that combine new development with measures to restore heavily-modified watercourses and their flood plains to a more natural state...These measures can result in reductions in flood risk, as well as significant improvements in amenity, biodiversity and water quality."

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- **Flood Warning System**

The Environment Agency issues flood warnings so that people can put flood defence measures in place by their homes, implement their flood plan or even evacuate the area as expediently as possible.

- **Clean Energy Flood Walls**

Clean energy ‘built-in’ automated flood walls or barriers are also available. These come into operation due to rising flood water itself and self-close to becoming visually discreet as floodwaters recede.

- **Temporary Water filled ‘Dam’ Floodwalls**

Used like traditional sandbag walls, large water-filled bags are an eco-friendly method of defending residential property and land from flood waters, and they can be ready to use in minutes. They require no sand, are light, inflate in minutes, require less space for storage and can be stored flat almost anywhere.

Low risk flood areas

‘Soft’ flood resistance and flood resilience measures mainly form part of sustainable drainage systems (SuDS) and can be considered for developments in locations less prone to flood risk. They are suitable either for new-build or in retrofit applications.

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'Soft' flood resistance and flood resilience measures forming part of SuDS systems are as follows:

- **Managed Flooding** (ecological flooding or wet wash lands).

Rivers can be allowed to flood naturally in places on a flood plain where development has been restricted in terms of use. The aim of managed flooding is to give adequate space for floodwater and prevent flooding from occurring elsewhere, such as near settlements. Simultaneously to this, it enhances biodiversity by providing areas of habitat and is often used in combination with hard defences to provide areas for recreation. For example, additional playing fields for residential developments.

- **Water Retention**

Water retention can be achieved through the following:

- ✓ Management of water infiltration, by maintaining or ameliorating soil condition or using permeable paving that improves infiltration into the soil.
- ✓ The provision of water storage areas, including through some green roof systems.
- ✓ Surface water attenuation (balancing) ponds and swales.

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- ✓ Lessening flows through hillslope management and river conveyance by methods such as upland grip blocking, cover crop planting, re-establishing smaller watercourses to a more natural alignment, re-establishing meanders, reconnecting river channels and dismantling culverts within areas of flood plain obstructed by unnatural manmade features.

- **Afforestation**

When trees are planted near to a river there is greater interception of rainwater and lower river discharge. Replanting woodlands in floodplains flanking residential development will help to slow the flow of water runoff and help it filter through the soil. This is a relatively low cost option, which enhances the environmental quality of the drainage basin as well.

- **Green Revetments**

- **Green Roofs**

Green roofs slow rainwater runoff through filtration and can polish and clean the water to be used in non-potable areas of a building, as well as allowing for increased biodiversity.

- **Water-filled Bags**

The equivalent of sandbags but water-filled, are

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available. These are biodegradable, lightweight and can be managed by one person. They are biodegradable, and when floodwater eventually subsides the water in them returns to the environment gradually and naturally over time.

- **Inflatable Flood Barriers**

Sustainability and Innovation

In *The Pitt Review: 'Lessons learned from the 2007 floods'*, by Sir Michael Pitt, recognised that:

"...working more with natural processes does not mean that more traditional hard defences will not be needed, but that more sustainable 'soft' approaches should work alongside them. The approach should complement and extend the life of traditional defences..."

Mutations in flood management philosophy (for the large part governed by predictions of increased flooding probability due to future climate change, along with changes in the way the rural economy is viewed), should allow all future developments in areas prone to flood risk in the UK to rigorously take on board sustainable and innovative concepts embodied in the 'soft' approach to flood defence, or at least to complement existing traditional measures.

The prevailing view of the Environment Agency is that

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flood risk cannot simply be managed by building 'hard' flood defences of an ever-increasing size. Increased use of sustainable 'softer' approaches which work with natural processes is therefore required.

Planning policy can provide the justification for working more with natural processes. *Planning Policy Statement 25* supports the process of restoring rivers to their natural function.

For all urban and rural landscapes there is now a wider choice of cost effective flood defence systems and products available, including ones with far-reaching sustainable benefits.

With more properties being affected by flooding each year (quoted by a government business information source to be as much as 1 in 6 properties in England and Wales), there is an increased requirement for flood defence for the users and owners of them. They naturally want to avoid the cost, trauma and upheaval involved in flood events.

Ironically, the 'soft' engineering approach to flood defence systems, is the area where there is a higher degree of innovation focus. This is because it represents the most sustainable approach, and for once innovation does not necessarily equate with high cost.

The key to this 'sustainable innovation' seems to be harnessing the inherent forces of nature to counter the powerful Post-Industrial Revolution progress made earlier by man.

Visual Appeal

'Hard' flood defence options can have a significant visual and physical impact on the aesthetics of the built environment, and are often considered as the 'traditional' building solution. 'Soft' flood defence options are landscape orientated, with the potential for significant and often positive aesthetic effects on the natural environment.

Cost implications

There is a cost attached with all flood defence products and measures. However, it is negligible when compared with the potential cost involved in repairing damage in the event of a serious flood and the fact that investment in quality design for good visual impact can provide real psychological benefit and social amenity to the communities concerned.

'Soft' flood defence options are more ecologically sensitive as low impact systems, and they are available for the residential, commercial and agricultural sectors. They are becoming more readily available and cost-effective for smaller-scale applications and are increasingly available for use in urban areas.

These options are generally cheaper for large scale areas than the 'hard' alternatives, and they are a viable part of flood defence strategies, for both existing and new developments.

Residential applications

The purpose of this chapter section is to shed light on the different approaches for flood defence in private and public residential applications available today.

Why should flood defence be employed in residential situations?

With more residential properties being affected by flooding each year, there is an increased requirement for flood defence systems for them, in order to avoid the cost, trauma and upheaval involved in flood events.

Who should be interested in residential flood defence?

Private and public residential property owners in the UK with homes in proximity to rivers or the coast, as well as built and unbuilt environment professionals and the stakeholders involved in them.

Where can residential flood defence occur?

Residential flood defence may serve urban or rural domestic property, either in coastal locations or near rivers, and can be either traditional or innovative in nature.

How can residential flood defence be carried out?

Methods and techniques of flood defence in residential

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applications can benefit wildlife by providing areas of habitat, and they are often used in combination with hard defences to provide areas for recreation and leisure alongside residential developments.

These options are generally cheaper for large scale areas than the *'hard'* alternatives, and they are becoming a viable alternative or addition to flood defence strategy for both retrofit and new-build public or private residential developments. They are also becoming more available and cost-effective for smaller-scale residential applications and are becoming increasingly available for use in urban residential areas.

'Hard' flood resistance and resilience measures are on the whole *less suited* for residential new-build developments where permanent avoidance measures should be applied as integrated features of the residential environment.

Some *'hard'* flood defence resistance/resilience measures, that can be considered for residential property developments in locations of **high flood risk**. These are as follows:

- Flood barriers (permanent)
- Non-return valves (sewage and white goods)
- Airbrick covers
- Smart airbricks

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- Damp proof course
- Damp proof membrane
- Seals and mastics
- Sumps and pumps

Some '*soft*' flood defence avoidance approaches that can be considered for residential property developments in locations of **high flood risk**. These are as follows:

- Planning policy strategy
- Flood warning systems
- Clean energy flood walls
- Temporary water filled 'dam' flood walls
- Inflatable flood barrier

A '*soft*' flood defence resistance/resilience approach that can be considered for residential property developments in locations of **low flood risk**. These are as follows:

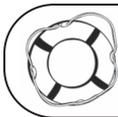
- Managed flooding (ecological flooding or wet wash lands)
- Water retention
- Afforestation

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- Green revetments
- Green roofs
- Water-filled bags

Sustainable Flood Defence for Residential Properties

For individual residential property and land owners, there is now a wider choice of cost effective flood defence systems and products available, including ones with far-reaching sustainable benefits.



To book your **FREE** flood assesment, simply go to;
www.keepingitdry.co.uk/freefloodassessment

Commercial applications

Let me explain the different approaches for flood defence in commercial applications available today, so that I can highlight key advantages and disadvantages of both traditional and innovative methods, the techniques involved and the influence of sustainability and innovation on them.

Why should flood defence be employed in commercial situations?

With more commercial properties being affected by flooding each year, there is an increased requirement for flood defence systems for them, in order to avoid the cost, trauma and upheaval involved in flood events.

Who should be interested in commercial flood defence?

Any private and public residential property owners in the UK with homes in proximity to rivers or the coast, as well as those architects and stakeholders involved in the developed and undeveloped environments.

Where can commercial flood defence occur?

Commercial flood defence may serve urban or rural commercial property, either in coastal locations or near rivers. They can be either traditional or innovative in nature.

How can commercial flood defence be carried out?

Methods and techniques of flood defence in commercial applications can benefit wildlife by providing areas of habitat, and they are often used in combination with hard defences to provide areas for recreation and leisure alongside commercial developments.

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'Softer' options are more ecologically sensitive as low impact systems.

These options are generally cheaper for large scale areas than *'hard'* alternatives and they are becoming a viable alternative or addition to flood defence strategy for both retrofit and new-build public or private commercial developments. They are also becoming more available and cost-effective for smaller-scale residential applications and are increasingly available for use in urban commercial areas.

Hard flood resistance and resilience measures are on the whole *less suited for commercial new-build developments* where permanent avoidance measures should be applied as integrated features of the commercial environment.

Some *'hard'* flood defence resistance/resilience measures, can be considered for commercial property developments in locations of **low flood risk**, are as follows:

- Flood barriers (permanent or semi-permanent)
- Non-return valves (sewerage and white goods)
- Damp proof course
- Damp proof membrane
- Seals and mastics
- Sumps and pumps

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Some '*soft*' flood defence avoidance approaches can be considered for commercial property developments in locations of **high flood risk**, are as follows:

- Planning policy strategy
- Flood warning systems
- Clean energy flood walls
- Temporary water-filled 'dam' floodwalls
- Inflatable flood barriers

A '*soft*' flood defence resistance/resilience approach that can be considered for commercial property developments in locations of **low flood risk**, is as follows:

- Managed flooding (ecological flooding or wet wash lands)
- Water retention
- Afforestation
- Green revetments
- Green roofs
- Water-filled bags

Sustainable Flood Defence for Commercial properties

For commercial property and land owners, there is now a wider choice of cost effective flood defence systems and products available, including ones with far-reaching sustainable benefits.



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Chapter Six

Sustainable Drainage Systems

In 2008, Defra launched the government's *'Future Water'* strategy for England and Wales.

This called for **sustainable management** of surface water, which includes facilitating water re-use, storage and infiltration into the ground to decrease the reliance on traditional drainage systems.

Results from the *'Future Water'* and the preceding *'Making Space for Water'* strategies resulted in the Floods and Water Management Act, which has partly been driven by the necessity for adaptation within the changing climate.

The act includes provision for the implementation of **Sustainable Drainage Systems** (SuDS) and national standards for their design and performance in order to mitigate the impacts of surface water flooding.

This chapter aims to provide informative and concise information drawn from a global resource base on sustainable drainage systems for those responsible for

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both new build and existing developments.

"...In the midst of the 1990s, various countries, following the example of the United States, France, and Australia, proposed a set of new strategies for qualitative and quantitative treatment of rainwater in the urban milieu..." ~ Poletto C and Tassi R Sustainable Urban Drainage Systems Drainage Systems (2012)

What are Sustainable Drainage Systems?

Sustainable Drainage Systems (SuDS) are sustainable drainage management practices, control methods and strategies designed to drain surface water by imitating the natural hydrological cycle. SuDS systems aim to minimise pollution to the environment and groundwater and improve the quality and quantity of local water supply, as well as providing amenity and biodiversity benefits.

Although the natural hydrological cycle cannot be completely replicated by SuDS, they currently represent the best practice for water management in the urban environment.

Historically in the UK, the term was applied to sustainable urban drainage management, as it is today in Australia with its term '*Water Sensitive Urban Design*' and in New Zealand with '*Low Impact Urban Design and*

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Development'. However, sustainable drainage systems can apply beyond the urban realm to rural contexts. In the US, these systems relate to Best Management Practice and Low-Impact Development.

A common misconception of SuDS is that they reduce flooding on a development site. In reality, they are designed to reduce the impact that the surface water drainage system of one site has on another. For example, where impermeable paving or building over land results in flash flooding, flows entering a sewer can exceed capacity and cause it to overflow. SuDS aim to minimise or eliminate discharges from the site, thus reducing the stormwater impact. The idea is that if all development sites incorporated SuDS then flooding would be less problematic.

They contain elements that aim to reproduce the water infiltration capacity in the soil lost due to ground impermeability. As a result, there is less surface runoff, reducing the likelihood of flood damage. This recharges underground aquifers and improves water quality.

Not only using soakaways, ponds or wetlands, they comprise of a range of components working in different ways, through infiltration, conveyance, attenuating, retaining and detaining water, to drain a variety of sites with source control, inlet, outlet and control structures.

Often SuDS schemes use a combination of these processes and unlike traditional solutions, SuDS manage runoff on the surface, often using multifunctional space.

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This means that they will be visible to the local community during dry conditions and also during both everyday and extreme rainfall events.

We have classified various SuDS components here as either '**green measures**', '**blue measures**' or '**source control measures**', and the way these can be employed are discussed later in this chapter.

Why should Sustainable Drainage Systems be used?

Compliance with Legislation

European legislation is now in place through the Water Framework Directive (Directive 2000/60/EC) (WFD) to ensure there is integrated river basin management in Europe, which Sustainable Drainage Systems can contribute directly to. Legislation, on a European, national and local scale, now supports and promotes the advantages of SuDS and the key advantages of them; their two key drivers: sustainability and flexibility.

The Flood and Water Management Act (2010) has designated '*Lead Local Flood Authorities*'. One of the new statutory duties for these authorities is for them to become a SuDS Approving Body (SAB). A SAB will be responsible for determining SuDS applications for new developments and adopting and maintaining the appropriate SuDS.¹

There is continued acceptance today that we need a

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more sustainable approach to managing surface water.

¹. At the time of writing, the government's Department of Environment, Food and Rural Affairs (Defra) has not yet announced a date for the commencement for such a local authority's new SAB duty.

Sustainability

The fabrication and upsizing of prevailing systems, sewers and underground water storage tanks means sustainable solutions are maintained, whereas by employing sustainable drainage management practices, control methods and strategies, this outcome is alleviated.

In the UK, the bad situation (of flash flooding, which leads to water pollution as well as flood damage) is made worse:

"...by connecting stormwater drains to foul sewers resulting in huge variations in the amount of sewage being discharged untreated into rivers via combined sewer overflows and impaired sewage treatment owing to the effects of the pollutants on the microbiology of the sewage works..." ~ Thornton J Green Building Bible

Flexibility

As Susdrain¹ explains, SuDS are perceived to be more flexible than traditional solutions, allowing room for

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any future modifications because of climate change or any other requirement.

There are many different opportunities available for managing surface water.

Retrofitting SuDS is an important way of addressing drainage deficiencies and generally improving the drainage of an area.

¹Created by CIRIA, www.susdrain.org is the independent and authoritative platform for those involved in delivering sustainable drainage.

‘Opportunistic retrofitting’ of SuDS can be carried out in addition to the primary reasons for redevelopment and other local area improvements.

‘Strategic retrofitting’ may provide wider regeneration benefits beyond the primary reasons for the redevelopment of a site.

In the urban or rural environment, new build or retrofitted SuDS are used to capitalise on their advantages.

The key advantages of SuDS are that they are more sustainable and flexible than traditional drainage methods. This is because they:

1. Integrate stormwater treatment into the landscape by utilizing a more joined up approach to managing surface water across wider areas, improving local

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amenity, serving to meet the needs of the local community and even providing opportunities for public artwork.

2. Require little or no energy input (apart from environmental sources, such as sunlight).

3. Reduce runoff and peak flows thereby reducing the negative impact of urbanisation on flooding. This is achieved by managing stormwater runoff volumes and peak flow rates, storing runoff by local detention measures and minimising impervious areas, releasing it slowly through attenuation and by slowly conveying surface water.

4. Protect water quality by filtering out pollutants through surface water management.

5. Promote and protect natural water systems, flow regimes and ecosystems in watercourses - particularly in urban areas - by allowing sediments to settle out and provide habitats for wildlife.

6. Encourage natural groundwater recharge (where appropriate) by allowing stormwater to soak into the ground (infiltration) via permeable surfacing.

7. Provide opportunities for evapotranspiration from vegetation and surface water via green roofs etc.

8. Add value to property by minimizing drainage infrastructure costs through reduced peak flows and enhancing natural features, such as rivers and lakes.

Who can instigate and develop Sustainable Drainage Systems and who do they serve?

All stakeholders involved in the design of the built environment, and in particular the urban environment, from grass-roots communities, private and public landowners, developers, masterplanners, urban designers, architects, landscape architects and highways engineers, to local authorities, are in a position to instigate and develop sustainable drainage systems to serve their own private or public property, their communities and work or leisure environments.

The different bodies responsible for the management and development of urban areas have traditionally regularly worked in isolation, often not achieving all the benefits possible with a more integrated approach.

For example, highway resurfacing projects aimed at creating a better urban space but failing to achieve any benefits in managing urban flood risk can be considered as missed opportunities for SuDS.

Local planning policies can also help promote SuDS retrofitting.

As cited by Cambridgeshire County Council, the *Flood and Water Management Act* (2010) designates it as the 'Lead Local Flood Authority' in Cambridgeshire. One of the new statutory duties for it is to become a SuDS Approving Body (SAB).

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Current and future Surface Water Management Plans (SWMPs) encouraged under this act provide the opportunity for stakeholders to work together beyond their responsibilities to enhance services and infrastructure with clear timelines and objectives.

This can also influence Geographic Information (GI) Strategies (and other documents like the *UK Government Highways Agency Design Manual for Roads and Bridges*). The understanding of the interactions and synergies between SWMPs, GI Strategies and other relevant planning documents will be useful in fully exploiting benefits.

Retrofitting SuDS need to become part of the strategic plans of all relevant stakeholders, and these plans should fit together to make one coherent strategy. This will need more forward planning and greater sharing of information and aspirations than has been traditional practice.

Any retrofit of the built environment will directly affect a community's quality of life.

Urban design is about the design of places for people. Considered in this way, the role of SuDS in urban design becomes easy to understand. Retrofitting SuDS can be seen as a good opportunity to create better urban communities. To maximise the potential benefits, SuDS should be consistent with good urban design which should in turn embrace the principles of SuDS.

When should Sustainable Drainage Systems be used?

Sustainable drainage projects generally derive from a specific need, known also as the '*driver*'. This may be the draining of a new development or an improvement to the drainage of an existing development by sustainable means. Opportunities abound for considering a SuDS approach to managing surface water drainage. However, these systems are best considered at the earliest stages of site selection and conceptual design with stakeholders, for either new build or regeneration projects for existing sites. This allows them to be integrated into developments and influence other aspects of site development (design, layout, function) and minimise impermeable areas.

This should improve the cost effectiveness of them and their integration within any development, and should also increase their influence on improving amenity.

Where can Sustainable Drainage Systems be used?

Sustainable drainage systems can be used to create new or improve existing sustainable developments, whether in urban or rurally situated locations. These could be car parks, footpaths and verges, gardens, landscaped areas, driveways, courtyards, or other communal spaces.

New build or **retrofit schemes** may occur at different scales, from a single plot to a neighbourhood

development involving one or more streets, or to a catchment development involving a whole drainage area (as its name implies). There is however a tendency for retrofit schemes to be applied to single plots, new build interventions to entire catchment areas, and either of these to neighbourhood development.

There are two key types of SuDS retrofit opportunity:

Opportunistic Retrofitting

'Opportunistic retrofitting' or *'nibbling,'* relates to small scale urban regeneration or site reconstruction where the primary aim is not necessarily that of drainage improvement, but of site or building redevelopment or enhancement. It sometimes forms part of green network strategies.

Their individual effects may be small, but if combined with other opportunities over time, the cumulative effect is significant.

Strategic Retrofitting

'Strategic retrofitting' is *'needs driven,'* occurring in response to a particular driver such as to control flooding or pollution (or both). It is normally delivered through a defined scheme.

It may occur across a larger area and be more strategic than *'opportunistic retrofitting,'* hence its name.

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There are many examples of SuDS worldwide and locally. A few we have come across include:

New-build developments

- Lamb Drove SuDS Showcase Project in Cambourne UK
- Rummelsburger Bucht, Berlin, Germany
- Potsdamer Platz, Berlin, Germany
- Hoppegarten, Germany
- Plötzin, Germany

Existing developments

- Green City, Clean Waters in Philadelphia, USA
- Green Streets approach in Portland, Oregon, USA
- Emscher-Catchment, Germany
- City of Potsdam, Germany
- Glencourt Place, North Shore, Auckland, New Zealand
- Talbot Park, Glen Innes, New Zealand

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Where possible, retrofit SuDS should be built on the surface instead of underground, as are traditional piped or culverted drainage systems. It is important to consider retrofitting SuDS as an integral and integrated part of any urban design.

How should Sustainable Drainage Systems be designed?

The first part of the design process is to understand the problem and then to find a solution. This will determine what a SuDS scheme will need to deliver and what opportunities for retrofit exist. In this way, all needs and opportunities are matched and specific measures identified (with their associated costs and benefits) before a SuDS scheme is delivered.

Successful SuDS designs for new-build or existing development sites should consider local policy documents by Local Planning Authorities, such as Planning Policy Statement PPS25, and take into account the local Flood Risk Management Strategy and associated documents.

'Green' design measures

Trees and vegetation:

Trees and vegetation can be introduced into an urban landscape. These can help break down the hard appearance of a built landscape, help define the scale of a place and improve the general amenity of it,

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potentially facilitating a wider range of human activities there.

Such measures form part of district and local policies, such as that of East Cambridge District Council.

Hill slope management:

Hill slope management can reduce flows by methods such as upland grip blocking, restoring peat bogs and cover crop planting.

'Blue' design measures

Water infiltration, detention, retention, storage and conveyance measures.

These measures may involve any of the following:

- Water infiltration management by maintaining or ameliorating soil condition or using permeable surfaces (permeable paving, geocellular membranes or gravel) that improves infiltration into the soil, or appropriately sited soakaways.
- The provision of water storage areas such as washlands which are defined by Natural England as:

"...areas of land adjoining a river or stream that flood from the positive act of directing floodwaters onto it as part of a flood defence measure (such as a flood storage reservoir)..."

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and are categorised into three types:

- *“...flood management washlands - primarily for flood management with biodiversity a lesser consideration...”*
- *“...integrated washlands - flood management and biodiversity are given equal weight...”*
- *“...conservation wetlands - where biodiversity is the main concern...”*

- Local detention and retention by exploiting land use for flood mitigation by using multiple smaller storage points as opposed to single large retarding basins. This will reduce the infrastructure required downstream and drain urban developments effectively during rainfall events.
- Balancing ponds and swales.
- Reed beds and wetland habitats which collect, store and filter soiled water and provide a wildlife habitat.
- River conveyance which involves re-establishing smaller watercourses to a more natural alignment, reestablishing meanders, reconnects river channels and dismantling culverts with areas of flood plain obstructed by unnatural man-made features
- Infrastructure drainage measures including rain gardens and kerb drainage.

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'Source control' measures

Source control may be the preferred, cheaper and easier option for many developments. By dealing with runoff at source, the potential amount of contamination is less, which requires smaller SuDS components further downstream. Often source control components are within the curtilage of properties and are maintained by the property owner or manager.

Susdrain explains that a management train starts with prevention (preventing runoff by reducing impermeable areas), or good housekeeping measures for reducing pollution, and progresses through local source controls to larger downstream site and regional controls. Runoff need not pass through all the stages in the management train. It could flow straight to a site control, but as a general principle it is better to deal with runoff locally, returning the water to the natural drainage system as near to the source as possible.

Only if the water cannot be managed on site should it be (slowly) conveyed elsewhere. This may be due to the water requiring additional treatment before disposal or the quantities of runoff generated being greater than the capacity of the natural drainage system at that point. Excess flows would therefore need to be routed off site.

End of pipe solutions where runoff is directly discharged to a wetland or pond should be avoided. SuDS design requires a balancing of different options, often depending on the risks associated with each course of action. The risks of an area flooding have to

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be balanced with the costs of protecting the area from different levels of floods.

The management train concept promotes division of the area to be drained into sub-catchments with different drainage characteristics and land uses, and each with its own drainage strategy. Dealing with the water locally not only reduces the quantity that has to be managed at any one point, but also reduces the need for conveying the water off the site.

When dividing catchments into small sections it is important to retain a perspective on how this affects the whole catchment management and the hydrological cycle.

Reducing runoff

Minimising paved areas

Runoff increases in proportion to the impervious area of the site. If less than 5% of a site is paved or compacted, the impact on the quantity of the surface runoff will be negligible.

Reducing the amount of runoff also reduces the wash-off of pollutants. Rainwater harvesting can remove runoff from the drainage system altogether and green roofs, water butts (rain tanks/rain barrels) and permeable paving can alleviate the problem.

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Minimising directly connected areas

Hard paving and roofed areas can be drained onto unpaved areas. Driveways and footpaths can be drained onto surrounding lawns.

Reducing pollution

House keeping

The amount of pollution in the onset of a storm is reduced by:

- ✓ Keeping paved areas clean, particularly around commercial or industrial areas.
- ✓ Sweeping hard surfaces regularly.
- ✓ Preventing the accumulation of contaminants by placing canopies over areas of potentially high contamination.

Education

Informing and educating users of the site about the way it is drained, can help prevent contaminants from entering the drainage system.

Typical pollutants may include:

- Car oil and antifreeze
- Detergents (from car washing)

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- Household chemicals
- Garden chemicals
- Illegal household dumping
- Litter and animal faeces

These should be used carefully and disposed of properly - not poured down surface water drains. Fertilisers, herbicides and pesticides should be used sparingly, in accordance with the manufacturers' instructions, and not used where they can be washed directly to a watercourse. Pollution from litter and animal faeces can be reduced through education and the provision of bins.

As described in *Ecological Design* by Sim Van der Ryn and Stuart Cowan, a local activist group called Urban Ecology in Berkeley, California, once endeavoured to raise awareness of the perils of dumping near local culverted drains. They placed warnings near them indicating how local flora and fauna were being affected by illegal dumping, as the drains led to San Francisco Bay.

The point here is that information and education at any level, grassroots or above, on issues of environmental pollution risk to drainage systems does count.

Avoiding sewer misconnections

Connecting foul sewers to the surface water system

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causes pollution. The use of swales and permeable surfaces can limit these missconnections by replacing underground surface water drains because there are no surface water pipes to connect to. If a foul connection is made to SuDS, the source of pollution will soon become apparent.

Road maintenance

Preventative measures should be taken, including cleaning, winter and general maintenance.

Containment

Some substances are so polluting that special measures must be taken to contain them and stop them reaching the drainage system. Risk assessments must be made and appropriate 'bunds' and treatment facilities provided. Oil separators are discussed in the UK Government Planning Policy Statement 23: Planning and Pollution Control.

Managing water on the surface

Whereever possible, runoff from developments should be managed on the surface. This enables their performance to be more easily inspected and managed, with pollution incidents and potential flood risk being visible. Managing water on the surface can also greatly improve the quality of places by integrating water features into the development; this can either be through soft or hard landscaping.

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SuDS should be seen in the context of other surface water management approaches, including flood routing, the management of extreme events where the rainfall exceeds the capacity of the drainage system (drainage exceedance), and the opening of urban channelised watercourses (culverts).

SuDS designs may relate to different rainfall events such as:

Everyday events: return period less than a year (100% probability). These tend to be ones that most affect the quality of receiving waters.

Designing to accommodate these events is most appropriate when delivering water quality schemes.

Design events: return period between once a year (100% probability), and once in 200 years (50% probability) depending on the system type, or an upper limit of once in 30 years (3.3% probability). These relate to rainfall that drainage systems should normally be able to accommodate without flooding to an extent that significant impacts occur. For example, there may be some limited ponding on roads. Design events may be used when designing retrofit SuDS to ensure adequate hydraulic performance is maintained. These events will also provide opportunities for using surface water within the environment in watercourses, channels and ponded areas.

Extreme events: greater than the design return period.

They may vary from stakeholder to stakeholder, or from location to location. These are those that cannot normally be accommodated by a drainage system (the minor system) and where flood water will usually need to be managed on the surface (the major system).

To reiterate, SuDS aim to minimise pollution to the environment and groundwater, and improve the quality and quantity of local water supply as well as providing amenity and biodiversity benefits.



For further info on SuDS systems, email info@floodsense.co.uk and we will be happy to answer your questions.

I hope this chapter has helped you have a further understanding, and given the current global pressure to counter the dramatic implications of climate change, we believe there is a sense of urgency to instigate sustainable urban drainage systems. Sometimes there is no better place to start than your home, business or local community.

Section Two

Flood Defence for Stakeholders

Including:
Master Planners
Property Developers
Urban Desingers
Town and Country Planners
Architects and Landscape Architects

Introduction to Flood Defence for Stakeholders

There are many stakeholders involved in the design and specification of properties, either in a new-build context or in alterations. These include; master planners, property developers, urban designers, town and country planners, architects and landscape architects.

Therefore, it's really important that stakeholders understand flood defence systems. It's a necessary part of the *savoir-faire* of these professionals as it is for property developers, their clients as providers and, in many cases, operators of flood defence measures. The Department for Environment, Food and Rural Affairs (Defra) retains an archive of press releases on its website, including those relating to flood defence, which all stakeholders can refer to.

FloodProBE was a research project supported by the European Commission addressing '*Technologies for Improved Safety of the Built Environment in Relation to Flood Events*'. The project addressed research topics under the *Framework Seven programme* ENV.2009.3.1.5.1. FloodProBE started in November 2009, and ran for a period of 4 years.

The interdisciplinary *Flood Risk Management Research Consortium* (FRMRC) was the largest consortium of UK universities and other organisations undertaking research in flood risk science. Between 2004 and 2012,

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FRMRC produced over 300 journal and conference papers and 40 technical reports. It also held over 50 knowledge sharing events.

This chapter hopes to provide the stakeholder with an enhanced understanding of flooding. This will enable them to improve their ability to reduce flood risk through the development of sustainable flood management strategies, and increase the cost effectiveness of future investments.

The information should also allow them to integrate the knowledge developed on the project in assessment of vulnerability of urban areas and flood defences, as well as the newly developed construction technologies and concepts to support holistic flood risk management strategies.

Also, it will help contribute to guidance in flood risk assessment and flood management practice in the urban context, thereby supporting implementation of the EU Flood Directive.

Chapter Seven

Flood Defence For Stakeholders

As mentioned in the introduction to this section, it's really important that stakeholders understand the implications of flood defence for the various people involved in new building developments. This chapter will address each sector and hopefully you will gain some valuable insight into the new practices being carried out by the various bodies...

Much important research into flood defence is being carried out on a European level by bodies such as FloodProBE. This has become a useful resource to aid stakeholders in the decision-making process of determining which flood defence measures are required.

The overall objective of FloodProBE is to investigate the *'reliability of flood defences,'* to improve the performance (reliability) and assessment of urban flood defences, and to underpin the construction technologies developed in its *working document 4: 'investigating construction technologies and concepts for flood defences and damage mitigation'.*

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It's methods will also support and coincide with the integrated decision support methods identified in working document 5: *'integration in decision support, pilot studies and guidance'*. The research will build upon the results of recent or ongoing European or national/regional projects such as those led by the UK's Flood Risk Management Research Consortium (FRMRC).

In their own words FloodProBE:

"...develop technologies, methods and tools for flood risk assessment and for the practical adaptation of new and existing buildings, infrastructure and flood defences leading to a better understanding of vulnerability, flood resilience and defence performance..."

and:

"...support implementation of the Floods Directive through the development of effective flood risk management strategies. The work is being undertaken in close partnership with industry, and is utilizing pilot sites across Europe, to help provide practical industry guidance and cost effective construction solutions..."

Climate Change

The effects of climate change coupled with changes in the way the rural economy is viewed, should allow all stakeholders of future developments in areas prone to

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flood risk in the UK to rigorously take on board sustainable and innovative concepts in flood defence.

As described in the 7th component of the Royal Institute of British Architect's (RIBA) guidance document, '*Climate Change Tools, Designing for Flood Risk*':

"...Climate change is predicted to cause sea levels to rise and more extreme weather patterns, which in turn will cause greater risk of tidal flooding, inland flooding from rivers and surface water runoff.

The pressure for new housing and current policies that prioritise the regeneration of brownfield land, much of which is already at risk of flooding, may well mean more new development within the floodplain.

Increasing urbanisation and higher densities of development have reduced the amount of natural soak-away available and strained existing drainage infrastructure. People and properties that are not within currently recognised and defined floodplains are increasingly at risk of flooding, usually from surface water..."

Environmental Design Quality

As described further in the 7th component of the Royal Institute of British Architect's (RIBA) guidance document, '*Climate Change Tools, Designing for Flood Risk*':

"...Standard responses to the risk of flooding include flood defences, barriers to flood pathways and raising

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accommodation above the potential water level onto columns or stilts. These measures are often not well integrated with the overall architecture and landscape design, resulting in poor quality and badly functioning neighbourhoods and streetscapes. Flood barriers limit opportunities for linkage as they are often both physically and visually isolating which can result in poor quality public and private spaces. Also, developments characterised by empty undercrofts or dominated by car parking at ground level tend to lack identity and a sense of neighbourhood..."

However, recent innovations attempt to mitigate the physical and visual impact of flood defence, with flood defences either being demountable, having automated mechanisms or coming with an increased variety of size and/or colour options available for any permanent fixtures forming part of them.

The onus on all stakeholders concerned is thus two-fold to consider the implications of **sustainability** and **climate change** and **innovation and environmental design quality** as they go about their individual and increasingly collaborative flood defence work.

Areas of concern

Areas that have suffered flood damage, and new development sites in proximity to rivers or the coast, require planning policies that will take into consideration the risk of fluvial or coastal flooding and the need for flood defence measures. Flood maps can be

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referred to which prioritise and classify areas according to the probability of a flood event.

As described in *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century* by Jha AK, Bloch R, Lamond J:

“...flood maps in the UK are published by the Environment Agency, the Scottish Environmental Protection Agency (SEPA) and the Rivers Agency (for Northern Ireland); these illustrate flooding from rivers for a return period of 100 years, for coastal flooding 200 years and also provide an extent for an extreme 1000 year event...”

Timing of considerations

Flood defence measures should be carried out by stakeholders to the timeframes stipulated by UK planning policy, guidance or advice. These should be in compliance with European directives concerning flood defence. Available options can be costed and appropriate defence measures taken according to the available budget in each instance.

Planning Policy

EU Planning Policy:

There is now an EU directive in place that relates to *Flood Defence, the European Directive 2007/60/EC: Assessment and Management of Flood Risk*, with criteria that the UK government must meet.

UK Planning Policy Strategy:

All stakeholders and developers should be aware that local authorities have planning policies to control any proposed development close to or on river floodplains or coasts in terms of its location, size and nature.

The aim of these policies is to reduce the risk of flooding and any associated damage to property. However there can be resistance to restrictions on proposed developments in areas where there is a shortage of housing.

The best approach to flood risk management is avoidance. Ideally, this would mean building outside of areas known to flood (or likely to flood). If this is not possible, it can be achieved by building above the flood level or preventing floodwater from reaching a building by site layout.

The government's *Standard Note 4100* explains that:

"...decisions over the location of development are of great importance in determining the effects of floods. Not only may houses be built where they are at risk of flooding, floodplain development can also increase flood risk elsewhere as flood storage capacity can be reduced.

The Environment Agency has never had a veto on potential development. Government guidance strongly discourages building on the floodplain, unless there are suitable defences.

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In March 2012, the government published the National Planning Policy Framework. This is supplemented by technical guidance that also contains a major section on flooding..."

England and Wales:

With regards to planning issues in England and Wales concerning flood defence, the UK government's *National Planning Policy Framework* can be referred to for cases in England, and *Planning Policy Wales* and *TAN 15* can be referred to for cases in Wales.

Scotland:

In Scotland, planning policy is developed and regulated by the Scottish Government Built Environment department, including policies and standards relating to flood defence. In its own words:

"...it requires planning authorities to take the probability of flooding from all sources (coastal, fluvial (water course), pluvial (surface water), groundwater, sewers and blocked culverts) and the risks involved into account when preparing development plans and determining planning applications. Prospective developers should take flood risk into account before committing themselves to a site or projects."

The *Flood Risk Management (Scotland) Act 2009* includes the duty placed upon Scottish ministers, SEPA, local authorities, Scottish Water and other responsible

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authorities to exercise their functions with a view to managing and reducing flood risk and to promote sustainable flood risk management.

The Scottish Government Planning Advice Note 69 contains good practice advice on planning and building standards in areas where there is a risk of flooding. It has commenced work on a consolidated PAN to replace PAN 61 on sustainable urban drainage systems, PAN 69 on flooding and PAN 79 on water and drainage.

Northern Ireland:

The Department of the Environment (DOE) Northern Ireland Planning Portal gives details of the *Planning Policy Statement 15: Planning and Flood Risk*, published in June 2006. The DOE Planning and Local Government Group is responsible for developing and regulating planning policy in Northern Ireland.

Flood Defence for Masterplanners

“...The growing understanding that the modern prerequisite for masterplanning in flood defence is knowledge of its multi-functional context...” ~ Coping with Floods (Proceedings of the North Atlantic Treaty Association Advanced Study Institute), Giuseppe Rossi G, Harmancioglu N, Yevievich V

A masterplan is defined as a long-term outline of a project or government function. Thus, those involved in their preparation are masterplanners.

Who can create masterplans that allow for the provision, design and operation of flood defence measures in the UK?

In the UK today, masterplans affecting land use and development can be created and implemented either publicly by government organisations, or privately by interdisciplinary professional consultancy teams, but more often than not they result from partnerships between government bodies and private consultants and local communities (depending on the circumstances).

For example, as explained by Defra:

“...the ‘National Flood and Coastal Erosion Risk Management Strategy for England’ provides a national framework for local communities to develop local partnerships and solutions to the flood and coastal erosion risks they face, and underpins the partnership approach to funding flood and coastal resilience projects...”

One particular example of a partnership approach is the *Ipswich Flood Defence Management Strategy* compiled by Halcrow, which were appointed by the Environment Agency to provide overall project management, engineering design and environmental assessment services for this strategy, for which it explains:

“...the primary recommendation made was to construct a tidal barrier...in order to reduce the risk of

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flooding of up to 2,300 properties within Ipswich."

Incorporating flood defence measures

Flood defence measures can be incorporated into a development's masterplan by taking on board all relevant issues relating to it, adhering to relevant planning policy and following project appraisal guidance for the given place, whether within a fluvial or coastal scenario. Thus, they can be included within either a fluvial *Catchment Flood Management Plan* or a coastal *Strategy Plans* as part of a Shoreline Management Plan (as outlined by flood and coastal defence appraisal guidance notes and planning policies).

The Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) published by *The Environment Agency (EA)* for Defra in 2010, replaces the series of *Flood and Coastal Defence Project Appraisal Guidance (FCDPAG)* notes published by the former Ministry of Agriculture, Fisheries and Food (Flood and Coastal Defence with Emergencies Division) between 1999 and 2001.

These notes are aimed at operating authorities and stakeholders, such as masterplanners.

Fluvial flood defence measures

Catchment Planning:

In the case of fluvial flood defence, catchment planning can be undertaken and the results of this incorporated

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into a *Catchment Flood Management Plan*, previously referred to as a *Flood Masterplan*, with suitable flood defence measures.

Catchment planning includes two principal areas, firstly consideration of a river's floodplain and then consideration of the rest of the catchment area.

As the EA describes, Catchment Flood Management Plans enable flood risk management measures to be planned over the long-term in a way that makes sense across a catchment.

Such work has been underway on a European and national level for a while now, as described in *Coping with Floods (Proceedings of the North Atlantic Treaty Association (NATO) Advanced Study Institute symposium Italy, 1992)* by Rossi G, Harmancioglu N, Yevievich V, states:

"...Each of the 10 regions of the UK's National Rivers Authority (now the Environment Agency) is preparing a Catchment Masterplan. These are multi-functional plans which seek to integrate the interests of the water environment to factors external to the National Rivers Authority, particularly natural and built land-use planning, supported by a range of river corridor and catchment area assessments from modelling to natural habitat surveys..."

The EA now publishes an annual report regarding such masterplans, entitled: *'Catchment Flood Management*

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Plans'. The methods and procedures in catchment planning can include all or some of the following:

- ✓ Data survey and analysis
- ✓ Inventory survey
- ✓ Hydraulic / Hydrodynamic calculations with software such HYSTEM-EXTRAN, GIPS and KOSIM. These take into account different forms of discharge and retention.

Coastal flood defence measures

Strategic Planning

In the case of coastal flood defence, strategic planning can be undertaken along with shoreline management and strategy plans.

The term **strategic planning** is used to mean co-ordinated analysis, planning and decision-making. It's deemed a prerequisite for achieving successful coastal flood defence measures.

It is the implementation of policy which is not straightforward, reflecting the complexity of the flood system and the need to appraise and implement both structural and non-structural options coherently. It is fundamentally about making choices and managing change in a structured way.

Flooding systems are complex and can be characterised

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as a variety of interacting sources, pathways and receptors. They are subject to change. Such change can be driven by external influences (*drivers*), including climate change or population growth, or internal influences (*responses*), as well as new flood defences or the construction of flood resilient buildings. The degree of control that flood managers have over these drivers and responses vary.

The report '*COMRISK – Common Strategies to Reduce the Risk of Flooding in Coastal Lowlands Sub-Project 2 - Strategic Planning*', prepared by HR Wallingford for the Environment Agency regarding the pan European COMRISK project, details UK strategic plan-making to achieve flood management policy objectives. It explains that at the broadest scale, the UK coastline has been split up into 11 sediment cells and a series of sub-cells. Within each sediment cell, longshore processes are largely considered self-contained.

More recently, the coastline has been re-divided into geomorphological processes units (so-called '*Shoreline Behavioural Units*') as part of the Future Coast Project sponsored by Defra. The development of the sediment cells signalled a move away from administrative boundaries to 'process' boundaries; a move towards regional management and shared responsibilities, and a recognition of the wider demands on the coastal zone.

Three different scales of studies provide the framework for strategic planning in the UK on national, regional and local levels.

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Shoreline Management Plans - The strategic planning process starts with the development of a Shoreline Management Plan (SMP) that are each between 50 and 150 km long and combine multiple local authorities and interested stakeholders through a series of coastal groups.

Large scale plans may be made to establish the strategic aims for a length of coast, while more detailed plans for strategies and schemes will be made to realise those aims.

Some stages will be more highly developed than others, in terms of coastal defence.

Strategy Plan - A Strategy Plan provides broader benefits than simply a programme of actions. It provides an effective framework for wide consultation in relation to the key coastal flood defence issues for the study area. In turn, this enables the ownership of both problems and opportunities to be shared amongst all stakeholders, facilitating the emergence of common goals.

It relates to a specific spatial unit, in this case to a particular length of coastline and flood cell. It may include some or all of the following stages in a cyclic and hierarchical process:

- Problem formulation
- Flood risk analysis

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- Generation and appraisal options and decision-making
- Implementation (e.g. carrying out the flood management plan)
- Monitoring and review

They flow from the SMP process, are more detailed and include more local analysis of defence performance, flood risk and the preferred programme of intervention options.

As necessary, local management plans are then developed to implement preferred options identified at higher levels.

Future methods for masterplanning flood defence

At present, the masterplanning system is based on **risk-based decision making, combined probability and consequence** and geared to *maximising benefits* with respect to costs.

Multi-criteria methods are currently the subject of detailed research.

Tools to support risk assessment and whole system optimisation principles are only just starting to emerge (such as RASP), so risk assessments can be rather approximate and optimisation is dominated by engineering judgement rather than by rigorous optimisation methods.

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This will become increasingly important in the revised Defra strategy *Making Space for Water* for flood and coastal risk management. This is likely to suggest more integrated management of the whole flooding system, including coastal, fluvial, sewer and groundwater flooding.

Significant changes are also being made to improve the monitoring of the coastal zone in England and Wales, and improved recording of flood events and post event diagnostics are becoming more routine. It is hoped that this new information will support new and more reliable assessment tools.

Flood Defence for Property Developers

Developers involved in *new-build, regeneration* or *refurbishment projects* in fluvial, coastal and other flood prone locations, need to be familiar with flood defence measures and the changes and innovations.

How to incorporate flood defence measures into your budget

Government Funding

The government announced at the end of November 2012 that £120 million in new funding will speed up the delivery of flood defences that could protect up to 60,000 homes and deliver up to £1 billion of economic benefits.

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The additional funding will be phased over 2013-14 and 2014-15 with a total of £35 million in 2013-14 and £85 million in 2014-15.

Within the total, £60 million over the two years will be reserved for flood defence schemes that meet a set of growth, value for money and delivery criteria.

Sponsors of five schemes, including the proposed flood defence at Ipswich, will be invited to apply. Funding criteria will be published by Defra shortly. All allocations will be dependent on local co-funding arrangements being confirmed. Unused elements will be added to the EA Partnership Funding allocations.

Partnership Funding

Partnership Funding is a new system (introduced in 2011), which boosts co-funding from businesses, developers, local authorities and other sources.

This approach is enabling up to a third more schemes to go ahead and giving communities a greater choice about flood protection levels in their area.

The *Government Standard Note 5755* on Flood Defence also states that this new funding scheme aims to:

“...encourage local investment in flood defence and coastal erosion management, so that schemes that might not be funded nationally may still go ahead. The changes would also give greater local choice over which projects would proceed. However, there are concerns

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about the extent to which local communities will be able to contribute to schemes in light of budget cuts. There is also concern that the funding changes may reduce clarity for local people about where responsibility for flood defence lies and have an impact on flood insurance costs..."

Flood Insurance Costs

The Government's *Standard Note* (6187) on Household Flood Insurance, updated in November 2012, states that:

"...there could be large flood insurance cost increases in coming years. New arrangements to ensure that affordable flood insurance remains widely available are currently being debated. The government said that it would make an announcement in spring 2012, but it is still in consultation with the insurance industry..."

Flood Re

In 2011, the ABI formally recommended *Flood Re* as a long-term *flood insurance solution* in the UK and after lengthy negotiations, an outline agreement between the government and the insurance industry was reached in June 2013. Since then the industry and government have been working through the finer detail, and the Water Bill, legislating the powers to set up Flood Re, has been working through Parliament. Royal assent was gained in May 2014, and the ABI is working hard to try and get Flood Re up and running in the summer of 2015.

What is Flood Re?

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The Flood Re scheme will be a not-for-profit flood reinsurance fund, owned and managed by the insurance industry, and established to ensure that those domestic properties in the UK - at the highest risk of flooding - can receive affordable cover for the flood element of their household property insurance.

How does it work?

Insurers will sell insurance in the normal way, and have an incentive to compete for the business of customers with high flood risk because they know they can pass the flood component element of the policy into Flood Re. The flood element of a home insurance policy will be placed in Flood Re, based on the council tax band, and priced accordingly:

“Most changes regarding flooding have only come about within the last seven years.”

Asset Maintenance and Construction Spending Requirement

The government’s *Standard Note 5755* on Flood Defence, updated January 2012, and November 2014, states that:

“...it has been estimated that maintaining existing levels of flood defence would require spending on asset maintenance and construction to increase to over £1 billion per year by 2035. Central Government spending on flood defences will reduce in real terms over the spending review period. The Government has

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introduced a new flood defence funding system, which it believes will help to meet the shortfall. The new funding arrangements seek to encourage more local investment in flood defences, so that schemes that might not be funded nationally may still go ahead. There are concerns about the extent to which local communities are able to contribute to flood defence funding. While the number of properties at risk of flooding may not rise in the short term, there could be a significant increase in the longer term if current spending levels do not increase."

Flood Defence Product Cost -v- Flood Damage Cost

There is a cost attached to flood defence products, however, it is negligible when compared with the potential cost involved in repairing damage in the event of a serious flood event and the fact that investment in quality design for good visual impact provides real psychological benefit.

Flood risk management benefits can be quantified. This is clearly explained by Environment Agency Wales in its report, *'Future Flooding in Wales: Flood Defences, Possible long-term investment scenarios'*.

"..Average (UK) flood damage costs are currently in the region of £1.1 billion per year, but these costs could rise to as much as £27 billion by 2080. Some 5.2 million properties are at risk of flooding in England..." ~ Standard Note 5755

Given the significant risk outlined by the government, this risk could be seen to represent a significant potential in terms of property redevelopment, improvement or even rebuilding, and therefore an opportunity for property developers and the government to work together to counter the rift between need and ability to supply in terms of flood defence.

Flood Defence for Urban Designers

“...Failures (in flood defence) are very often caused by internal and/or external erosion processes, particularly at transitions between defence types. Complex combinations of defence types are typical in urban areas. Since flood defence systems are only as strong as the weakest links (“risk hotspots”), these have to be identified, assessed and strengthened...” ~ FloodProBE

When are flood defence measures required in urban designs?

The Joint Defra/EA Flood and Coastal Erosion Risk Management R and D program report, *‘The Impact of Flooding on Urban and Rural Communities’*, refers to the Adaptation Strategies for Climate Change in the Urban Environment Project. These consider flood defence in the city of Manchester afflicted by a multitude of flooding issues derived primarily from aging infrastructure. It also examines Lewes, one of several south coast towns affected by an amalgamation of river and coastal flooding.

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The report explains that:

“... The biggest issue for Flood Risk Management (FRM) in urban areas is the forecast that under climate change there will be considerably more flooding in these areas. Given the density of living in cities, many people would be affected by a flood in an urban area. These provide powerful reasons for examining the social impacts of flooding in urban areas...”

and elaborates, critically that:

“...The ‘Adaptation Strategies for Climate Change in the Urban Environment project’...publication suggests that the increase in flooding will be the most serious direct impact of climate change in the North West.”

Who can create urban designs that allow for the provision, design and operation of flood defence measures in the UK?

In the UK today, urban designs affecting land use and development can be created and implemented either publicly by government organisations, or privately by specialist interdisciplinary professional consultancy teams. More often than not, they result from partnerships between government bodies and private consultants and local communities (depending on the circumstances).

This is exemplified in the *River Clyde Flood Management Strategy Study*, which was created when Glasgow City Council appointed a joint venture of Halcrow Group

Ltd and Fairhurst (The Halcrow- Fairhurst JV) to undertake the River Clyde Flood Management Strategy Study.

How can flood defence measures be incorporated into urban design?

Flood defence measures can be incorporated into urban design by taking on board all relevant guidance relating to it, via the relevant European Directive, authorities such as FloodProBE and UK Planning Policy.

Flood defence methods already in place in continental Europe are of particular interest, as Europe is at the forefront of flood control technology, with low-lying countries such as the Netherlands and Belgium developing techniques that can serve as examples to other countries facing similar problems. Some innovative methods for incorporating flood defence in the urban environment are already being used (or are in place) for these countries and may become more frequent.

That source highlights some of the measures possible such as:

- Underground water storage
- Reservoir water storage in large car parks or on recreation areas
- Floating housing developments

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- High-tech sensors to detect levee failure
- Movable semi-circular structures closing an entire river

However, other research that has been carried out, such as the work *Application of Dutch Reliability-Based Flood Defence Design in the UK* by Buijs, F.van Gelder, P. Vrijling, J. Vrouwenvelder, A. Hall, J. Sayers, and P.B. Wehrung, M. and has implied that risk based reliability methods for flood defence developed in the Netherlands for, “the planning, appraisal, design and operation of flood defences”, are not applicable across the board in the UK.

Flood Defence for Town and Country Planners

“...Where new (urban) environments are better planned within areas at risk from flooding, flood-receptive design can be employed at a potentially lower cost and disruption during the build or reconstruction phase than to attempt to later retrofit. This allows the building in of resilient design – with potential payoff well into the future...” ~ “Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century” Jha A K, Bloch R, Lamond J

Which town and country planners allow for the provision, design and operation of flood defence

measures in the UK?

In the UK today planning policy affecting land use and development is made by government organisations, including local authority planning departments. More often than not, these policies are subject to consultation with local communities, organisations and individuals, depending on the circumstances.

Flood defence measures are incorporated into town and country planning policy by taking on board all relevant guidance relating to it in via the relevant European Directive 2007/60/EC: *Assessment and Management of Flood Risk*.

- UK Government Planning Policy, Guidance and Circulars, as well as major research documents - as outlined below - can be referred to with regards to flood defence:

National Planning Policy Framework Planning Policy Wales

TAN 15

Scottish Planning Policy

Planning Policy Statement 15: Planning and Flood Risk (Northern Ireland)

- Town and Country Planning (EIA) Regulations 1999 (SI 1999 No 293)

Town and Country Planning (Flooding) (England) Direction 2007 set out by Circular 04/06 (Communities and Local Government) under the Town and Country Planning

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(General Development Procedure) Order 1995 (SI 1995 No 419).

This circular requires English local planning authorities to notify the secretary of state of any application for major development in flood risk areas when permission is to be granted contrary to advice given by the Environment Agency (EA) on flood risks.

Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century Jha AK, Bloch R, Lamond J, is described as summarising;

“...the key areas that policy makers need to be knowledgeable about and to take action on as they create policy directions for urban flood risk management and develop the strategic frameworks to manage successfully the growing risk of urban flooding...and takes a strategic approach that in which appropriate risk management measures are assessed, selected and integrated in a process that informs and involves the full range of stakeholders...”

Urban Flood Risk Management

A Guide to Integrated Urban Flood Risk Management for the 21st Century discusses Urban Flood Risk Management in relation to land use planning thus:

“...Land use planning and the regulation of new development is a key aspect of integrated urban flood risk management. In developing countries in

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particular, the opportunity to better plan the formation of new urban areas is central to prevent the predicted increase in future flood impacts from being realised.

The need to integrate flood risk management into land use planning and management is therefore important in order to minimize risk and manage the impacts of flooding. In growing urban settlements in particular, flood risk may be seen to be of lesser importance than other social and economic concerns.

It is likely that floodplain development will continue, due to pressure on land resources and other political and economic considerations.

However, where new urban environments are better planned within areas at risk from flooding, flood-receptive design can be employed at a potentially lower cost and disruption during the build or reconstruction phase than to attempt to later retrofit. This allows the building in of resilient design – with potential payoff well into the future...”

It goes on to say that:

“...Integrated urban flood risk management strategies are naturally designed to fit in with water-related planning issues and can be part of a wider agenda such as urban regeneration or climate change adaptation. Action to reduce flood risk should be carried out through a participatory process involving all those stakeholders that have an interest in flood management, including those people at risk or directly impacted by flooding. The measures selected will need to be

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negotiated by stakeholders, and to be adaptable to natural, social and economic conditions which can be expected to change over time."

The fact that flood defence is the visible sign of flood risk management appears to be the key to understanding the significant relevance of it to town and country planners (as examples of 'flood risk managers') through their contribution to land-use policy-making in the UK today.

The question of whether or not it is still possible, indeed legal, to build on floodplains is perhaps the principal concern of the UK public and the requirements of planning authorities under the *National Planning Policy Framework*.

Flood Defence for Architects

Flood defence measures should be taken by architects in conjunction with UK planning and building regulation, or standard requirements, policy or advice. In doing so, this should be in compliance with European directives concerning flood defence. Available options can be costed and appropriate defence measures taken according to the available budget in each instance.

Planning policy implications have already been covered as they are applicable to all stakeholders. Building regulation and standard implications, whilst of interest to other stakeholders, are outlined here.

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The UK government and local authorities have adopted specific regulations to help ensure that new construction will not make our flooding problems worse. Construction is regulated on sites that are in floodplains. New buildings, and substantial improvements to existing buildings in the floodplain, must be built or flood-proofed to one foot or more above the 100-year regulatory flood level.

Most flood construction projects and regulations are designed to protect people and property from the estimated 100-year flood by keeping them out of harm's way. The 100-year flood has a one percent (0.01) probability of being equalled or exceeded every year. This is considered a cost-effective design standard for most construction projects, though some uses require different protection standards. Floods larger than the 100-year design flood can, and frequently do, occur.

There are different building regulations for developments located outside the floodplain. However, most construction projects must submit a drainage plan, to demonstrate that the proposed water runoff will not overload the site's drainage and sewer systems.

England and Wales

As mentioned in the UK Planning Portal, current building regulations for England and Wales do not require design details or materials to withstand long-term immersion in flood water. However, key building regulation information and requirements that architects

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can refer to are described below:

- *Approved Document C*: guidance on site preparation and resisting contaminants and moisture. It does not provide information on preventing or reducing the impacts of flooding.
- *Approved Document H*: information on drainage and waste disposal. It covers the mitigation of flood risk associated with the surcharge of drains and sewers.
- *Approved Document J*: identifies the need for secondary containment where there is a significant risk of oil pollution, but does not contain recommendations for ensuring storage is above the predicted flood level.

There are, however, some proposed changes afoot:

“...existing guidance on flood-related issues in England and Wales is in a number of Approved Documents and for clarity and ease of use this needs to be brought together in one place, together with any new guidance...”

...any changes to the Building Regulations...should concentrate on managing the residual risks in so far as they affect the health and safety of persons in and about buildings.

The requirements should incorporate:

- a flood risk assessment (England)/flood consequence

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assessment (Wales).

- a requirement to incorporate measures to mitigate possible consequences.

Scotland

In Scotland, building standards are developed and regulated by the Scottish Government Built Environment department, including policies and standards relating to flood defence.

Building Standards deal with mitigating the damage to buildings and removing the threat to the health and safety of occupants as a result of flooding.

Guidance is given on the use of building materials that are not adversely affected by flood water. The following standard is relevant to new buildings prone to flooding:

“...BS3.3: Every building must be designed and constructed in such a way that there will not be a threat to the building or the health of the occupants as a result of flooding and accumulation of groundwater....” ~ Scottish Buildings Standards Agency, 1996

Northern Ireland

Building Control Northern Ireland is responsible for regulating building control work but for now there are no specific requirements for flood defence measures in the Northern Ireland Building Regulations.

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The publication, *'Living with Water, Visions of a Flooded Future'* is a contribution to the RIBA think tank, building futures continuing work programme on flooding. It explains that:

"..many groups are continuing to research flood resilience measures for homes to identify their cost implications and their role in reducing flood risk and recovering faster after flooding takes place. With appropriate designs, uses and materials the effects of a flood can be greatly reduced..."

It also outlines some further 'soft' flood resilience measures to homes and businesses such as:

- Water resilient flooring and fittings
- Making the ground floor more resilient with concrete floors
- Waterproof plaster
- Placing electrics above the typical flood level
- Designing the ground floor for less vulnerable uses (including for car parking)
- Adding an extra storey to properties or flats

As the former RIBA president, Sunand Prasad, and Igal Meyer, CEO of Norwich Union Insurance, perceived, in their foreword to the RIBA supported *Norwich Union Competition Flood-Proof Houses for the Future: A*

Compendium of Design:

“...reducing the risk of flooding does not begin and end with concrete walls and buildings on stilts, as the results of this competition show. Good design lies at the heart of creating communities that are more resilient against flooding, of lessening the cost caused by flooding when it does occur, and of minimising the impact flooding has on local livelihoods and safety. The variety of the approaches demonstrated by the entrants shows the enormous potential of such design...”

Flood Defence for Landscape Architects

In the UK today, landscape designs affecting land use and development can be created and implemented either publicly by government organizations, or privately by specialist interdisciplinary professional consultancy teams.

More often than not, they result from partnerships between private consultants and local communities (depending on the circumstances).

Three examples are considered here:

Broadlands Flood Alleviation Project

The Broadlands Flood Alleviation Project covers the ‘sensitive area’ of the Norfolk Broads. It is the first example of a Public Private Partnership programme

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involving flood defence measures. Although an external professional landscape architecture practice does not form part of the appointed consultancy team in this case (a joint venture between engineering consultancy and a contractor firm), landscape design measures are necessarily considered by its in-house landscape design team.

Given landscape architects can be appointed as part of a private consultancy team involved in the design and specification of external works, either in a new-build context or as alterations to existing landscapes, it follows that the requirement and understanding of flood defence systems is a necessary part of their *savoir-faire* as much as it is for their clients and providers, and, in many cases, operators of flood defence measures.

Boscastle Flood

A second example of this is the approach taken following the catastrophic flood in Boscastle in 2004, with reference to a case study by the Landscape Institute.

A professional landscape architecture practice was appointed with an engineering consultancy by the Environment Agency in partnership with North Cornwall District Council (now part of Cornwall Council), the National Trust and the local community.

Margate seafront renewal

A third example of this is given in the Margate seafront

renewal scheme undertaken by the multidisciplinary design team of Thanet District Council along with Canterbury City Council, a specialist risk management consultant, a landscape architect and a project artist.

Incorporating flood defence measures into landscape design

Flood defence measures can be incorporated into landscape design by taking on board all relevant guidance relating to it via the relevant *European Directive 2007/60/EC: Assessment and Management of Flood Risk* and via relevant *Environmental Impact Assessment (EIA)* documentation. This latter documentation includes *UK Government Planning Policy*, guidance and circulars such as the *Department of the Environment, Transport and the Regions (DETR) Circular 2/99: Environmental Impact Assessment and the Town and Country Planning (EIA) Regulations SI 1999 No 293*.

Environmental Impact Assessment

EIA for Schedule 2 development (as described by the EIA Regulations) is not mandatory, but where a development is located wholly or partly within a 'sensitive area', an EIA is more likely to be required.

The remit of an appointed landscape architecture practice is often to prepare a Flood Alleviation Strategy (in conjunction with an appointed engineering consultancy), contribute to an Environmental Impact Assessment (EIA) and to carry out a Landscape and Visual Impact Assessment.

Landscape Flood Defence Measures

To give you an idea of the range of landscape flood defence measures possible, we have looked at the three case studies further.

Broadlands Flood Alleviation Project

“...in 1997, the Environment Agency produced a draft Strategic Environmental Assessment report. This was a first attempt to assess the impacts and opportunities that could arise during the design, construction and implementation of flood defence works. It also began to set out guidelines for dealing with these.

Strategic Environmental Assessment (now known as the Strategic Environmental Framework) aims to identify and evaluate all potential effects on the environment. The term environment in this case is used in its very widest sense and refers to the broader environment in which projects operate. It includes local economic and social well-being, as well as agriculture, recreation and navigation...” ~ Broadlands Flood Alleviation Project

The EIA, as summarised by the *Broadlands Flood Alleviation Project* with reference to the EIA Regulations, contained the following:

- ✓ Scoping the key issues
- ✓ Consultation
- ✓ Description of the existing environment

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- ✓ Consideration of options and selection of the preferred scheme
- ✓ Identification of the potential environmental impact
- ✓ Assessment of the significance of the impact
- ✓ Identification of mitigation measures
- ✓ Assessment of residual impacts
- ✓ Identification of monitoring requirements

This project considers the implementation of the following flood defence measures:

- ✓ Floodbank strengthening
- ✓ Floodbank setback
- ✓ Floodbank rollback, with the use of a hydraulic model

Boscastle Flood

In the Boscastle scenario, the appointed landscape architects provided concept design input and carried out a *Landscape and Visual Impact Assessment*, considering the incorporation of both hard and soft landscape flood defence measures. These included:

- ✓ River channel widening and deepening

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- ✓ Embankment reinforcement
- ✓ Native planting
- ✓ Meadow restoration
- ✓ Hedge replacement
- ✓ Overland flow routes and vehicle escape routes

Margate seafront renewal:

The seafront reconstruction scheme designed with computer modelling at Margate includes new:

- ✓ Seafront walls
- ✓ Floodgates which close in the event of a flood warning

I hope this chapter has shown you how landscape professionals, indeed all those involved with the natural environment - from individual community organisations through to governmental agencies - can have a vital role to play and responsibilities to face in the design and specification of flood defence measures (be they for urban, rural, coastal or inland waterway situations).

These roles and responsibilities are now more often than not shared (since the Environment Agency introduced a first draft Strategic Environmental Assessment report

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in 1997). Landscape professionals act either in-house or as private consultants within any or all of the following: multidisciplinary design teams, formal joint venture companies or public private partnership programmes.



As a Stakeholder, it's really important to be up to date with flood defence issues. Visit www.keepingitdry.co.uk/resources for current legislation

Section Three

EU & Government Legislation

Including:

**European Directive;
Directives 85/337/EEC, 96/82/EC,
Directive 2001/42/EC, Directive 2000/60/EC,
Public Information and Consultation,
Directive 96/61/EC, 2003/35EC,
2003/105/EC and Decision 1999/468/EC**

Introduction to EU & Government Legislation

While local flooding and coastal erosion risk should be managed at a local level, the national significance of the impact they have should not be ignored. The interdependent nature of a member country's infrastructure means that the failure of one system caused by a localised flooding event can generate a cascade effect across public services, impacting on multiple communities.

Below are the relevant directives and legislations that have recently been brought into force by the UK government and the European Union.

The directives/legislations provide clarity over the roles and responsibilities of disparate flood risk management authorities. They seek to force improved co-ordination and integration when managing all types of flood risk at the local level, which should improve effectiveness and efficiency in the management of flood and coastal erosion risk.

Chapter Eight

European Directive

2007/60/EC Assessment and Management of Flood Risk

This chapter is a summary of the *European Directive 2007/60/EC Assessment and Management of Flood Risk*, often referred to as the *Flood Risk Directive (FRD)*.

It was published on 23 October 2007 by The European Parliament and Council of the European Union.

The purpose of it relates to European Directive 2000/60/EC, establishing a framework for community action in the field of water policy - referred to as the *Water Framework Directive (WFD)*, published on 23 October 2000 by the same authors.

It interfaces with other European Directives and Decisions including: *Directives 96/61/EC, 85/337/EEC, 96/82/EC, 2001/42/EC, 2003/35EC, 2003/105/EC* and *Decision 1999/468/EC*.

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The directive applies to the 28 member countries of the European Union (EU).

The aim of the Flood Risk Directive is to establish a framework for the management and assessment of flood risks. This is important in order to *reduce the negative effects* on human health, the environment, cultural heritage and economic activity in each of the member countries.

The reader should keep an eye on the evolution of the EU for any impact of it on the content of this chapter.

The Flood Risk Directive is addressed to *all the member countries*, and responsibility lies with the governments of each of these countries. This aide-memoire should appeal to **stakeholders** and **professionals** serving and engaged by these governments who are concerned with *flood risks in their communities*.

By preparing the items described below within the required timeframes of the Flood Risk Directive, member countries can meet the requirements of it. If they do not fulfill these requirements, the European Court of Justice can impose significant fines.

Flood Risk Assessment (FRA)

Member countries shall make use of the Water Framework Directive for the Purpose of the Flood Risk Directive.

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They can appoint competent authorities outside those listed in the Water Framework Directive and/or identify river basins or coastal areas and give them a management unit different from those assigned in the Water Framework Directive.

Definitions:

“River Basin District”, “Subbasin”, “River Basin”, “River”: These are defined in the WFD.

“Flood”: Unusual temporary covering of land by water from groundwater sources, rivers, mountain torrents, Mediterranean ephemeral watercourses and coastal floods. It excludes sewerage system floods.

“Flood risk”: Probability of a flood event and the potentially negative consequences of such an event on human health, the environment, cultural heritage and economic activity.

Preliminary FRA

By December 2011, existing member countries were obliged to carry out a preliminary FRA for each relevant management unit - *“river basin district”* or *“international river basin district”* - within their territories.

These assessed potential flood risks and the impact of climate change on flood occurrence based on available or easily derivable information, records or long-term development studies.

These assessments include the following:

- Maps showing land-use, topography, coastal areas, sub-basins, river basins or relevant river basin district.
- A description of the consequences of significant past floods that are likely to recur in the future and could have negative effects on human health, the environment, cultural heritage and economic activity, and an assessment of them showing:
 - Flood conveyance routes and extent
 - Geomorphological and topographical characteristics
 - Floodplains, watercourses and hydrology
 - Man-made flood defences, populated areas, economic activity areas
 - Climate change and long-term development impact on flood occurrence

Potentially significant and likely flood risks are identified for each relevant management unit, “*river basin district*” or portion of “*international river basin district*” area lying within individual territories. Areas identified as belonging to a relevant management unit or “*international river basin district*” shared with another member country are coordinated between the member countries concerned.

Flood Hazard Maps/Flood Risk Maps

Flood Hazard/Flood Risk maps are a vital part of preliminary FRAs, and where geographical areas are shared with other member countries, information exchange is necessary between each state for their completion.

These maps cover areas where flood occurrence is a:

- Low probability
- Medium probability >100 years
- High probability <100 yrs

They indicate flood extent, water depths or water level as appropriate, and flow velocity or relevant water flow as appropriate.

They indicate the potential consequences in terms of the...

- Number of inhabitants affected
- Type of economic activity affected
- Installations referred to in Directive 96/61/EC and areas identified in the WFD
- Areas where a high content of transported sediments and debris can occur

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- Other significant sources of pollution

For coastal areas where an adequate level of protection is in place, or from where flooding is from groundwater sources, these maps are only necessary for the low flood probability scenario.

Flood Risk Management Plans

Member countries shall establish FR management plans which focus on reducing the negative consequences of flooding on human health, the environment, cultural heritage, economic activity and on non-structural or flood reduction objectives.

Measures for achieving these objectives include:

- Conclusions of the preliminary FRA in the form of a summary map delineating the areas which are the subject of the FR management plan.
- Flood hazard maps / FR maps and the conclusions that can be drawn from those maps.
- Description of the appropriate objectives of FR management.
- Summary of the measures and their prioritisation aiming to achieve the objectives of FR management, including measures in accordance with the *WFD*.³
- Description of cost: benefit analysis methods for

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shared “*subbasins*” or “*river basins*” to assess measures of transnational effects.

- Description of the plan implementation including:
 - Competent authority list and coordination process description within any international river basin district and with the WFD.
 - Public information and consultation method strategy.
 - Prioritisation and progress monitoring.

³ and measures taken under other Community acts, including *Directive 85/337/EEC*, *Directive 96/82/EC* and *Directive 2001/42/EC*.

FR management plans shall:

- Include measures for achieving the objectives established and the components set out with this Directive’s annex.
- Incorporate costs and benefits, flood conveyance routes and extent, natural floodplains or similar, environmental objectives set out in the WFD, soil and water management, nature conservation, land use and spatial planning, navigation and port infrastructure.
- Address all aspects of FR management, focusing on prevention and preparedness, protection (including flood forecasts and early warning

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systems), and taking into account the characteristics of the particular “*river basin*” or “*subbasin*”.

- Include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.

FR management plans by member countries shall not:

- Include measures which considerably increase flood risks of other countries upstream or downstream in the same “*river basin*” or “*subbasin*”, unless these measures have been coordinated and an agreed solution has been found as concerned in the framework below:
 - for “*river basin districts*”, or relevant management units which fall entirely within their territory, one single FR management plan, or set of FR management plans, coordinated at the level of the “*river basin district*”, is to be produced.
 - where an international river basin district or relevant management unit falls entirely within the Community, coordination of a single international FR management plan, or a set of such plans, coordinated at the level of the international river basin district, should be produced.

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- where not possible, plans covering at least the parts of the international “*river basin district*” falling within their territory, coordinated at the level of that district, should be produced.
- where an international “*river basin district*” or relevant management unit extends beyond the boundaries of the Community, member countries shall endeavour to produce one international FR management plan, or a set of such plans, coordinated at the level of the international “*river basin district*”.
- where not possible, such plans should relate to the parts of the international “*river basin*” falling within their territory. Countries sharing a “*subbasin*” should supplement such plans with more detail, coordinated at the level of the international “*subbasins*”.
- where a member state identifies an issue which has an impact on the management of flood risks of its water, and that issue cannot be resolved by that member state, it may report the issue to the Commission, and any other member state concerned, and make recommendations for a resolution of the issue. The Commission shall respond within six months.

Coordination with Directive 2000/60/EC, Public Information and Consultation

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Member countries shall coordinate the application of this Directive, the WFD and Community legislation for improved efficiency, information exchange, common synergies and benefits with regard to the environmental objectives of the WFD.

In particular, information produced is to be:

- Made available to the public.
- Consistent with that of the WFD and coordinated with the reviews required by it.

and:

- The development of the first FR management plans and their subsequent reviews shall be coordinated with, and may be integrated into, the reviews of the “*river basin*” management plans of the WFD.
- The active involvement of all interested parties under this Directive shall be coordinated, as appropriate, with the involvement of interested parties under the WFD.
- Member countries shall encourage involvement of interested parties in the production, review and updating of the FR management plans.

Implementing Measures and Amendments

The Commission may adopt technical formats to

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process and transmit data, including statistical and cartographic data, to the Commission. The technical formats should be adopted at least two years before the dates indicated, taking into account existing standards as well as formats developed under relevant Community acts.

The Commission may adapt the Annex to scientific and technical progress.

These actions shall be adopted in accordance with the regulatory procedure.

The Commission shall be assisted by the committee established under the WFD.

Where reference is made to this, Decision 1999/468/EC shall apply.

The period laid down in Decision 1999/468/EC shall be set at three months.

Transitional measures

Member countries may decide not to:

- Undertake the preliminary FRA for those river basins, subbasins or coastal areas where they have decided, before 22 December 2010, to prepare flood hazard maps and FR maps, and to establish FR management plans in accordance with the relevant provisions of this Directive.

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Member Countries may decide to:

- Make use of flood hazard maps and FR maps finalised before 22 December 2010, if such maps provide the required level of information of this Directive.
- Make use of FR management plans finalised before 22 December 2010, provided the content of these plans is equivalent to the requirements of this Directive.

Reviews, reports and final provisions

Reviews and updates are to be as follows:

- Preliminary FRA or equivalent by 22 December 2018, and every six years thereafter.
- Flood hazard maps and the FR maps by 22 December 2019, and every six years thereafter.
- FR management plan(s) by 22 December 2021, and every six years thereafter.
- Climate change impact on flood occurrence shall be considered in these reviews. By 22 December 2018, and every six years thereafter, the Commission shall submit to the European Parliament and Council a report on the implementation of this Directive. The impact of climate change shall be taken into account in drawing up this report.

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- Member countries shall make available to the commission preliminary FRA, the flood hazard maps, the FR maps and FR management plans as well as their review and updates within three months after the dates given in this Directive.
- Member countries shall inform the Commission of the decisions taken and make available the relevant information by the dates given in this Directive.
- When they are adopted by member countries, the laws, regulations and administrative provisions necessary to comply with this Directive shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by member countries.
- Member countries shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Annex

Flood risk management plans:

Components of the first FR management plans:

- Conclusions of the preliminary FRA in the form

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of a summary map of the “*river basin district*”, or the relevant management unit, delineating the areas identified.

- Flood hazard/FR maps and the conclusions that can be drawn from those maps.
- Description of the appropriate objectives of FR management.
- Summary of the measures and their prioritisation aiming to achieve the appropriate objectives of FR management and flood related actions taken under other Community acts, including Directives 85/337/EEC, 96/82/EC, Directive 2001/42/EC and the WFD.
- When available, for shared “*river basins*” or “*subbasins*”, a description of the methodology, defined by the member countries concerned, of the cost benefit analysis used to assess measures with transnational effects.

Description of the implementation of the plan:

- Description of the prioritisation and the way in which progress in implementing the plan will be monitored;
- Summary of the public information and consultation actions taken;
- List of competent authorities and, as appropriate,

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a description of the coordination process within any international “river basin district” and of the coordination process with the WFD.

Components of the subsequent update of FR management plans:

- Changes or updates since the publication of the previous version of the FR management plan, including a summary of the reviews carried out.
- Assessment of the progress made towards the achievement of the objectives.
- Description of, and an explanation for, any actions foreseen in the earlier version of the FR management plan which were planned to be undertaken and have not been carried out.
- Description of any additional actions since the publication of the previous version of the FR management plan.



To keep up to date with all of the current legislation, visit www.keepingitdry.co.uk/resources Everything that is discussed in this chapter is available for download.

Chapter Nine

National Planning Policy Framework

The UK Government's National Planning Policy Framework (NPPF), published in March 2012 by the Department for Communities and Local Government, superseded a collection of Planning Policy Statements, including Planning Policy Statement 25 (PPS25), published in 2006. It applies to Planning Policy in England.

The NPPF should appeal to '**plan-makers**', including UK **Architects** and their clients or developers, as an 'aide-memoire,' and to **decision-makers** and to *all those concerned with the relevance of flood risk.*

It relates to sustainable development proposals in either inland or coastal locations.

As the Environment Agency (funded by the Department of the Environment, Food and Rural Affairs (Defra) state:

"...The policy principles remain unchanged, supporting Technical Guidance has been issued and the associated Practice Guide remains in place until

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Government chooses to replace it.

In Wales, Planning Policy Wales and the associated Technical Advice Note 15 Development and Flood Risk (TAN15) set out Government policy on the subject. The NPPF will not apply in Wales."

In Scotland, the *Scottish Planning Policy (SPP)* document, published in February 2010, supersedes a collection of planning policies, including the former *SPP7: Planning and Flooding* policy document.

In Northern Ireland, the document *Planning Policy Statement 15 (PPS 15)* was published in June 2006 and remains the key reference document in this domain.

What is the National Planning Policy Framework?

The NPPF is, in the UK government's words:

"...guidance for local planning authorities and decision-takers, both in drawing up plans and as a material consideration in determining (planning) applications..."

It stipulates that:

"...planning policies and decisions must reflect and where appropriate, promote relevant EU obligations and statutory requirements."

Why is the National Planning Policy Framework important in relation to flooding?

Flooding can be life-threatening, causes significant damage to property, directly affects the value of land and the costs of developing, managing and using it.

The NPPF relates to **four key areas**: one of which relates *directly* to flooding, as follows:

- The provision of retail, leisure and other commercial development.
- The provision of infrastructure for transport, telecommunications, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat).
- The provision of health, security, community and cultural infrastructure and other local facilities.
- Climate change mitigation and adaptation, conservation and enhancement of the natural and historic environment, including landscape.

When should the National Planning Policy Framework be referred to in relation to flooding?

The NPPF can be referred to initially at the pre-application stage via discussions with the relevant local planning authority and the Environment Agency, as well as with any other relevant bodies or parties.

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The framework aims to ensure that flood risk is considered at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk.

Planning law requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

Proposed development that accords with an up-to-date local plan should be approved, and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date local plan in place.

“The NPPF must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions.”

Where do responsibilities lie in the National Planning Policy Framework in relation to flooding?

Protecting property or land against flooding in England is not a statutory duty of the UK government. *The Environment Agency* has statutory responsibility for flood management and defence in England and provides information and advice to those proposing new developments and preparing flood risk assessments.

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The UK government's local planning authorities consult The Environment Agency for all new development in areas of flood risk. Its regional planning bodies are also involved in delivering sustainable development through planning strategies that appraise, manage and reduce flood risk in partnership with the Environment Agency and other stakeholders.

Landowners have the key responsibility for safeguarding their land and other property against flooding, whilst **individual property users and owners** are responsible for the *drainage management* of their land which should aim to reduce the impact of flooding on neighbouring land.

Those proposing development are responsible for showing that their developments are consistent with this framework.

The particular roles and responsibilities of parties involved in the process, as with any collaborative project, should be clarified at the onset of any development proposal.

How can a development proposal relating to flooding meet the requirements of the National Planning Policy Framework?

A development proposal can meet the requirements of the NPPF if it concurs with the requirements of the local plan relevant to its situation.

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At the heart of the NPPF is a presumption in favour of sustainable development.

A set of core land-use planning principles is sought to underpin both plan-making and decision-taking in this realm, one of which relates directly to flooding.

The core principle relevant to this guide is effectively two-part and entitled: *'Meeting the Challenge of Climate Change, Flooding and Coastal Change.'* A second relevant, more general principle, is entitled: *'Requiring Good Design'* but is not considered in detail here.

New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

Sequential Test and Exception Test

A sequential, risk-based approach is to be taken to the location of development to avoid, where possible, flood risk to people and property, and manage any residual

risk, taking account of the impacts of climate change by applying the *Sequential Test* and if necessary, the *Exception Test*. This safeguards land from development that is required for current and future flood management using opportunities offered by new development to reduce the causes and impacts of flooding. Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, opportunities are sought to facilitate the relocation of development, including housing, to more sustainable locations.

The aim of the *Sequential Test* is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

If, following application of the *Sequential Test*, it is not possible, consistent with wider sustainability objectives, for development to be located in zones with a lower probability of flooding, the *Exception Test* can be applied.

For the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a *Strategic Flood Risk Assessment*, where one has been prepared.

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- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime - taking account of the vulnerability of its users - without increasing flood risk elsewhere and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

For individual developments on sites allocated in development plans through the Sequential Test, applicants need not apply the Sequential Test. Applications for minor development and changes of use are not subject to either test but are to meet the requirements for site-specific flood risk assessments.

Neighbourhood Plans

Neighbourhood planning gives communities direct power to develop a shared vision for their neighbourhood and deliver the sustainable development they need.

Neighbourhood plans must be in general conformity with the strategic policies of the **local plan**. They can shape and direct sustainable development in their area, including flood-related development.

Once a neighbourhood plan is brought into force, the policies it contains take precedence over existing non-strategic policies in the local plan for that neighbourhood, where they are in conflict.

What do the government's authorities consider in flood-related development proposals in relation to the NPPF?

Flood risk, the probability of a flood occurring and the anticipated consequences of a flood within and beyond a development area are the key factors considered by the government's regional planning bodies and local planning authorities (decision makers) in each case. Various documents, outlined below, detail the reference principles on the matter.

Local Plans

This principle asks that local plans support the transition to a low carbon future in a changing climate in various ways. These ways include taking full account of flood risk and coastal change, water supply and demand considerations, and encouraging the reuse of existing resources, including conversion of existing buildings and the use of renewable resources.

Each local planning authority should ensure that the local plan is based on adequate, up-to-date and relevant evidence about the economic, social and environmental characteristics and prospects of the area.

Plans aim to meet objectively assessed sustainable development needs, with sufficient flexibility to adapt to rapid change, unless any adverse impacts of doing so significantly and demonstrably outweigh the benefits.

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Planning decisions must be taken in accordance with the plan unless material considerations indicate otherwise.

Strategic Flood Risk Assessment

Local plans should be supported by *Strategic Flood Risk Assessment* and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.

These assessments are to meet the requirements of the European Directive on strategic environmental assessment and are an integral part of the plan preparation process. They should consider all the likely significant effects on the environment, economic and social factors.

With regards to infrastructure local planning authorities should work with other authorities and providers to:

- Assess the quality and capacity of infrastructure for flood risk and coastal change management amongst other things and its ability to meet forecast demands.
- Take account of the need for strategic infrastructure, including nationally significant infrastructure, within their areas.

River Basin Management Plans

With regards to the environment, local planning authorities should work to ensure that planning policies and decisions are based on up-to-date information about the natural environment and other characteristics of the area including drawing, for example, from river basin management plans. Working with local nature partnerships where appropriate, this should include an assessment of existing and potential components of ecological networks.

Shoreline Management Plans

Wherever possible, assessments should share the same evidence base and be conducted over similar timescales, but local authorities should take care to ensure that the purposes and statutory requirements of different assessment processes are respected. Assessments should be proportionate, and should not repeat policy assessment that has already been undertaken. Wherever possible, the local planning authority should consider how the preparation of any assessment will contribute to the plan's evidence base. The process should be started early in the plan-making process and key stakeholders should be consulted in identifying the issues that the assessment must cover. Shoreline Management Plans should inform the evidence base for planning in coastal areas. The prediction of future impacts should include the longer-term nature and inherent uncertainty of coastal processes (including

coastal landslip), and take account of climate change.

Integrated Coastal Zone Management

In coastal areas, local planning authorities are to take account of the *UK Marine Policy Statement* and **marine plans**, and apply *Integrated Coastal Zone Management* across local authority and land/sea boundaries, ensuring integration of the terrestrial and marine planning regimes.

Coastal Management Areas

Local planning authorities are also to reduce risk from coastal change by avoiding inappropriate development in vulnerable areas, or adding to the impacts of physical changes to the coast. They identify any *Coastal Change Management Area* likely to be affected by physical changes to the coast, clarify what development will be appropriate in such areas and in what circumstances and make provision for development and infrastructure that needs to be relocated away from these areas.

When assessing applications, they are to consider development in a **coastal change management area** where it is demonstrated that it will be:

- Safe over its planned lifetime and will not have an unacceptable impact on coastal change.
- The character of the coast including designations is not compromised.

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- The development provides wider sustainability benefits.
- The development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

They are also to ensure that appropriate development (coastal change management area) is not impacted by coastal change by limiting the planned life-time of the proposed development through temporary permission and restoration conditions (where necessary to reduce the risk to people and the development).

When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the *Sequential Test*, and if required the *Exception Test*, it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location.
- Development is appropriately flood resilient and resistant, including safe access and escape routes where required.
- Any residual risk can be safely managed, including by emergency planning.

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- It gives priority to the use of sustainable drainage systems.

Decision-takers are expected to approve development proposals that accord with the development plan without delay, and where the development plan is absent, silent or relevant policies are out-of-date, grant permission unless:

- Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits when assessed against the policies in this Framework taken as a whole.
- Specific policies in this framework indicate development should be restricted.

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All of these PDF's are available to download, simply visit www.keepingitdry.co.uk/resources

About The Author

Kevin was involved with the water and fire damage industry for more than fifteen years. He dried out everything from one-bedroom flats to commercial office blocks (these were flooded due to a variety of reasons, which included rivers, the sea, surface water, burst mains pipes, water tanks and anything else you can think of).

Fire damaged buildings brought their own problems. Not only did these properties have to be cleaned, they also had to be dried. This was due to the amount of water that was poured onto or into them by the fire brigade as they extinguished the fire.

So Kevin's experience in dealing with flood damaged properties is vast and interesting.

His journey into the flood protection industry was born through the requirement of a good friend who worked for a major housing association in Norfolk.

They owned properties along the quay in Great Yarmouth, Norfolk, and were unable to borrow against them for expansion plans due to not being able to insure them against flooding.

Kevin received a call from his friend one day asking if he could install some kind of flood mitigation systems on the properties in order to get them insured. After a

bit of research, and trial and error, he designed a system that was accepted by the client and the insurance company, resulting in the birth of Flood Sense.

Kevin has witnessed first-hand the traumatic effects flooding can have on adults, children and pets. This makes him passionate about educating property/business owners and residents, living or working within flood prone areas, in how to protect themselves and their family, staff, homes and businesses from devastating flooding.

Kevin has appeared on Sky News, BBC Radio, and in local newspapers.

He lives in Swaffham, Norfolk with his wife Jane. Together they have a son called Leo and a labrador, Rex.

He enjoys cycling, walking, football, scuba diving, sky diving and motorcycling, as well as trying to pass these traits on to his son.

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