

# Learning lessons from the 2007 floods

An independent review by Sir Michael Pitt

# Summer 2007 Floods Timeline

JUNE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

## WEATHER REPORT

Severe thunderstorms and the resulting floods leave parts of the country under water.

## NEWS REPORT

One man dies after being swept away by a bursting river, in North Yorkshire.

Evacuations under way from homes and schools but blocked roads and disrupted rail services leave people stranded and hamper rescue efforts.

## WEATHER REPORT

A month's rain falls in one hour in Kent. Residents of Folkestone also have to contend with thunderstorms and lightning.

## NEWS REPORT

Multiple lightning strikes hit an oil refinery at Fawley, Southampton. Fortunately there are no reports of fire or damage.

## NEWS REPORT

Overnight rain causes floods in Boscastle, three years after record floods hit the village.

## WEATHER REPORT

Some parts of Yorkshire receive over four times the average monthly rainfall. Severe rain in Hull causes surface water floods.

The Environment Agency (EA) has 26 severe flood warnings in place, as well as further warnings affecting more than 200 rivers across England.

## NEWS REPORT

One man dies while attempting to clear debris from a manhole in Hessle. Elsewhere, there were another three flood-related fatalities. More than 30,000 people are left homeless in Hull.

Over 700 people are evacuated from villages near Ulley Reservoir near Rotherham. The M1 is closed as a precaution. The fire brigade launch the 'biggest rescue effort in peacetime Britain'.

Neepsend electricity sub-station is inundated affecting almost 40,000 people around Sheffield.



Ulley Reservoir

Home Office figures show that 3,500 people have been rescued from flooded homes and a further 4,000 call-outs were made by the fire, ambulance and police services.

Areas of Lincolnshire and East Yorkshire, which supply about 40% of British produce, see thousands of tonnes of vegetables ruined.

Experts predict that floods will cost an extra £1bn a year by 2075.



21 22 23 24 25 26 27 28 29 30

JULY

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

## NEWS REPORT

Environment Secretary Hilary Benn announces an increase in funds, for flood protection to £800m by 2010/11.

## WEATHER REPORT

Forecasters warn of treacherous weather for the rest of July.

## NEWS REPORT

Prime Minister Gordon Brown visits flood victims in Yorkshire. A £14m support package for flood zones is announced for areas affected by the recent floods.

The Association of British Insurers estimates damage from the floods at £1.5bn.

## WEATHER REPORT

Met Office issues a Severe Weather Warning for 50mm of rain in some parts of the country for the day.

## WEATHER REPORT

Met Office predicts heavy rain, thunderstorms and even tornadoes, as strong winds and low pressure sweeps across England. The EA issues severe weather warnings in the north-east. Much of Yorkshire and parts of north-east England are already saturated from the previous rain in June.

## WEATHER REPORT

Tropical storms, mini tornadoes and torrential rain hit parts of England causing flooding and leave hundreds of people stranded.

## WEATHER REPORT

Over 3 inches of rain fall in just 12 hours over much of south and south-west England.

## NEWS REPORT

Severe flooding across Gloucestershire, including Tewkesbury, Cheltenham and Gloucester. A teenager is feared dead in Tewkesbury.

Millions of travellers face disruption to their travel plans by road, rail and air, as the school holidays begin. Up to 10,000 people are left stranded on the M5 as drivers are forced to abandon cars. 500 people are stranded at Gloucester railway station as the railway network fails. Rest centres are set up for 2,000 people unable to get home.



Flooding in Tewkesbury town centre

## NEWS REPORT

Mythe water treatment works floods, leaving over 350,000 people without clean water for up to 17 days. The lack of water for drinking, cooking, washing and sanitation causes severe distress to thousands of people, despite efforts to distribute bottled water and bowsers.

There are fears that Walham electricity switching station, which serves over half a million homes across Gloucestershire and South Wales, may fail, leading to power cuts. Temporary defences are mobilised at Walham and additional pumping equipment brought in.



Mythe water treatment works

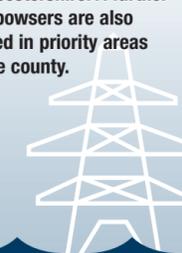


Walham switching station

## NEWS REPORT

Environment Secretary Hilary Benn announces a further £10m to supplement the existing flood recovery grant made available to local authorities.

Over 1 million litres of bottled water have been distributed in Gloucestershire. A further 700 bowsers are also placed in priority areas in the county.



## NEWS REPORT

Floods hit the Thames region as evacuations take place in Oxford, while other areas around the River Thames are warned of heavy rain and risk of flooding. The EA has six severe flood warnings for River Severn, River Thames and River Ock.



Water distribution

## WEATHER REPORT

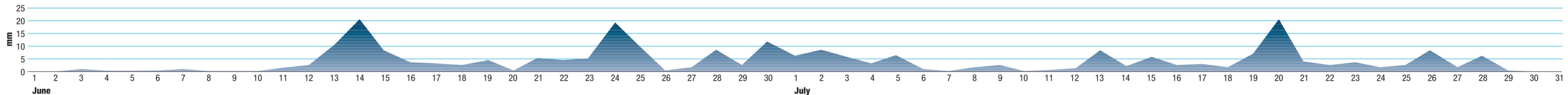
Another heavy downpour of rain falls across England, causing localised flooding in Gloucestershire.

## NEWS REPORT

A father and son are found dead at Tewkesbury Rugby Club. They were attempting to pump water out of premises, but were overcome by fumes from a pump.

A further 2.5 million litres of bottled water are distributed, with over 1,000 bowsers now put out across Gloucestershire.

## Average daily rainfall (mm) over England, June and July 2007



# Contents

Foreword .....	1
Executive Summary .....	3
Chapter 1: The events of June and July – a summary .....	9
Chapter 2: The effect of the summer 2007 floods on individuals and communities .....	20
Chapter 3: Building a better understanding of the risk .....	31
Chapter 4: Managing flood risk .....	39
Chapter 5: The emergency response .....	66
Chapter 6: Critical infrastructure: keeping our essential services going .....	91
Chapter 7: Engaging the public .....	111
Chapter 8: Next steps .....	129
Annexes and Glossary .....	141



# Floods Review: Independent Chair's opening letter

Dear Secretaries of State,

This is the first of two reports on the lessons to be learned from the severe flooding which took place during June and July 2007.

In preparing this Report, members of the Review Team and I have examined evidence from all concerned, including over 600 written submissions from the public and a wide variety of organisations. We have also visited many parts of the country affected by the emergencies, spoken to people involved and inspected damage to homes and businesses.

The scale of flood damage to property is shocking, but above all we have been moved and troubled by the first-hand accounts of people. It is difficult to fully capture in words the sense of loss and outrage associated with a home or business being flooded, and the prospect of it happening all over again at some unknown future date. We saw businesses that had been ruined and met many people who face the prospect of Christmas and Easter in a caravan or some other form of temporary accommodation. It is for this reason that we have chosen to write this Report from the viewpoint of the flood victims and why those in a position of influence should do all they can to reduce the risk and impact of flooding in the future.

We also want to pay tribute to the very many people who worked tirelessly during the floods, saving lives and doing what they could to help people directly affected. There may be questions about multi-agency states of readiness, but once the level of risk became known, all of the relevant organisations acted with considerable force, compassion and effectiveness.

Despite the impressive efforts of emergency responders, much work needs to be done to avoid emergencies of the scale we witnessed this summer happening again. Our emerging conclusions are wide-ranging and will require a determined effort on the part of central government and other relevant organisations to see them through. In some instances, we have

made urgent recommendations which have already been the subject of intensive study and discussion and should be progressed and implemented immediately. In others, the position is less clear-cut and in these cases, we would like readers to regard this first Report as a consultation document. Our second and final Report will be published next summer and will firm up areas of uncertainty.

Finally, I would like to thank everyone who has given so generously of their time and, in particular, those members of the public who showed such fortitude at a difficult time in their lives. I am also grateful to the Review Team for their considerable efforts over the last few months. We reached agreement on all matters, although, of course, the ultimate responsibility for the contents of this report rests entirely with me.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Michael Pitt', with a stylized flourish at the end.

**Sir Michael Pitt**  
*Independent Chair*

# Executive Summary

## Background

During August 2007, Sir Michael Pitt was asked by ministers to carry out a review of the flood-related emergencies which occurred during the summer of 2007. This is the interim report of the Review. It is being published now to achieve three objectives:

- to identify issues which need urgent action;
- to set out the direction for the remainder of the Review; and
- to provide a document for consultation before the final report is published next summer.

The floods during June and July 2007 were a wake-up call. The three months from May to July were the wettest since records began and the events that followed have been linked to the deaths of 13 people. They also resulted in damage to approximately 48,000 homes and 7,000 businesses. Power and water supplies were lost, railway lines, eight motorways and many other roads were closed and large parts of five counties and four cities were brought to a standstill. From an emergency response standpoint, this was a new level of challenge. The flooding triggered a series of emergencies which stretched local resources to the limit.

Conversations with victims illustrated the scale of distress and human misery experienced by many people. Even considering the extraordinary degree of disruption caused by the floods, the country was fortunate that the impact was not much more severe. There were several near disasters of an even greater magnitude. While the scale of loss and damage was massive, the crisis would have been worse had it not been for the dedication, quick thinking and effective action of those involved in the rescue and recovery operation.

Flood risk is here to stay. The Review recognises the findings of other reports, such as Stern and Foresight, which predict climatic change and state that this country can expect more extreme weather, with periods of intensive rainfall. The Review proposes that the country should confront these mounting challenges and adapt accordingly, recognising that this process of adaptation will take place over a generation. The impact of the floods and the high level of risk involved could have been significantly reduced with stronger local leadership of flood risk management, clarification of roles, more effective cooperation between responsible organisations, better protection of infrastructure and wider and deeper public engagement.

**Given the severity of the emergencies this summer and the risks we face in future, the over-riding purpose of the Pitt Review is to learn lessons from the floods of 2007 and to bring forward recommendations that will help the country adapt and deal more effectively with future flooding incidents.**

## The findings

The Report contains a total of 15 recommendations and 72 interim conclusions. They are strategic in nature but with implications for every locality in the country. The Report also considers one or two of the 'myths' surrounding flooding. These include strongly held views about standards of waterway maintenance and the belief that some communities were deliberately allowed to flood to reduce the impact on places further downstream.

**Chapters 1 and 2** provide the context for the Review, describing the severity of the emergencies and their wider social and economic impacts. They summarise the events of June and July and the effects the floods had on individuals, their families, businesses and communities. They are drawn from social research commissioned specifically for the Review, published in full as a supporting document to this Interim Report.

Climate change and the risk of flooding are discussed in **Chapter 3**. Ideally, experts would be able to accurately forecast bad weather and predict well in advance which properties will flood even more effectively than they already do. Doing so would give the emergency services and others more time to respond and to make the right decisions in a crisis. In practice the distribution, timing and intensity of rainfall and the dynamics of water flow once rain hits the ground are notoriously complex to model. Also, the nature of flooding is changing. In the past, considerable attention has been paid to the risks of coastal and river flooding. However, the greater intensity of rainfall and increasing urbanisation are leading to more flash floods caused by water running off the surface of the land. River, surface water and groundwater flooding all took place this summer, adding to the complications.

During the emergencies, the Met Office and the Environment Agency worked well together, but the limitations of some existing processes, together with technical limitations of flood prediction, meant that many property owners received warnings after their property had already flooded or not at all. Research into flood prediction is advancing and we believe this should be a priority subject to feasibility and cost effectiveness. Rapid progress must be made over the next few years to ensure that flood risk planning and management, including public warnings and emergency response, is underpinned by an improved understanding of when and where flooding will occur.

There are obvious concerns about the large number of properties currently at risk of flooding and the likelihood of further significant development in flood risk areas.

**Chapter 4** discusses the need to strengthen and enforce the provisions of PPS 25 and Building Regulations to ensure that flood resistance and resilience measures are fully built into all new development where necessary.

The law relating to drainage systems is complex and numerous bodies are involved including the Environment Agency, water companies, local authorities, internal drainage boards and private owners. It is not surprising that the public are confused and that they wonder who is accountable. There is room for improved inter-agency cooperation. This Review recommends that the Environment Agency should take strategic direction of managing inland flood risks, while local authorities should adopt a new leadership and scrutiny role overseeing flood risk management within their local area.

In general, insurance companies responded quickly and effectively to the emergencies despite the vast number of claims they received from residents and businesses. However, some were less efficient than others and some people have received an unsatisfactory level of service. The Review is discussing with the insurance industry ways of achieving uniformly high standards and this subject will be reviewed again next year.

**Chapter 5** deals with the calling of Gold, Silver and Bronze Commands and the response to the flooding emergencies. Relevant aspects of the Civil Contingencies Act were put into practice effectively and there is admiration for the way in which the emergency services and other responders worked tirelessly throughout one of the most complex, challenging and lengthy series of emergencies for many years. However, the Review also believes that the country was not as well prepared as it should have been.

Responders were surprised by the scale and duration of the emergencies and they often found themselves reacting to unexpected events. Sometimes basic information about operation and characteristics of the local drainage systems was unavailable when needed. The vulnerability of critical infrastructure and consequences of its failure were not fully appreciated in advance. The country must be better prepared and the Review makes a series of recommendations about national and local leadership, emergency planning, protection of local emergency facilities, water supplies, rescue and funding mechanisms.

In **Chapter 6** the Review is concerned about the major loss of essential services during the floods. Sites containing critical infrastructure were poorly protected. For example, tens of thousands of people found themselves without tap water and power, 10,000 were stranded on the M5 motorway overnight and 500 were left stranded at Gloucester Railway Station. Even greater loss of essential services was only narrowly avoided and there were major concerns about the complete failure of Ulley Reservoir. The Review makes recommendations on sharing information, building greater standards of protection and the closer involvement in preparedness planning of essential service providers, such as the water and power companies.

People depend on warnings and advice during an emergency. They will have important decisions to make about their safety and that of others, and about the risk of damage to their property. **Chapter 7** describes the efforts made by responders to keep the public informed and the contribution of local media – especially the ability of local radio to transmit up-to-the-minute broadcasts. The public appreciated the efforts of local authorities and other organisations which systematically knocked on doors and checked on the well-being of residents and businesses. The Report sets out proposals for ensuring that advice and warnings from various agencies are better coordinated, that councils play their full part in reassuring the public and that people are made fully aware of any flood risk when they buy or rent property. It also makes clear that individuals and communities must share responsibility for actions to deal with flooding.

## Next steps

This first Report sets out the Pitt Review's initial thinking and proposals after just four months' work. The Review has benefited from the extensive evidence already submitted, but much more needs to be considered before the final Report will be ready next summer.

In particular, further work needs to be done to consider the costs, benefits and feasibility of the interim conclusions.

Interested individuals and organisations should let us have their views and join in a discussion over the coming months. You can find different ways to contact the Review Team set out in **Chapter 8**. The deadline for comments and further evidence is 31 March 2008.



Tank No.  
**109**

**DRINKING WATER ONLY**

Drinking Water  
It is advisable to  
Boil Before Use



# Chapter 1: The events of June and July – a summary

## Summary

- This chapter describes the exceptional events that took place during summer 2007, when 13 people lost their lives and about 48,000 houses and 7,000 businesses were flooded.<sup>1</sup>

It is divided into three sections:

- The Weather – This section describes the weather conditions and the record-breaking rainfall. Information has been provided by the Met Office.
- The Flooding – This section explores the effects of the rainfall once it reached the ground, including the exceptional amount of surface water flooding that occurred.
- The Impacts – This section covers the destructive impact of the floods during and after the event.

A timeline of events can be found at the front of this Report.

**1.1** The rainfall during June and July 2007 was unprecedented. Data on rainfall and river levels shows that the summer 2007 floods were extreme, with only a 1-in-150 chance of this level of flooding occurring in any one year. The sheer volume and intensity of the water meant that drainage systems and flood defences were unable to cope, resulting in devastating floods affecting tens of thousands of people.

## The Weather

**1.2** The severe flooding which affected much of the country during June and July 2007 followed the wettest-ever May to July period since national records began in 1766. Met Office records show that an average of 414.1mm of rain fell across England and Wales – well over double usual levels (see Table 1). The additional volume of rain which fell from May to July was 31,140 million cubic metres – more than four times the amount of water in all the lakes in England and Wales combined. The sheer volume and intensity of the water overwhelmed many drainage systems and a number of defences.

**1.3** The exceptionally heavy rain resulted in two severe and disruptive flooding events. Figure 1 (below) shows that the rainfall peaks for the worst affected areas (Midlands, North East and South West) occurred during the week of 13 June (which did not result in serious flooding but did saturate the ground), the week of 20 June and the week of 18 July.

## Weather patterns for summer 2007

**1.4** The heavy rainfall was the result of an unusual weather pattern. The jet stream was stronger and further south than normal and the North Atlantic Ocean was warmer than usual in the vicinity of the UK.

<sup>1</sup> Department for Communities and Local Government

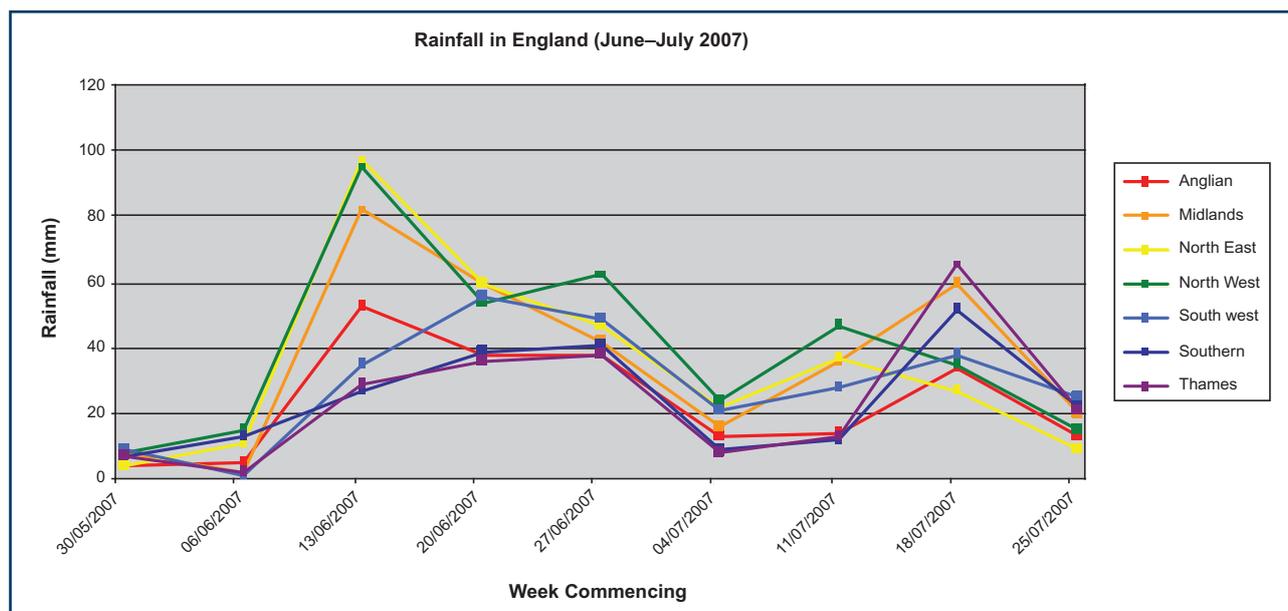
**Table 1 – May – July rainfall totals for England and Wales**

Area	May – July 2007 rainfall	May – July 1971 – 2000 average	Previous wettest May – July in series	Additional information
NE England	379 mm	170 mm	Wettest since records began	Previous wettest was 308mm in 1879
NW England & North Wales	387 mm	198 mm	Wettest since records began	Previous wettest was 354mm in 1920
Central England	364 mm	154 mm	Wettest since records began	Previous wettest was 297mm in 1879
SE England	315 mm	153 mm	Wettest since records began	Previous wettest was 293mm in 1903
SW England & South Wales	422 mm	178 mm	Wettest since records began	Previous wettest was 345mm in 1879
England & Wales	414 mm	186 mm	Wettest since records began	Previous wettest was 349mm in 1789

**Note:** England and Wales record starts in 1766, other regions in 1873.

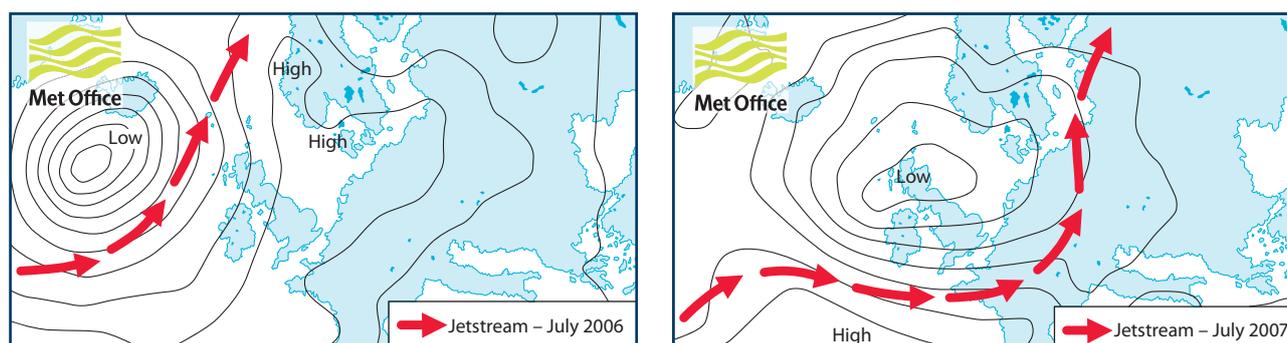
Source: Met Office – Submission to EFRA Select Committee 2007

**Figure 1 – Rainfall totals for regions in England in June and July 2007**



Source: Environment Agency Weekly Rainfall and River Flow Summaries

**Figure 2 – Relative positions of the jet stream in June 2006 and July 2007**



Source: Met Office 2007

## The jet stream

**1.5** The jet stream is a key factor in controlling the UK's weather. Jet streams are ribbons of very strong winds formed by temperature differences in the upper atmosphere between cold polar air to the north, and warm tropical air to the south. The abrupt change in temperature results in a large pressure difference which forces the air to flow rapidly, usually in a west to east direction due to the rotation of the Earth. Jet streams are typically thousands of miles long, hundreds of miles wide and a few miles deep and can reach speeds of 300 miles per hour. At the latitude of the UK, the jet stream is generally found at around 35,000 feet and is called the Polar Front Jet Stream. Because the jet stream follows the boundary between the cold polar air and the warm tropical air, it can move in a north-south direction. At this boundary, weather fronts develop which

can bring heavy rain and strong winds. The location of the jet stream has a strong influence on the movement of depressions bringing unsettled weather to western Europe.

**1.6** For much of summer 2007, the jet stream was stronger in force and positioned further south for longer than usual. This resulted in many heavy rain-producing weather systems crossing southern and central areas of the UK. Figure 2 shows the relative positions of the jet stream in June 2006 and July 2007 for comparison.

## North Atlantic sea surface temperatures

**1.7** The temperatures of the North West Atlantic Ocean waters were above normal for much of the spring and early summer of 2007. The air mass above the ocean heated up more than normal and held more

**Table 2 – Wettest locations in England during June 2007**

Weather Station	Rainfall (mm)	
	June 2007	Anomaly against 1971 - 2000 average
Emley Moor, West Yorkshire	294	4.35 times the average
Bingley, West Yorkshire	283	4.01 times the average
Fylingdales, North Yorkshire	269	4.06 times the average

Source: Met Office – Submission to EFRA Select Committee 2007

moisture. When this air mass was forced to rise, either as a result of convection or frontal activity (see below), more rainfall formed.

### Types of rainfall events

**1.8** There are two main types of rainfall event. The first is convective rain – slow moving heavy showers or thunderstorms that usually cover areas of up to around 50 square miles, which can result in surface water (or pluvial) flooding. The second is frontal rain – much larger in scale and associated with depressions moving close to or over the UK. This is the sort of rain which is presented as bands across the weather map. Frontal rainfall events are more easily tracked and predicted by current weather forecasting models, while convective events are more difficult to predict because they are smaller and driven by localised circumstances.

**1.9** The rainfall events on 24–25 June and 19–20 July were frontal, but with embedded convective elements. By way of comparison, the rain which caused the flood in Boscastle in August 2004 was convective in nature, while the Carlisle flooding in January 2005 was caused by frontal rain.

### The June event

**1.10** Heavy rainfall first affected much of northern England on 14–15 June due to a complex and slow-moving area of low pressure. While this rainfall did not itself cause much flooding, it did saturate the ground over much of northern England. This amplified the impact of the heavy rainfall on 24–25 June, after which the weather remained unsettled and wet until the end of the month. The highest rainfall total recorded on 25 June was at Fylingdales in North Yorkshire, with 111mm of rain. Table 2 gives the highest June rainfall totals for the wettest areas. Some places received over four times the average monthly rainfall.

**1.11** Figure 3 provides a snapshot of the meteorological conditions on 25 June 2007. An area of low pressure (depression) over the UK remained static for a prolonged period of time. The rainfall corresponding to the conditions is shown in the bottom right-hand corner, with the brighter colours indicating more rain.

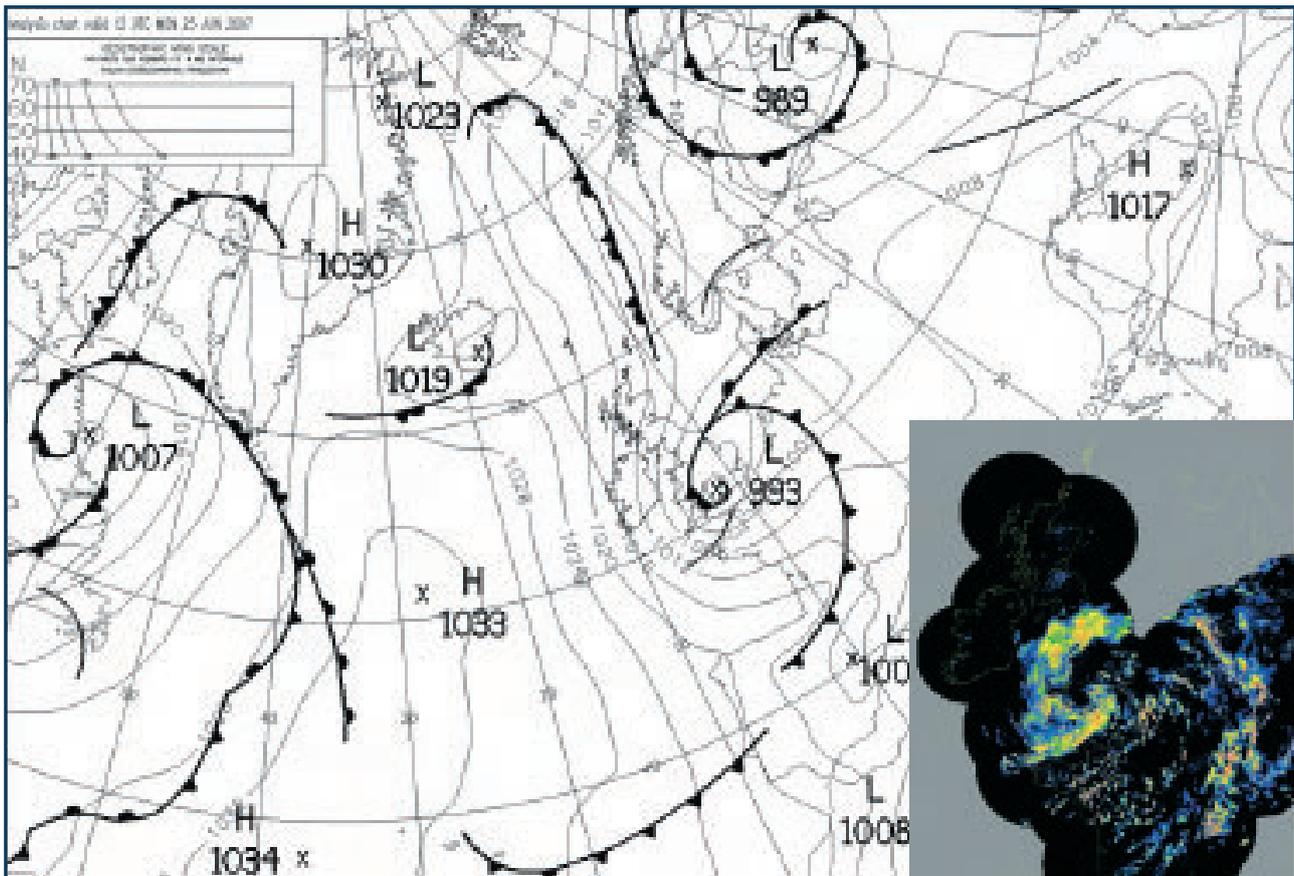
### The July event

**1.12** The second main flooding event was due to exceptionally heavy rainfall on 19–20 July. This was caused by a slow-

**Table 3 – Wettest locations in England during July 2007**

Weather Station	Rainfall (mm)	
	July 2007	Anomaly against 1971 – 2000 average
Pershore College, Worcestershire	252	5.88 times the average
Great Malvern, Worcestershire	189	4.48 times the average
Little Rissington, Gloucestershire	189	3.78 times the average
Brize Norton, Oxfordshire	178	4.38 times the average

Source: Met Office – Submission to EFRA Select Committee 2007

**Figure 3 – Synoptic situation on 25 June 2007**

Source: Met Office 2007

moving depression centred over south-east England. Heavy rainfall moved northwards during the day. The heaviest rainfall recorded was at Pershore College in Worcestershire with 157.4mm recorded in the 48 hour period 19–20 July 2007. Table 3 gives the highest July rainfall totals for the wettest areas. Some places received nearly six times the average monthly rainfall. Table 4 shows that for the worst affected counties, the monthly rainfall was around 3–4 times the average.

**1.13** Figure 4 is a snapshot of the meteorological conditions on 19 July 2007 showing an area of low pressure (depression) over the UK.

## The Flooding

**1.14** The events of the summer were characterised by two types of flooding:

1. rivers overflowing to flood surrounding areas (river or fluvial flooding) and direct flooding of areas with insufficient drainage capacity (surface water or pluvial flooding) following exceptionally high rainfall.

**1.15** During the summer, and in particular June, there was surface water flooding on an unprecedented scale. This type of flooding is more difficult to predict and provides limited opportunity for warning. It also tends to result in significant amounts of flooding in areas that have not previously flooded.

## Types of flooding

### River (fluvial) flooding

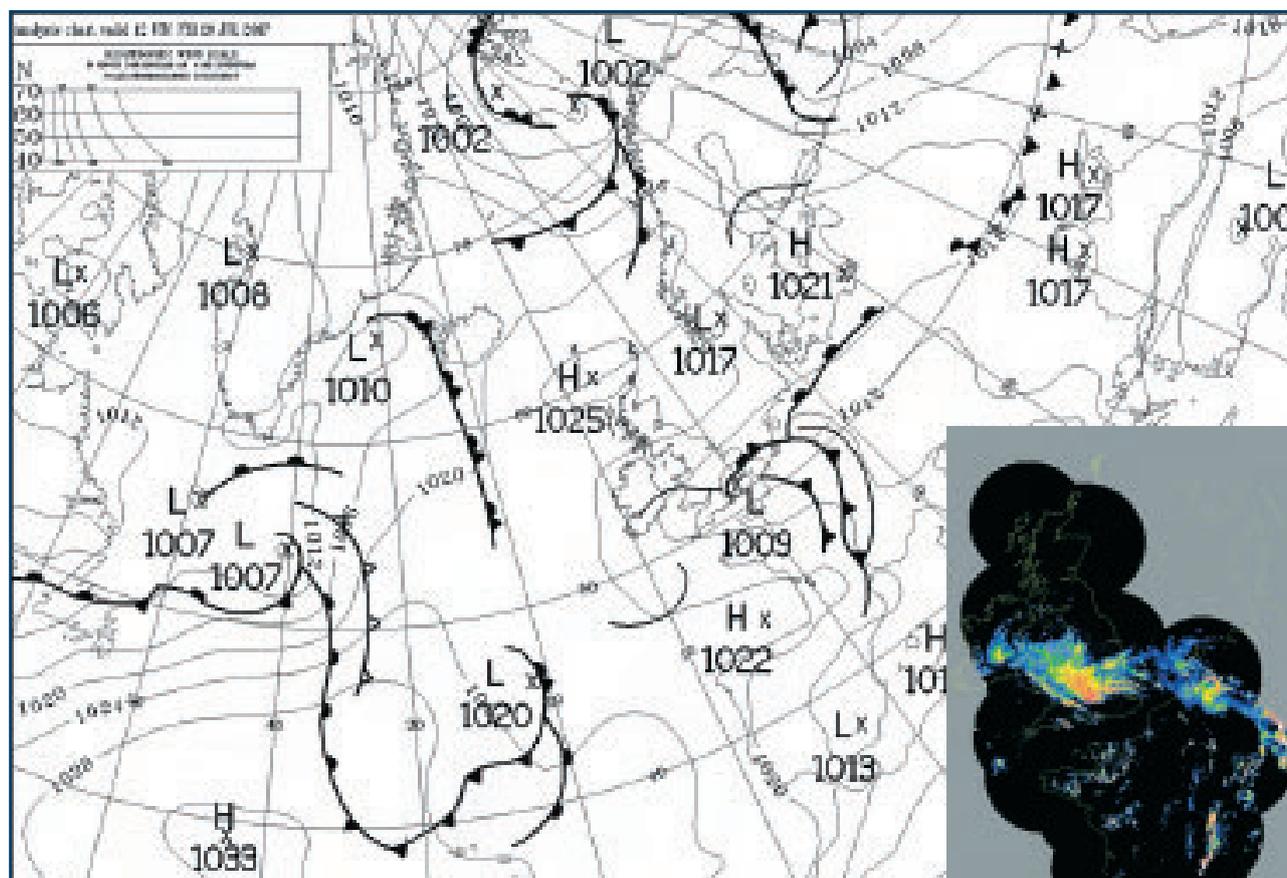
**1.16** River flooding occurs as a result of water overflowing from river channels. There are two key factors – the volume of rainfall and the capacity of the ground and

**Table 4 – July rainfall totals for counties across England**

County	Rainfall (mm)	
	July 2007	Anomaly against 1971 – 2000 average
Gloucestershire	197	4.11 times the average
Herefordshire	189	4.27 times the average
Oxfordshire	150	3.39 times the average
Shropshire	165	3.30 times the average
Warwickshire	208	4.53 times the average
Worcestershire	201	4.17 times the average

Source: Met Office – Submission to EFRA Select Committee 2007

**Figure 4 – Synoptic situation on 19 July 2007**



Source: Met Office 2007

ivers to absorb and transport the water. River levels, groundwater levels and soil moisture are usually low following a typical summer. This provides capacity to absorb heavy rainfall during the winter and reduces the likelihood of flooding. However, May and early June this year were particularly wet, so river, groundwater and soil moisture levels were already high. This exacerbated the problem when the intense rain fell at the end of June and in July. Figure 5 shows that in the worst-affected areas of the North East and the Midlands, river levels during the July flooding were up to six times higher than the long-term average.

**Surface water (pluvial) flooding**

**1.17** Surface water flooding happens quickly and is hard to predict. It occurs when natural and man-made drainage systems have insufficient capacity to deal with the volume of rainfall. The critical factors for surface water flooding are the volume of rainfall, where it falls and its intensity. In urban areas sudden and intense rainfall cannot drain away as quickly as it can in rural areas where the soil is exposed. Around two-thirds of the

flooding in summer 2007 was due to surface water and this was a particular problem during June.

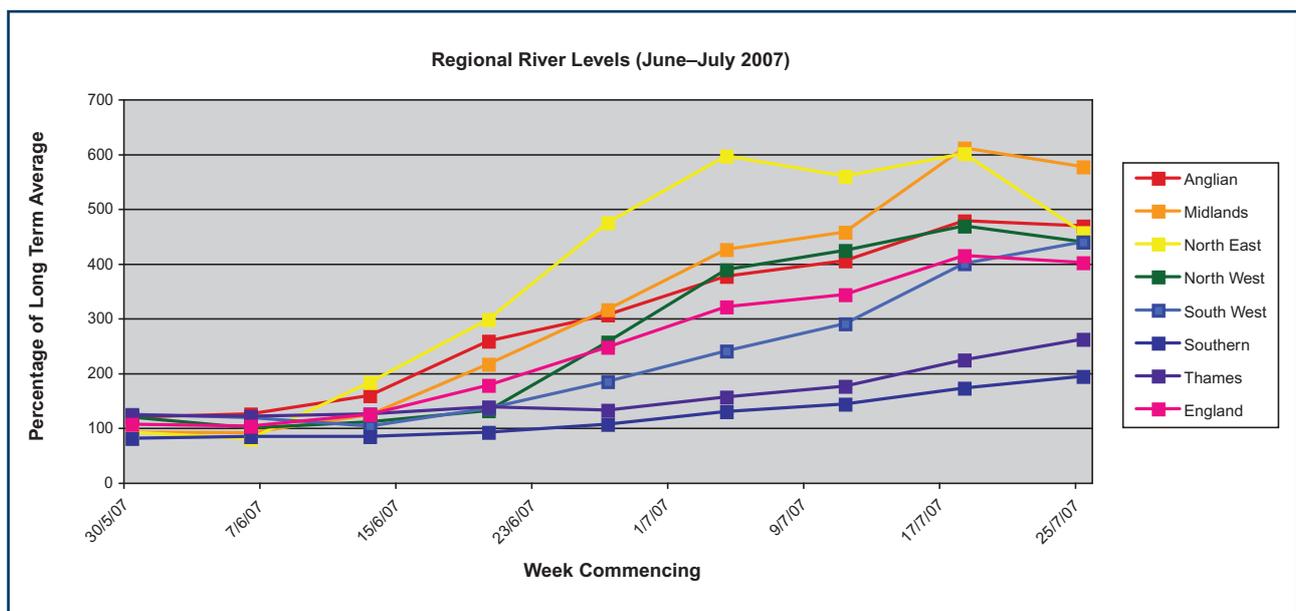
**Groundwater flooding**

**1.18** Groundwater flooding occurs when the level of water underground (the ‘water table’) rises and water emerges above the natural surface. It generally happens in low-lying areas, particularly those which sit above layers of permeable rock such as chalk.

**Coastal flooding**

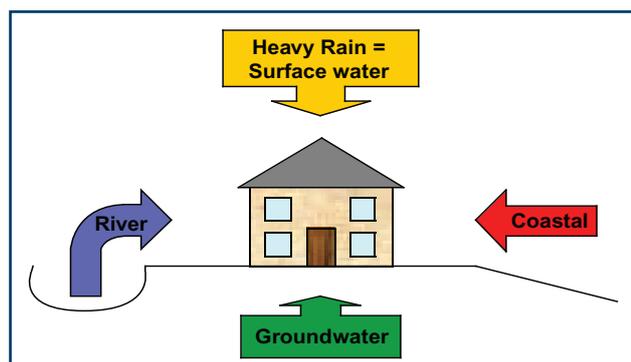
**1.19** Coastal flooding occurs when the sea level rises above the level of coastal land. Although this type of flooding was not a part of the serious summer flooding, the East Coast storm surge in November this year shows the very real risk that it presents. Indeed, the potential impact of coastal flooding is significantly higher than for other types of flooding, with a greater probability of loss of life and inundation – especially if larger-scale coastal defences fail.

**Figure 5 – River levels in June and July 2007 by EA Region**



Source: Environment Agency Weekly Rainfall and River Flow Summaries

**Figure 6 – Types of flooding**



## Properties flooded across England

**1.20** Figure 7 displays the widespread and destructive nature of the summer 2007 floods, giving details of the number of residential properties affected. The geographical distribution of affected property can be compared with precipitation levels shown in Figure 8.

## The Impacts

### Case Study – Personal Experience of Flooding



Tim Aston lives in Newton, Tewkesbury, in Gloucestershire. His house is not on the Environment Agency's floodplain map – something he had checked before the flooding. Tim described the torrential rain that fell all day on Friday 20 July as unbelievable and unlike anything he had experienced previously.

#### **“It was like it was the end of the world”**

As a photographer, Tim was at a wedding that Friday and by the time he had left the reception at around 10pm, the water level in places was up to his waist as he waded against a strong current to get home. Tim's house had not yet been affected by the floods when he returned as it was on higher ground, and he believed he would be safe as the rain had started to ease off.

After reaching home, Tim noticed a patch of water on the floor near the patio doors and within a minute, the downstairs carpet was floating in an inch of water. Tim grabbed a number of essential items, while his wife turned off the power before the water reached the sockets. By the time he had returned downstairs for a second load of belongings, the water was shin-deep and much of what had been downstairs, including many precious personal items, was destroyed. Tim's neighbour called to tell him to move his car to higher ground, but unfortunately it was too late as both the car and his motorbike were flooded. While talking to his neighbour, Tim was able to look at his surroundings and it was only then that the enormity of the event struck him.

#### **“Water was everywhere and it'd all happened within a couple of hours.”**

The water levels started to recede at around 9am on Saturday and most of the water was out of the house by midday. However, by that evening, Tim noticed a perceptible rise in the water levels again and by Sunday morning, it was rising at a rate of around 1 inch per hour.

#### **“The worrying thing was that we just didn't know when it was going to stop rising.”**

It took until Monday morning for the water levels to become static and until late Monday afternoon for it to recede, leaving Tim and his family with the inevitable but distressing job of starting the clean-up. Although the whole event was a devastating experience for Tim and his family, he believed that there were a number of positives. Community spirit in his area improved and the experience encouraged Tim to look differently at the priorities in his life.

#### **“It was a life changing experience.”**

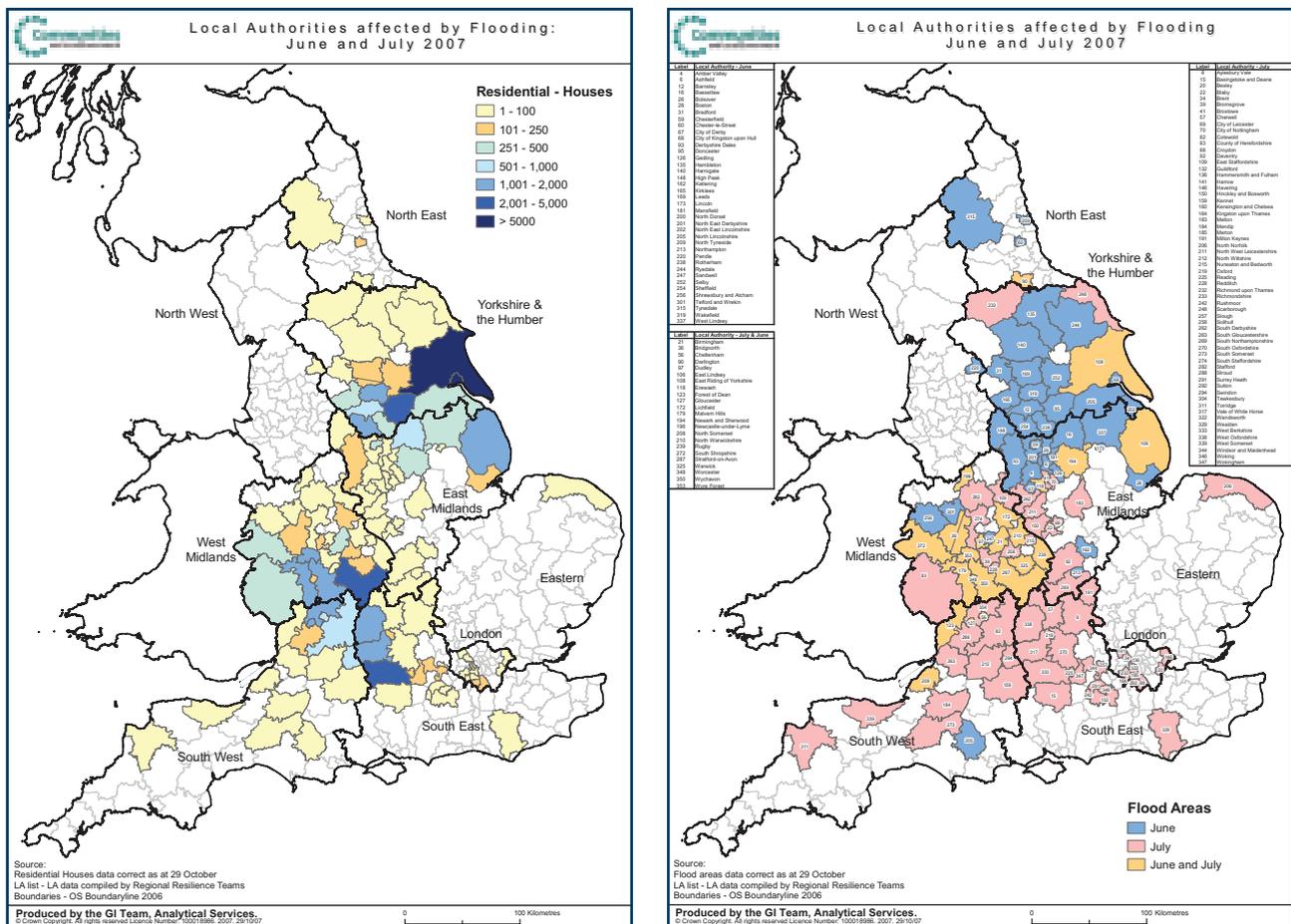
### Impact on critical infrastructure

**1.21** The widespread nature of the flooding had startling, major and unexpected impacts on infrastructure leading to the loss of essential services.

**1.22** Gloucestershire County Council's report on the July floods sums up some of the effects. On Sunday 22 July, Severn Trent Water's Mythe water treatment works in Tewkesbury was flooded. This left 350,000 people across Gloucestershire without water – the most significant loss of

essential services since the Second World War. On Monday 23 July, Central Networks' Castle Meads electricity sub-station was shut down, leaving 42,000 people without power. Only a concerted effort involving the fire and rescue service, the Armed Forces, the Environment Agency and the National Grid prevented the loss of Walham electricity switching-station. The extent of the flooding left many people stranded as critical elements of the transport network ground to a halt. Some 10,000 people were left stranded on the M5 motorway and other

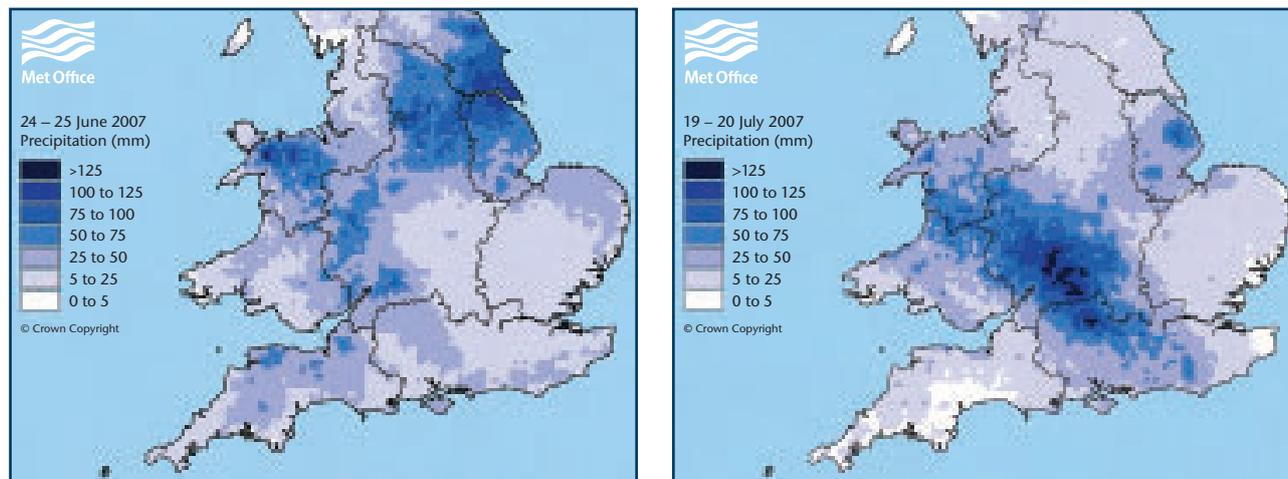
**Figure 7 – Effects of flooding on residential properties, by Local Authority<sup>2</sup>**



Source: Department for Communities and Local Government 2007

<sup>2</sup> The figures used to produce these maps include only residential properties where the habitable accommodation has been affected (it excludes those where, for example, only garages and/or outbuildings were flooded) and they are the latest estimate as at 29 October 2007. The figures are based on the individual local authority assessment of affected homes in their areas; this will have included an assessment of those presenting themselves as homeless, those seeking council tax exemptions and other support, as well as other measures. However, these figures may not include all households, particularly those who made private arrangements.

**Figure 8 – Precipitation levels for England and Wales during 24 – 25 June and 19 – 20 July 2007**



Source: Met Office 2007

roads overnight on 20 July, while an estimated 500 people were left stranded at Gloucester Railway Station as the rail network failed. The infrastructure failures and loss of essential services affected many people outside the flooded areas and increased the demand for emergency responses.

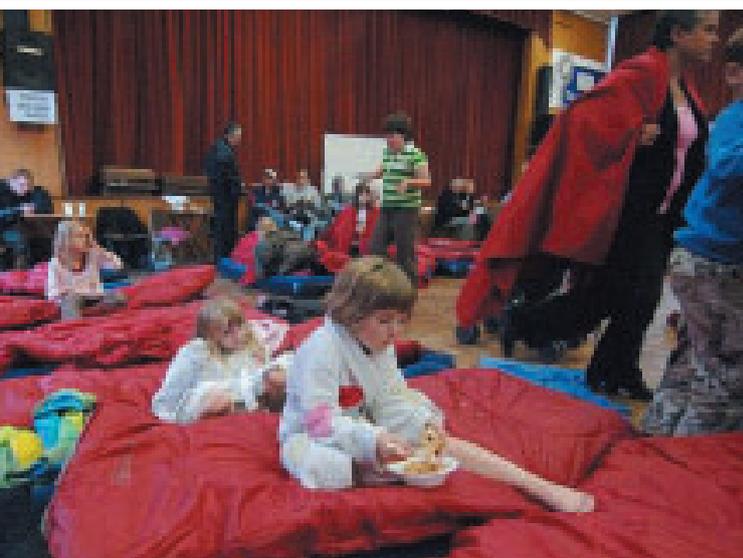
**1.23** There were also substantial losses of assets and disruption to essential services in other parts of the country and other sectors. In Yorkshire, four major electrical sub-stations and 55 secondary sub-stations were flooded, affecting the supply to 130,000 people. Hundreds of sewage treatment works and pumping stations failed, causing local pollution in flooded areas. The dam at Ulley reservoir, near Rotherham, very nearly failed, putting at risk the local population and a number of other infrastructure assets. Oil distribution was affected by rail suspensions which

prevented bulk fuel supplies reaching terminals and other storage facilities. There were also local failures in telecommunications networks that left people feeling vulnerable and isolated.

### Impact on local areas

**1.24** Annex D of this report explains how these national events impacted on some of the most heavily-affected local areas – Thames Valley, Gloucestershire, Humberside and South Yorkshire. Many more areas were affected to a lesser but still significant degree. Considered together, it is clear that the impact on all the people and communities affected has been both severe and long-lasting.





## Chapter 2: The effect of the summer 2007 floods on individuals and communities

### **Summary**

This chapter describes the experience of the floods from perspective of the individuals, businesses, farmers and communities affected.

It covers;

- The initial shock as the flooding began;
- The clean-up and aftermath;
- The on-going effects; and
- The public response.

## Introduction

**2.1** This chapter describes the exceptional and devastating effects of the 2007 summer floods on individuals, families, communities and businesses – effects which are still being felt today. It also describes some of the most visible positive stories that emerged – individuals and organisations going beyond expectations to help others and a genuine sense of community spirit and cooperation. These personal experiences form one part of the evidence base for recommendations later in this report.

**2.2** The evidence for this chapter comes primarily from qualitative research commissioned by the Review, carried out in October 2007 by the independent research agency GfK NOP Social Research. The full report is available for download from the Review website [www.cabinetoffice.gov.uk/thepittreview](http://www.cabinetoffice.gov.uk/thepittreview).

**2.3** The chapter also draws on evidence from research commissioned by The Consumer Council for Water to understand people's experience of the loss of water. The full report can be downloaded from [www.ccwater.org.uk/upload/doc/Final.doc](http://www.ccwater.org.uk/upload/doc/Final.doc).

**2.4** Also, we have used evidence submitted by members of the general public to the Pitt Review website,<sup>2</sup> comments sent to us by email and post and evidence gathered during visits to many parts of the country.

## The initial shock

**2.5** The scale and speed of the floods that affected people in summer 2007 came as a shock. In many cases, this reflects people's limited awareness of risk, especially of surface water flooding, and limited engagement in preparedness planning. Even if people were aware that heavy rain

was forecast, they did not expect it to affect them, and certainly not so seriously.

"You just think, oh, it'll never happen to me."

Householder, West Berkshire

"We were sat at the end of our drive watching... and all of a sudden it came up through the grate.... 10 seconds later Jane's house were gone."

Householder, Barnsley

**2.6** For some, the first sign of the flooding was water running down the street towards them. For others, it was water seeping up through their floors or their toilets backing up, rendering their attempts to block water by sealing doors and windows useless. Many people at work or away from home, despite warning calls from neighbours, did not grasp the full magnitude of the floods until they returned home and saw the damage for themselves.

"It happened really quickly. It just came... like a river coming down the street."

Householder, West Berkshire

**2.7** Most people had never experienced flooding like this before, and they did not know how to react – what preventative steps to take, who to call for help, whether to turn the power off. Many felt helpless and isolated and found that panic and distress immobilised them – they just watched helplessly as the water seeped through their homes and waterlogged their possessions. This was particularly the case for some vulnerable people who were unable to protect themselves or their possessions.

<sup>2</sup> [www.cabinetoffice.gov.uk/thepittreview](http://www.cabinetoffice.gov.uk/thepittreview)



Flooding at Botley, Oxford © Rex Features

“(The experience) was terrifying... I really thought we might get washed away at one point.”

**Householder, North East Lincolnshire**

**2.8** Others took steps to protect their property, either moving items upstairs or trying to prevent water ingress. Farmers and businesses were more likely to fall into this category, often because they had appropriate equipment on hand such as pumps or generators. Some farmers had the additional worry of rescuing their animals from drowning or from drinking contaminated water.

**2.9** Feelings of fear and helplessness were exacerbated if people lost their water supply. Although bowsers and bottled water were available in various locations, it was difficult for vulnerable people, those without transport or those without much physical strength to collect the water to take it back to their homes unless they had help from neighbours. People appreciated the work carried out by those who provided them with water, but there were also reports of the scarcity of water causing arguments and tension in local communities.

“There was a band of young people aged anything from 15 to 25 offering to put (water) in the car for you... they were top notch.”

**Householder, Cheltenham**

“You got 4 litres per person per day... but there were people abusing it. (People with) shopping trolleys trying to flog it.”

**Householder, Upton**

**2.10** Loss of power caused similar fear and distress. It meant that people could not get information from the television, radio and internet, and it also prevented people from communicating with others, as many modern landline and mobile telephones require power to charge batteries. Businesses could not communicate with customers or suppliers, leading in some cases to orders being cancelled. Loss of power could also cause serious health consequences – as in the case of one householder in Gloucestershire who relied on mains power for his oxygen source.

**2.11** Many people were forced to evacuate their homes, either staying with friends or relatives or sleeping in rest centres or

temporary accommodation. This in itself caused worry – fears that their homes would be looted in their absence, fears of continuing damage to their possessions which they had been unable to take with them, and concerns about when they would be able to return home.



Evacuation centre at Dinnington Comprehensive, South Yorkshire © Empics

## The clean-up and the aftermath

**2.12** When the floods began to recede, the full extent of the damage became obvious. Many felt overwhelmed by the scale of the clean-up and uncertain how to go about it. Those who stayed in their homes often had to live amongst the effects of the floods – mud, silt and sewage, in addition to wet floors and plaster hanging off wet walls. There were reports that this resulted in a continuous bad odour and infestations of rats, mosquitoes and flies.

“It didn’t even look like flood water. When you looked at it, it looked thick and soupy and grimy and horrible. When you walked into the water, if you held your hand an inch under the top.. you wouldn’t be able to see your hand... sludgy and slimy”.

**Householder, Sheffield**

**2.13** Disrupted living patterns also led to family and personal stress. In some cases, different members of the same family had to live apart. When families went to live with relatives, the arrangements increased the potential for family arguments. For those who stayed at home using only the upper floors, cramped living conditions added to family tensions. Those with continuing loss of power were unable to cook or store chilled food.

“We all live upstairs and everyone is at each other’s throat all the time now”.

**Householder, Hull**

**2.14** Many people talked about emotional health problems, and attributed these to the stress that the floods had caused.

“My wife will be fine one day, and she’ll be in tears the next”

**Business, West Berkshire**

“Every time you try and relax you envisage (the water) coming down the street again... it’s scary.”

**Householder, Toll Bar, Doncaster**

“..tired and stressed and obviously you are depressed and you are run down because you just walk down the stairs and your house is a complete shit hole and you have just had .. it redecorated”

**Householder, Toll Bar, Doncaster**

**2.15** Some people also reported physical health problems, including sickness, diarrhoea, asthma, sore throats, cold sores and bad chests, which many attributed to the damp living conditions and continuing contamination of their homes.

## Case study – Emma Dickens, Female Householder, Hull

Emma Dickens is a young mother from Hull whose family home was flooded this summer. At the time her baby was nine weeks old.

Soon after her home was flooded, Emma noticed that her breathing was becoming increasingly difficult, and she started to feel pain in her chest and back. She was diagnosed with pneumonia, which, according to her doctor, was brought on by breathing in mould spores. She was admitted to an acute hospital ward with her baby. However, as doctors were anxious about the baby's exposure to germs in the acute ward she was advised to leave the following day and move to a domestic location with a dry atmosphere, and not return home for the good of her own health and that of the baby.

Emma and her baby eventually moved in with relatives and stayed there for some weeks, before she felt well enough to return to her own home and the rest of her family.

“The aftermath and the clean-up? The point is that the community and the church did it. We cleared our street. We moved perhaps two tons of mud off the street. Five lads with hose pipes and jet washes and we cleared our own street because we were traipsing sewage into the house. That was after everybody had rung the council and said 'look, we've got our own skips, we've got rid of the stuff. Can you just send somebody down to clean the street, a road sweeper?' They wouldn't even send that. So we had to do that ourselves, because otherwise you're trailing crap back into your house that you've just cleaned out.”

**Householder, Chesterfield**

**2.16** Almost all businesses affected suffered stock and equipment losses, and were unable to operate normally due to flooded sales premises or loss of power and communications resulting in lost orders or enquiries. Where businesses were out of action for some time, there was a serious effect on trade – particularly small businesses. Delays were increased by paperwork which had been lost or damaged in the flooding, resulting in problems making insurance claims, tracing orders and filling in tax returns. Many businesses struggled to make payments for utility bills, bank loans and other expenses.

The effects of flooding on consumers also had an impact, with fewer customers and reduced spending, especially in the tourism and leisure industries. For other sectors such as building, hotels and takeaway restaurants, there was a reverse effect, with increased demand from customers.

**2.17** Farmers faced many of the same difficulties as other businesses, but they also had their own particular problems. For cattle and dairy farmers, barn flooding caused destruction of stored feed, and damage and contamination of grassland.

**2.18** Risk of contamination had a particularly serious effect on dairy farmers, as contaminated feed or water could permanently damage the animals' milking productivity. Milking cows must drink 15 – 20 gallons of water a day, so loss of water supply was a huge challenge. Animals had to be rescued from the flood water and temporarily housed, and a reliable alternative water source identified. In addition, heavy milking machines could not be moved to higher ground, and were therefore damaged and contaminated by the flood water.

**2.19** For crop farmers, the type of crop determined the level of damage caused by flood water. Peas and potatoes, some of the UK's most important crops, are

destroyed after just 24 hours in water. Wheat, sugar and rapeseed survived, but with poorer yields.



A bridge emerges from flood water near Tewkesbury, Gloucestershire © Empics

**2.20** In the aftermath of the flooding, those who were insured had a very different experience from those uninsured. As well as financial compensation, insurers provided invaluable advice about how to proceed with each stage of drying out and cleaning up.

**2.21** There were highly variable experiences of insurers' responsiveness. Most received an immediate response, though some tried for several days to reach their insurer before being able to make contact. The timing of visits from loss adjustors was also crucial as it represented the first step in the claim process, and meant that cleaning up could begin. Many received visits very quickly, while others were forced to wait due to a lack of available loss adjustors, with resultant hardship for businesses and householders.

“Personally I haven’t a problem with the insurance companies, it’s the loss adjustors.”

**Business, Rotherham**

“My mum has sent me her wages, that’s the only way I’m surviving because I’ve got no income. I can’t get a job because I am still classed as having my own business. I can’t get any benefits because I am classed as having my own business. It just seems like a road block dead end ... I’ve got cover that only pays at the end. I’ve got my building cover that pays at the end. I’ve got stock cover which pays at the end. Content cover which pays at the end... my loss adjustor said well we can’t do any kind of decent interim payment until you get these documents to me, these papers which I am scrabbling with my accountant to get because obviously I haven’t paid him either.”

**Business, Doncaster**

Advice was less easily available to those who were not insured. They also had to spend money hiring drying out equipment, and replacing damaged items such as white goods. Farmers were unable to insure growing crops, but most of those not insured were council tenants, and therefore received help with building repairs, and also financial support from the council and sometimes from community organisations such as parish councils and churches. Financial support from the Council was a key source of tension in some communities, as there was a perception that council tenants were given undue priority over both insured and uninsured private tenants.

“I was one of the idiots who wasn’t insured. I had to do it on my own but I didn’t get enough information about what to do. I bought meters, I bought humidifiers. You spend all that money, but it’s damp again later.”

**Householder, Berkshire**

### Case Study – Neil Robinson. Dairy Farmer, Gloucestershire

Neil Robinson had 200 milking cows in his herd, each consuming around 15-20 gallons of water a day. When the flood struck, the cows were not unduly affected as they were moved to higher ground. However, a few days into the flood, the farmer heard on the radio that the water was going to be cut off in a matter of hours. He had very little time to put in place an alternative source.

First, he explored the idea of getting water from an old well on the farm, but it had not been used for years and the water was stagnant. Second, he bought some water piping and tried to relay water from a borehole in an adjoining farm. This scheme also failed. Time was running out. With no fresh water to drink, the cows would become dehydrated and distressed. Option three was to investigate the suitability of using the water from a duck pond on the farm. This turned out to have fresh enough water for the cows to drink, so water from the pond was pumped into troughs in the farmyard until the mains water was restored.

Neil has yet to discover the long-term effects on the herd's milk yield.

“Those who were insured and not with the council didn't get no help from the council because the council prioritise people who weren't insured.”

**Business, Hull**

“Not having had a kitchen to work in until last week from June, Morrison's has been second home and I know all the transport cafes around Chesterfield! You don't get that back do you? It costs a lot more than catering for yourself at home.”

**Householder, Chesterfield**

### Ongoing effects

**2.22** The floods continue to have detrimental emotional, health and financial effects. Many people still cannot return to their own homes – or if they can, are forced to live in cramped conditions amongst rubble, dirt and ongoing repairs as winter approaches. In addition to the obvious costs of repairs, there are hidden costs which add an extra burden. These include having to rely on takeaways because the kitchen is not yet in use, or paying for expensive crèche facilities because homes are unfit for small children to play in during the day.

**2.23** Businesses and farmers also face ongoing emotional and financial difficulties as they try to rebuild their businesses, often crippled by rising expenditure coupled with reduced income.

“It's four or five month now, isn't it? It'd be six or seven month before we get open and then we've got to rebuild, business plan back again and start from scratch. It's going to be a massive job.”

**Business, Sheffield**

“Winter's coming. And you're living on a concrete floor with no doors.”

**Householder, Berkshire**

### The public response to the floods

**2.24** Whilst the emotional and financial toll of the floods is undisputable, one positive

### Case Study – Elderly woman from Wychavon area

This elderly woman was on holiday when the floods hit. She was told not to attempt to return home until the water subsided, and remained with friends for a month.

When friends took her to view the damage to her property, it greatly upset her. She was not able to return there, even to look, for some time, but relied on friends to do what was necessary to organise insurance and repairs.

After a month, the insurance company delivered a caravan to her drive so she could return home and be closer to the property while works were carried out. However, being small of stature, she found it impossible to reach the light switches which were on the ceiling, or comfortably use the work surfaces without standing on a stool. She simply burst into tears.

Her neighbours, she said, were wonderful – caring, supportive and always on hand to help. They were staying in a caravan on the adjoining drive and theirs was more compact. A solution was found – the neighbours and the elderly lady exchanged caravans.

aspect of the flooding was a heightened sense of community camaraderie. There were some reports of community division, with resentments arising over perceived disparities in the level of support provided by the authorities. But overall, the need for the community to pull together resulted in new relationships forged with neighbours. People, especially those who were vulnerable, often relied on neighbours for help and support during the flood and clean-up phase, whether in the form of cups of tea, hot meals, loans of equipment, help with cleaning or emotional support. As one householder summed up, “you realise how good people are”.



Residents of Abingdon, Oxfordshire prepare for the floods © Rex Features

“There is one thing that is good, if there are elements of good, that it has brought a lot of people together.”

**Business, Barnsley**

“A lot of people struggled but the community spirit on this estate then was absolutely unbelievable. Everybody pulled together, no matter what, no matter who was there. There are some kids on there that are ruffians and they were the ones wading through the water giving people, who couldn't get out, a loaf of bread or whatever you could get to them.”

**Householder, Sheffield**

### Case study – Coppertops Pub, Worcester

On Friday 20 July, Coppertops pub in Oldbury Road, Worcester flooded when, with no warning, a small brook nearby burst its banks. The landlady, Jenny Wilkes, was extremely shocked by the speed with which her pub flooded. Within a very short space of time, the water was halfway up the outside door, leaving little time to salvage anything from the cellars or ground floor of the property. By the evening, the entire ground floor had flooded right up to the ceiling and the pub had lost its power supply.

It took a week for the floodwaters to subside and, since then, Jenny has been trying to get her business fully up and running. Determined not to be beaten by the flood, Jenny quickly opened the upstairs bar, the only area not to be flooded, lighting it with candles and offering bottled drinks only as the cellars were contaminated. Her regular customers have been very supportive and have helped her business to continue to run.

In October, Jenny was still running her business from the upstairs bar, serving bottles and cans only, while work continued on the rest of the pub. There was power to work the lights and fridges using a generator but still no mains electricity. The ground floor was being refitted, but due to the time it took to dry out and for fixtures and fittings to be stripped out, the contractors were still working on the job. Coppertops Pub did not expect to be back to normal until January. Coppertops Pub is only open for business today because of the resolve of the landlady and the support of the customers.



We rediscovered community spirit, found what I thought was missing, had gone away”  
“People come to our community centre, and want to have a hot drink, sit in a soft chair and just be dry.”

**Residents, Barnsley**





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**WAITING GAME**

**FLOODS SPECIAL**



# Chapter 3: Building a better understanding of the risk

## Summary

This chapter explores the challenges society faces in relation to climate change. It identifies the need for Government policy to prioritise adaptation to climate change, particularly in relation to flooding, where we may already be experiencing the impact. To help us understand how climate change affects us, the chapter explores what further information and risk tools are required so that those on the ground at the local level can manage the change. It sets out some steps which can be taken quickly to address some of the most vital needs.

## A changing climate

**3.1** The summer 2007 floods cannot be attributed directly to climate change, but they do provide a clear indication of the scale and nature of the severe weather events we may experience as a result. The civil emergencies which followed the floods demonstrate that to minimise the impact of these events, we need to change the way we live our lives – and in particular how we organise our built and rural environments.

**3.2** As the world climate warms up, there will be more extreme weather events. The latest report from the United Nations Intergovernmental Panel on Climate Change (IPCC) suggests that global temperatures are likely to rise between 1.1 and 6.4°C above 1990 levels by the end of this century, depending on world emissions. This will result in a significant sea level rise and changes in rainfall patterns. For the UK, some element of climate change is already inevitable.

**3.3** The IPCC report makes it clear that even if current policies to slow the pace of climate change succeed, we will still feel the effects of climate changes well into the middle of the next century. To minimise the impact of those changes, we need to adapt our way of life now.

**3.4** In 2003, the Government commissioned the Foresight<sup>3</sup> report from independent scientists. The report investigated how risks of flooding and coastal erosion in the UK might change over the next 100 years, and what options the Government and private sector could adopt in response. Foresight identified that the results of climate change, including changing rainfall patterns, rising sea levels and stronger storm surges, could greatly increase the risk of inland and coastal flooding. It used a number of

<sup>3</sup>Foresight: Future Flooding, Office of Science & Technology, 2004

scenarios to model projected changes in precipitation, temperature and sea levels associated with a range of greenhouse gas emission levels. From those models, it identified the following major impacts:

- Precipitation changes could cause a two- to four-fold rise in the risk of flooding across the country, with a heavily-increased probability of river flooding in some areas, especially the North and West.
- The risk of coastal flooding could rise between four and ten times over the next 100 years, particularly in the South East due to the combined effects of rising sea levels, surges and storms.

**3.5** Foresight also identified other factors which could have a major impact on flooding levels, such as continued urban development. The annual cost of flood events in the UK could increase from around £1 billion today to £2 billion (at today's prices) by the end of the century, if flood management programmes were to be increased in line with the rising risk – but up to £27 billion if they were not. It concluded that the best and most cost-effective approach to managing flood risk would combine a range of engineering and non-engineering methods. To meet flood management needs, between £22 billion and £75 billion of new engineering might be needed by the 2080s.

**3.6** The IPCC, Stern<sup>4</sup> and Foresight reports helped increase our understanding of the changing world. We now need as a society to face up to the challenge of adapting to climate change. We need to put in place the measures that will allow us to mitigate the effects of climate change and to be ready for the consequences, including flooding.

**3.7** Our understanding of our climate will develop further when the UK 21st Century Climate Scenarios (UKCIP08) are published in October 2008. These scenarios are expected to be the most comprehensive package of climate information ever launched in the UK and will be of interest to anyone who needs to consider future climate in order to adapt to the risks.

### **The need for strong Government leadership**

**3.8** Adapting to climate change will be a challenge for more than just our generation. Logic suggests that the earlier it is started, the easier the job will be and the lower the overall cost. Timely decisions will allow organisations the flexibility to choose the most cost-effective measures, rather than being forced to act urgently and reactively. Early action will also avoid lock-in to long-lived assets such as buildings and infrastructure which are not resilient to the changing climate.

**3.9** The Government has a powerful opportunity to influence the way in which our society adapts to a changing climate. It has shown through its actions on the international stage and here through the introduction of the Climate Change Bill to Parliament that it is prepared to take a leadership role on action to tackle climate change.

**3.10** The Review welcomes the inclusion in the Bill of duties covering adaptation to climate change, and the Government's plan to publish its strategy for adaptation in spring 2008. The Review trusts that lessons from the summer 2007 floods and recommendations in this Interim Report will be reflected in the development of the Bill and the ensuing strategy.

<sup>4</sup> Stern Review: The Economics of Climate Change, Sir Nicholas Stern, 2007, Cambridge University Press.

**IC 1** – The interim conclusion of the Review is that Government takes the lead in making the case for the need for adaptation to climate change and particularly in mitigating the potential impacts on communities.

**IC 2** – The interim conclusion of the Review is that the Government develops a clear strategy and action plan to deliver the provisions of the Climate Change Bill to support adaptation to increasing impacts from flooding.

## The contribution of science to building better understanding

**3.11** Scientific and engineering techniques will play a crucial role in the adaptation strategy we put in place. If flood risk managers and emergency planners and responders are to prevent or reduce the impact of flooding, they must have dependable information on when and where it might flood, and what will happen if it does.

**3.12** As Chapter 5 describes, current tools were used well, within their limitations, during the July fluvial flooding. However, scientific developments mean there is already room for improvement. The June floods indicated that the absence or limitations of some current information-gathering tools meant there were weaknesses in the information available to responders. The Review believes that modelling and risk tools can be substantially improved.

### Modelling and mapping

**3.13** Flood risk maps are used to indicate which areas are at risk from flooding. To produce a flood map, detailed aerial survey information about the height of the land is combined with data on river flows (or, for coastal areas, sea and wave data). Many flood maps and models use historic records

of flows or levels from a network of gauging stations, others use rainfall run-off models. During the summer, many responders used maps based on historic flooding events.

**3.14** The Environment Agency has over the years made good progress with its partners in modelling and mapping river and coastal floods. However during the summer, some of its models did not forecast the extent or speed of the flooding, leading in some cases to inaccurate forecasting and late warnings, as with Mythe water treatment works.

**3.15** The Review believes that there is a clear need to extend the models for river and coastal flooding, drawing on data from the summer's floods, to analyse different extreme scenarios (including multiple flooding events occurring simultaneously or within overlapping time periods) and to capture the impact of saturated ground on flooding risk.

**3.16** In contrast, flood risk maps for surface water flooding simply do not exist. As a result, those responding to surface water flooding in the summer were often dealing with the unpredicted and unexpected. The technical and practical challenges of mapping surface water flooding are clearly much greater than for coastal and river flooding and information needs to be collated from a range of different sources. Even small variations in the built environment such as the height of kerbs and location of street furniture can have a significant impact on water flow and thus the likelihood and scale of flooding. If flood risk modelling for surface water is to be effective, models need to incorporate detailed information on drainage infrastructure and other routes which water will take during a flood.

**3.17** The Review recognises these complexities. Nevertheless, the scale of the surface water flooding problem faced in

summer 2007, and the growing likelihood of similar flooding in the future means there is a clear need for action.

**IC 3** – The interim conclusion of the Review is that the Environment Agency further develops its tools and techniques for predicting and modelling river flooding, especially to take account of extreme and multiple events; and takes forward work to develop similar tools and techniques to model surface water flooding.

**3.18** Whilst most of the summer floods were not of the high velocity experienced in Boscastle in 2004, in many areas they reached a significant depth. Some areas, such as Coalbrookdale in Ironbridge, flooded very quickly. The Environment Agency has identified catchments that could have a rapid response to rainfall as a result of their topography (for example, steep and narrow catchments) and will shortly be disseminating information about them to emergency planners. The Review welcomes this and considers mapping of depth and velocity in high risk areas to be a vital tool for emergency responders and planners to allow them to identify areas where rapid evacuation may be necessary or where certain rescue methods may not be practical.

**IC 4** – The interim conclusion of the Review is that the Environment Agency revises its flood maps to identify areas where there is a risk of significant depths and velocity of water, to improve the effectiveness of emergency planning.

**IC 5** – The interim conclusion of the Review is that the Environment Agency works more closely with Local Resilience Forums to provide information drawn from flood risk modelling and mapping tools to improve the accuracy and consistency of flood risk information in Community Risk Registers.

## Visualisation and real-time tools

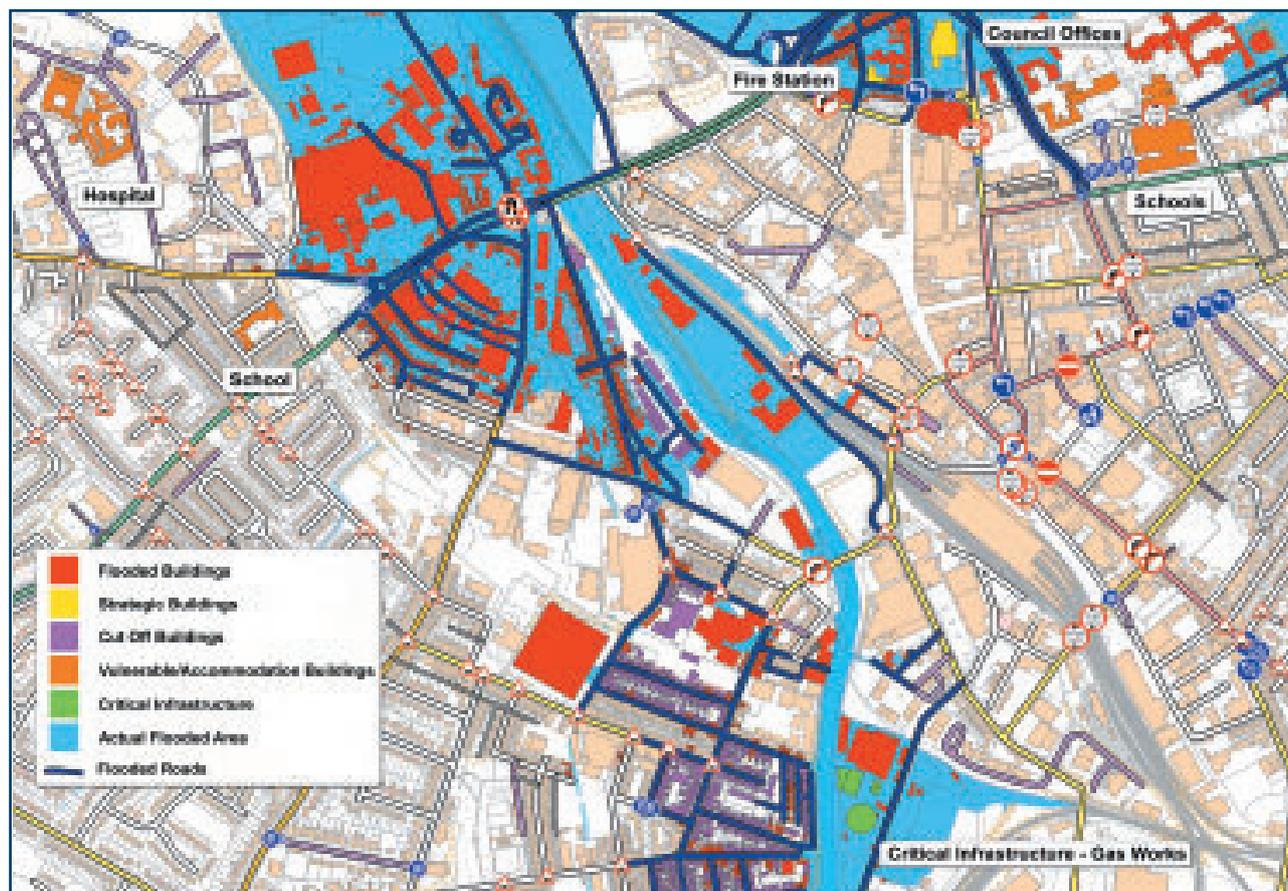
**3.19** The events of summer 2007 also demonstrated how important it is for emergency responders to receive flood risk information with a practical, real-time application. Forecasting, modelling and warning systems could be linked together to give responders information that will help them manage fast-moving events more effectively. This is particularly important where the onset of flooding is rapid and the event does not follow historic patterns.

**3.20** A number of submissions have been made to the Review about the value of visual, map-based tools that allow better spatial assessment of what is happening on the ground. These could potentially have pre-identified hot spots, drainage information or vulnerabilities at ground level. These tools could be used in flood planning exercises to run a range of scenarios to help local responders better prepare, and they could be used during flooding events to assess potential impacts.

**3.21** One example of work underway to improve the forecasting and modelling of all types of flooding is the Atlantis Programme<sup>5</sup>. This brings together datasets from different organisations including river network data, flood models, and geological and topographical data. Figure 9 shows an example of a visualisation map that could be produced to aid flood risk management and response.

<sup>5</sup> The Atlantis Programme is being delivered through a partnership between Ordnance Survey, British Geological Survey, the Centre for Ecology and Hydrology, the Environment Agency, the Met Office and the UK Hydrographic Office.

**Figure 9 – Impact of the Carlisle January 2005 flooding on the built environment**



Source: Ordnance Survey – Strategic Flooding Document 2007

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**3.22** The Review recognises that developing visualisation tools that can cope with the required volume and complexity of data may take some time and it will be important that such tools are cost-effective and easy to use. However, we believe that the Environment Agency and its partners should work to develop and bring such tools into use, and where necessary using simpler versions of these tools until more complex ones become available.

**3.23** None of the advances in modelling and mapping described above will be of value if they are not designed to the needs of those who will use them. The Review believes that research into these tools should focus on how flood risk managers, emergency planners and responders could use them.

**IC 6** – The interim conclusion of the Review is that the Environment Agency progressively develops and brings into use flood visualisation tools, designed to meet the needs of flood risk managers, emergency planners and responders.

### Forecasting

**3.24** Developing the tools described above will substantially help in flood risk management and emergency planning and could also support emergency responders. However the quality of data output in the run-up to a severe weather event will be greatly enhanced by more accurate input forecasts of where the rain will fall.

**3.25** The Met Office already provides a range of weather forecasting services,

including a severe weather warning<sup>6</sup> service for emergency responders and the public. However, at a resolution of around 5km, its models cannot accurately assess the likelihood of heavy rain falling on particular urban areas.

**3.26** The Met Office has indicated that greater accuracy in precipitation forecasting may be achieved soon. During summer 2007, a higher resolution model at 1.5km was run for short periods to test its capabilities. The potential improvement in accuracy is demonstrated in Figure 10, which uses rainfall data for 25 June for Hull and Sheffield. If this higher resolution forecasting capability had been fully available in summer 2007, the accuracy of rainfall prediction would have been greatly improved and more specific warnings could have been made in areas like Sheffield and Hull. This would have allowed emergency

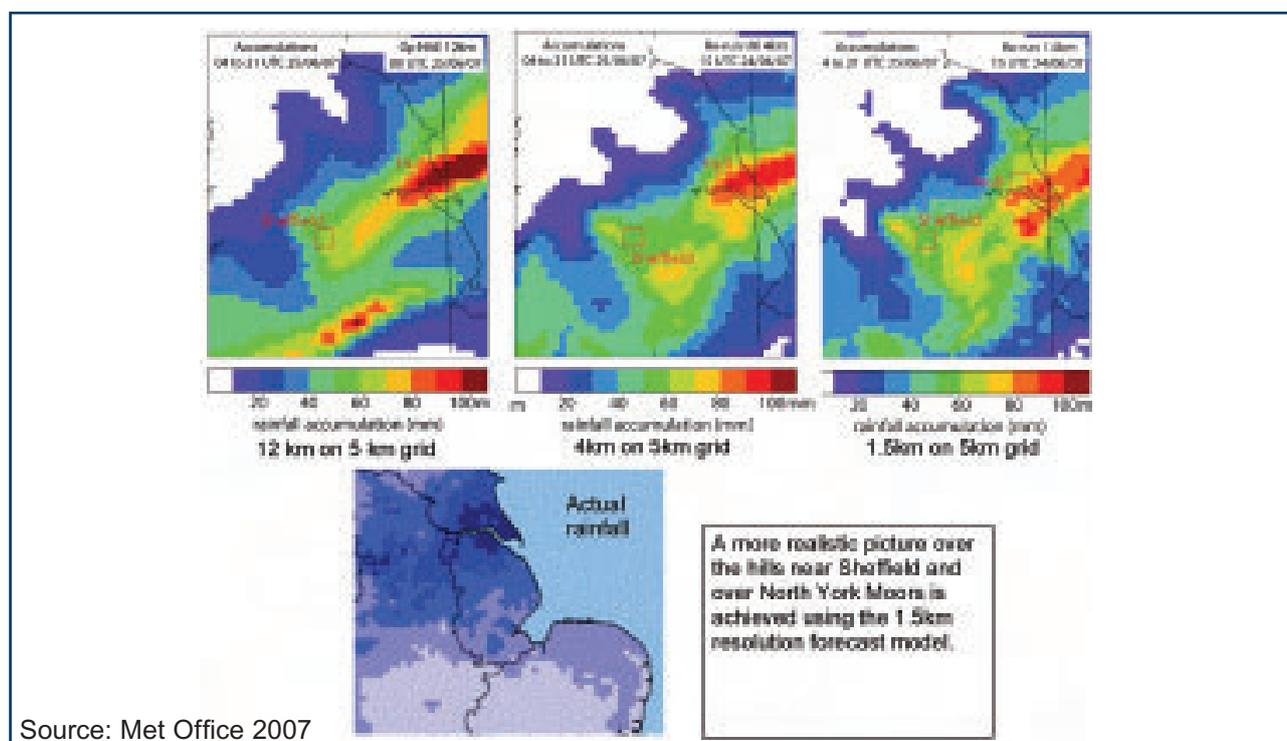
services and local authorities to position their resources in the highest risk areas and focus their support more effectively.

**3.27** Limitations in the capacity of the Met Office's IT systems mean that these models cannot be run routinely until a new supercomputer is purchased in 2009. The Review hopes that this purchase will go ahead as planned, and that superior forecasting capabilities can be introduced to emergency responders as soon as possible.

### Short term action

**3.28** The improvements described above will inevitably take time to implement. However, the events of the summer put a premium on more rapid action. The Review has identified some useful measures which can be put into place quickly in two areas.

**Figure 10 – Met Office forecast models of the rainfall on 25 June 2007 over Hull and Sheffield using different resolutions**



<sup>6</sup>The threshold for a severe weather warning to be issued for heavy rain is that with a greater than 50 per cent chance of probability, it is expected to persist for at least two hours and to give at least 15mm of rainfall within a three hour period, or a period of rainfall of sufficient intensity to cause flooding on already saturated ground.

## Groundwater Flooding

**3.29** Groundwater flooding generally occurs in low-lying areas underlain by permeable layers. This type of flooding is easier to predict as water can build up over a number of months before flooding occurs. However, there is currently no organisation with responsibility to respond to groundwater flooding, although the Environment Agency does monitor and warn in some areas. This gap needs to be addressed.

**3.30** Following the summer 2007 floods, the Environment Agency commissioned a report from the Centre for Ecology and Hydrology and the British Geological Society into the possibility of groundwater flooding this winter. The most recent update of this study has shown that some risk of groundwater flooding remains in areas such as the Chilterns, and parts of Yorkshire and Lincolnshire if winter rainfall is significant. The study's conclusions demonstrate that the risk of groundwater flooding should continue to be monitored.

**REC 1** – The Review recommends that more frequent and systematic monitoring of groundwater levels at times of high risk should be undertaken by the Environment Agency, which should begin as soon as possible to predict and mitigate further serious groundwater flooding from this winter onwards.

## Surface water 'hot spots'

**3.31** The Review has noted that the Environment Agency is assessing the feasibility of developing a rapid, national topographic screening technique to show areas which are susceptible to surface water flooding from heavy rainfall. This information would not be sufficiently detailed or specific for it to be of practical use to the public, but it could help forecast the risk of surface water flooding until higher resolution forecasting is available. In

the interim, even data on surface water flooding 'hot spots' will be of value to local responders.

**IC 7** – The interim conclusion of the Review is that the Met Office and the Environment Agency produce an early assessment of the costs, benefits and feasibility of techniques which can predict where rain will fall and where surface water flooding will occur.

**REC 2** – The Review recommends that the Environment Agency supported by local authorities and water companies, should urgently identify areas at highest risk from surface water flooding where known, inform Local Resilience Forums and take steps to identify remaining high risk areas over the coming months.



# Chapter 4: Managing flood risk

## Summary

This chapter of the Report looks at the various approaches that can be taken to managing flood risk.

It is divided into sections looking at:

- building and planning;
- surface water flooding and drainage issues;
- flood defence; and
- insurance.

## A Risk-Based Approach

**4.1** The events of the summer would have been significantly more devastating had measures not been in place to prevent flooding and mitigate its impact. The range of measures was tested to the full, and there are important lessons to be learned about which work best, especially given the increased risk of flooding described in Chapter 3. All those responsible for managing the risk of flooding, or those personally at risk, need to be clear about what can be done to manage risk effectively – measures ranging from large-scale defences for communities to individual measures such as property-level adaptation.

**4.2** Figure 11 below shows the complicated interaction of different types of flooding and risk management approaches. At the larger scale, these can include physical defences, flood storage, farming practices and development control, and at the individual and property level they can include property resilience and insurance.

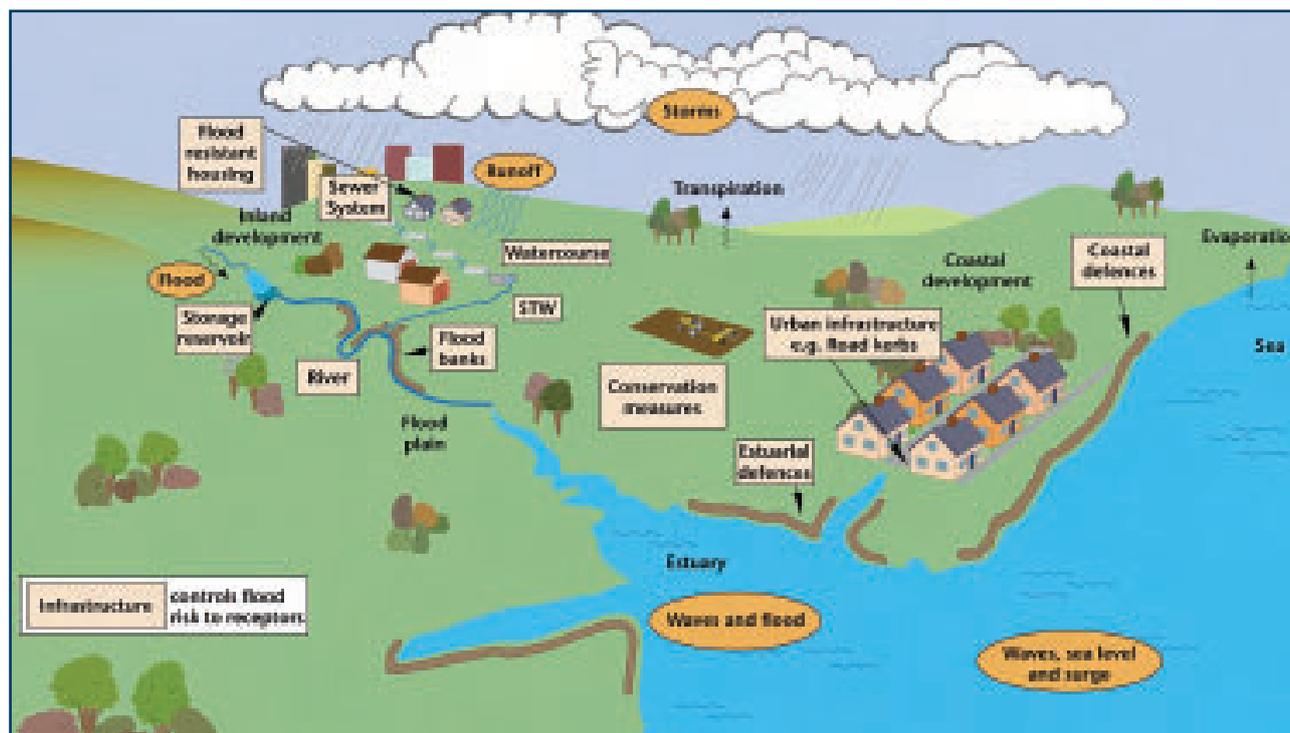
**4.3** Historically, flood risk management has mainly concentrated on river and coastal flooding. A high proportion of this summer's floods involved surface water flooding, alerting us as a society to the need to adopt an approach to managing risk that considers all sources of flooding equally. That said, the policies adopted and the measures put in place need to recognise that the greatest risk in terms of impact still comes from coastal flooding, where the potential for loss of life is significant. The surge events of early November on the East Coast were a reminder of that risk.

## Building And Planning

### Development control

**4.4** In responses to the Review and during our visits, attention was drawn to examples of good and bad design of new development.

**Figure 11 – Types of flooding and risk management approaches**



Source: Foresight Future Flooding 2004

**4.5** Development control is a central part of the process of managing flood risk, by avoiding development in risk areas where possible and, where such development does take place, by ensuring that risk is mitigated both for the development itself and for those living next to it. Many submissions to the Review have highlighted the issue of building on the floodplain and the importance of strong development control, with examples from both June and July’s floods of recent developments where flooding occurred. While the Review recognises that it is not possible to prevent all development on the floodplain, planners and developers must pay proper regard to the risks, as should those purchasing properties.

**4.6** The Government has sought to strengthen planning guidance on flood risk over the last five years, culminating in Planning Policy Statement 25 (PPS25),

published in December 2006. PPS25<sup>1</sup> promotes a strategic approach, ensuring that flood risk is considered at all stages of the planning process and strengthening the importance of flood risk assessments in supporting that analysis (including consideration of climate change). It also reminds planners and developers of the need to consider all sources of flooding, including surface water flooding.

**4.7** PPS25 introduces an exception test for those areas of flood risk where it is felt that development ought nevertheless to take place for exceptional reasons. Some respondents felt that the introduction of this test could be interpreted as a ‘get-out clause’ for local authorities. Local authorities must ensure that, when weighing up all development options, due consideration is given to flood risk. A decision to permit development should not be taken lightly by the planning authority,

<sup>1</sup> More detail is provided in the Practice Guide Companion, which is currently available on the Communities and Local Government website as a ‘living draft.’ [www.communities.gov.uk/publications/planningandbuilding/developmentflood](http://www.communities.gov.uk/publications/planningandbuilding/developmentflood)

### Case study – Flooding at Cypress Gardens, Longlevens in Gloucester



Cypress Gardens, Longlevens, Gloucester

Cypress Gardens is an estate in Longlevens, Gloucester, built within the last ten years on low-lying land adjacent to a brook. It was severely affected by both the June and July events, with flood water from both the brook and overflowing sewers causing water levels to reach four feet in some properties. In contrast, the surrounding area seemed to cope. There has been criticism that insufficient attention had been paid to the drainage of the estate and to maintenance of the brook and flood defences. However, the developers counter that all relevant planning and building approvals were granted.

not least because a prospective purchaser will generally assume that the granting of planning permission signals that the local authority does not perceive there to be a problem with flood risk.

**4.8** When a new development is permitted to go ahead, the developer is responsible for the provision of any necessary flood defences. The local authority must make sure that the developer funds not only the defences themselves but also their ongoing maintenance costs. Once defences have been built, they are likely to be in place for at least 50 years and there is an expectation that they will be maintained

during that lifetime. It is therefore important that an additional burden is not placed unnecessarily on either the local authority's or the Environment Agency's budget through a failure to adequately assess ongoing maintenance costs.

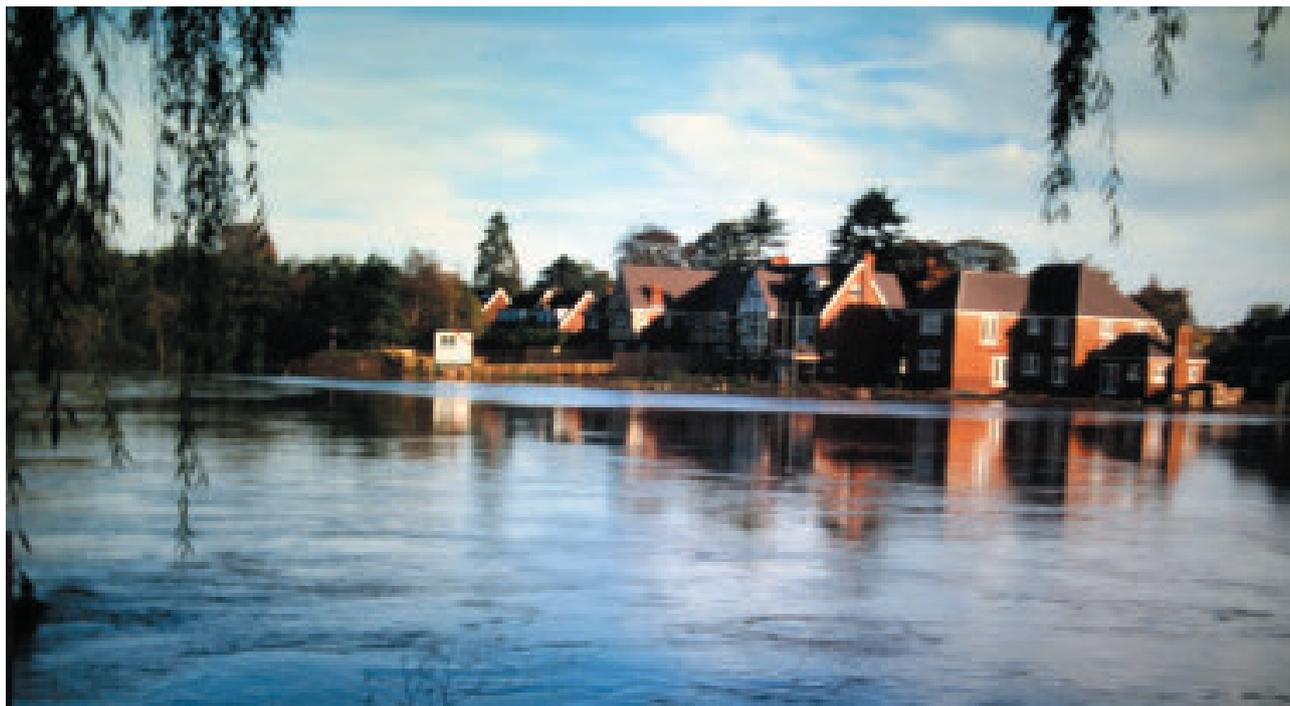
**IC 8** – The interim conclusion of the Review is that PPS25 should be rigorously applied by local planning authorities, including giving consideration to all sources of flood risk and ensuring that developers make a full contribution to the costs both of building and maintaining any necessary defences.

### Case study – Innovative planning: public park acts as valuable flood storage

For over 200 years the public water supply for Worcester came from a waterworks on a four-hectare site on the banks of the River Severn in the urban area. The site was within the functional floodplain but a flood defence was in place, consisting of a high concrete wall.

When the waterworks was decommissioned the owners, Severn Trent Water, in partnership with the City Council planning department and the Environment Agency, agreed a scheme to restore the land to a public park, Gheluvelt Park. Major improvements to flood management were achieved by removing the flood wall, removing the 17 brick and concrete tanks, recontouring the site and restoring the active floodplain. The spoil was used to fill the deeper tanks and housing was developed on an adjoining site, not at risk of flooding. A local river (Barbourne Brook) was also broken out of its culvert and allowed to flow freely through the park and into the river.

Worcester was flooded during the summer and the design worked. The park kept flood levels down in the city by providing a much-needed extra four hectares of flood storage capacity (and throughflow of flood water) and the new housing on its edge did not flood. The park was back in use shortly after the floods, hosting a folk festival and craft fair.



Old waterworks providing valuable storage of flood water for Worcester. Some properties in the adjacent unflooded new development can also be seen

### Urban creep

**4.9** Under natural conditions, a proportion of rainfall infiltrates into the ground but, in urban areas, properties and roads affect natural drainage. The permitted development right is an aspect of the Town and Country Planning (General Permitted Development) Order 1995 which allows private individuals and property developers in certain circumstances to carry out works without planning permission. It covers small developments such as the paving of driveways or gardens and the erecting of garden sheds. The cumulative impact of permitted development on the drainage of surface water is significant and the Government has already announced its plans to look at this issue in its forthcoming Water Strategy. The Review welcomes this.

**IC 9** – The interim conclusion of the Review is that householders and business owners should no longer be able to lay impermeable surfaces as of right.

### Drainage systems – the right to connect

“You see they are building new houses but they aren’t actually updating the existing drains, they are not improving them that were there.”

**Householder, Darfield, Barnsley**

**4.10** Section 106 of the Water Industry Act 1991 provides an automatic right for new developments to connect to public sewers once planning permission has been granted. This places an additional strain on existing sewerage and drainage networks, exacerbating the problems of flooding. Defra is currently considering whether this right should be removed in relation to surface water drainage so that developers of all new developments will have to consider their impact on the sewerage and drainage networks, and make greater use of sustainable drainage systems. A number of drainage systems were clearly under strain during the recent floods and the Review does not consider it sensible to

allow new connections of surface water drainage to the sewerage system to take place unchecked.

**IC 10** – The interim conclusion of the Review is that the automatic right to connect surface water drainage of new developments to the sewerage system should be removed.

### Property-level resistance and resilience

“When the flooding first happened, I wish I’d known the full long-term effects, like how long before the flooding receded and how long it would be before I could move back into my house. If I’d known that I could have prepared myself better and I wouldn’t be in the situation I am in now.”

Householder, Hull

**4.11** This summer’s flooding demonstrated the devastating impact that floods can have on homes and businesses, with some people expected to be out of their homes for almost a year. In Hull, for example, 31 per cent of those households affected by flooding had to move into temporary accommodation. In Tewkesbury, at the end

of November there were still 1,800 people out of their homes, with 200 families expected to be living in caravans over the Christmas period and into early 2008.

**4.12** Property-level resistance and resilience can help minimise the damage from floodwaters and greatly reduce the timescale for recovery of a property. Resistance measures are aimed at keeping water out of buildings, or at least minimising the amount that enters by the use of barriers such as door guards to seal entry points. Resilience measures are aimed at minimising the damage when a building is flooded, thereby facilitating the quickest possible recovery.

**4.13** Despite the evident benefits of these measures, their uptake is not high. The Association of British Insurers (ABI) recently commissioned a survey of public attitudes to climate change risk, including flooding.<sup>2</sup> The overwhelming majority of the 2012 respondents (85 per cent) identified flooding as a risk affecting the UK, but only 16 per cent considered themselves at risk. While 57 per cent believed that individuals had a key role in protecting against the effects of climate change, only six per cent said they would use resistant or resilient materials and products.

### Case study – Resilience measures: “It has made a huge difference to me”

A householder’s home near Worcester flooded both in 2000 and in the summer 2007 floods. Following the flooding of her lower ground floor in 2000, she had resilience measures installed. These included lightweight doors which could be removed to an upper floor, electricity sockets sited high up on the walls, concrete floors, cement-type plaster on the walls, and wooden skirting boards made water-resistant with many coats of yacht varnish. These measures meant that after the lower ground floor flooded in summer 2007, the householder was able to disinfect the affected rooms, let them dry out and move back in once a builder had repaired a breach in the concrete floor. The only loss was a carpet. When the rooms flooded in 2000, they were unusable for seven months, but their refurbishment with simple resilience measures meant that after the 2007 floods they were out of use for only four weeks and no insurance claim was made. The householder says “It has made a huge difference to me – coupled with the no insurance claim. And yes, I am a huge convert!”

<sup>2</sup>YouGov survey for ABI, August 2007, 2012 respondents.

**4.14** The Review received evidence of a Defra programme of pilot resistance and resilience grant schemes to test different approaches to reducing the impacts of flooding damage on householders, and to see how such grants could best be made available. Together with a parallel research project looking at which barriers to uptake, this will help inform long-term decisions over the feasibility of a grant scheme and other approaches. The Review will explore with Defra the emerging conclusions of its pilot schemes and consider the issue further in its final report.

### New buildings

**4.15** Where development (following the strict application of planning guidance) is allowed on the floodplain, buildings should be made flood resilient. The Government has recently produced guidance to developers on flood-resilient construction.<sup>3</sup> Developers and architects should be incorporating such measures into designs for the future. The simplest way of ensuring that new buildings do incorporate appropriate measures would be to include a requirement in Building Regulations. The Government has indicated that it aims to do this when they are next revised in 2010. The Review welcomes this intention.

**IC 11** – The interim conclusion of the Review is that no new building should be allowed in a flood risk area that is not flood-resilient, and that the Government should work with organisations such as the Royal Institute of British Architects and the building industry to encourage flood-resilient building and development design.

**IC 12** – The interim conclusion of the Review is that the Government should incorporate flood resistance and resilience requirements for new properties in flood risk areas into Building Regulations as part of the current process of revision.

### Existing buildings

**4.16** With some 10 per cent of properties situated in flood risk areas, and some 500,000 houses at greater than 1.3 per cent probability of being flooded in any one year,<sup>4</sup> adapting the existing housing stock presents a big challenge. A recent report commissioned by Defra indicates that the cost of properly applying resistance and resilience measures can typically range from £3,000 to £10,000 for a single property.<sup>5</sup> While such expenditure is significant, some measures may not cost more than standard repairs and could pay for themselves in a single flood event.

**4.17** There is, however, currently little incentive to repair flood-damaged properties with resilient materials, as insurers will generally not pay for betterment of a property but only for like-for-like repairs. In one case after the recent floods, simply moving a fuse box higher was considered to be betterment and was therefore not covered. Some insurance companies will, however, allow payment up to the like-for-like amount, with the policyholder paying the extra cost of a resilient repair.

“Well, it happened 110 years ago and now, so by the time it happens again we are not going to be here.”

Householder, Sheffield

<sup>3</sup> *Improving the Flood Performance of New Buildings – Flood Resilient Construction*, CLG, 2007

<sup>4</sup> *Sustainable Development Indicators*, 2006, [www.sustainable-development.gov.uk](http://www.sustainable-development.gov.uk)

<sup>5</sup> Bowker P, 2007, *Flood Resistance and Resilience Solutions: An R&D scoping study*, R&D Technical Report

**4.18** The Review considers that, in view of the obvious benefits, Building Regulations should be extended to ensure that where a property in a high flood risk area is undergoing major refurbishment, that it is refurbished using flood-resilient or resistant materials. Such an approach to flood resilience is consistent with the approach currently in place within Building Regulations in relation to energy efficiency: when replacing windows, the new ones must be double-glazed, and when a boiler is replaced, the new one must be energy-efficient. The suggested approach should also ensure that the issue of betterment in relation to insurance is addressed, as insurers will normally pay for improvements if they are part of a legal requirement.

**IC 13** – The interim conclusion of the Review is that the Government should incorporate requirements for resistant or resilient refurbishment of flooded properties in high flood risk areas into Building Regulations as part of the current process of revision.

**4.19** The Review recognises that it will take some time to incorporate resistance and resilience requirements into Building Regulations for properties in flood risk areas, and would like to see local authorities and social housing organisations take a leading role in increasing uptake. In their evidence to the Environment, Food and Rural Affairs (EFRA) Select Committee, Hull and Sheffield City Councils both expressed an interest in refurbishing buildings with resilient materials. The Review welcomes this initiative. Local authorities in affected areas could also make use of their powers under the Regulatory Reform (Housing Assistance) (England & Wales) Order (July 2002) to extend home improvement grants and loans to householders and businesses that

wish to reinstate their properties with resistant or resilient materials.

**IC 14** – The interim conclusion of the Review is that local authorities and housing associations should take a more active role in increasing the uptake of flood resistance and resilience measures, leading by example by repairing their properties with appropriate materials where it is cost-effective.

**IC 15** – The interim conclusion of the Review is that local authorities in high flood risk areas should extend eligibility for home improvement grants and loans to encompass flood resistance and resilience products.

“We have had all the electrics done; we’ve had to take out two central offices in the building and we are building a new reception office; the fencing around the property has had to come down; we have erected new fencing; and we are having a new brick wall and iron gate at the front of the premises.”

**Business, Toll Bar, Doncaster**

**4.20** There are clear benefits to installing flood resistance or resilience measures in business premises as well. Such measures should ensure a swifter reoccupation of a building and reduce the amount of time the business is out of operation. A recent survey of businesses<sup>6</sup> indicated that, of those affected by the summer 2007 flooding, nearly a third experienced flooding at their premises and 18 per cent saw a drop in income. Installation of flood resilience and flood resistance measures could represent a sound business investment and should be encouraged. There is evidence of some businesses

<sup>6</sup>Direct Line Business Owners’ Survey, November 2007

introducing such measures following the floods, including the relocating of certain services away from the ground floor. Local authorities, in carrying out their responsibilities to promote business continuity, should be encouraging the installation of flood resilience and resistance measures and business continuity guidance should reflect the benefits of such measures.

**IC 16** – The interim conclusion of the Review is that local authorities, as they discharge their responsibilities under the Civil Contingencies Act 2004 to promote business continuity, should encourage the uptake of property-level flood resistance and resilience measures. This should be reflected in guidance from the Government.

## Surface Water Flooding And Drainage

“They’re all pointing the finger at each other, saying you’re responsible – one party’s blaming another.”

**Business, Sheffield**

### Stronger leadership

**4.21** As Chapter 1 describes, a much higher proportion of the flooding during the summer was a result of poor surface water drainage rather than flooding from rivers. Many of the responses to the Review highlighted the current unsatisfactory arrangements for managing surface water flooding. In addition to the lack of information on surface water flood risk (as set out in Chapter 3), the range of responsibilities and lack of any overarching leadership have resulted in poor co-ordination and ownership of the issues that need to be tackled. The EFRA Select Committee recently noted with

astonishment that it was only following the summer 2007 floods that those with responsibilities in relation to surface water flooding in Hull got together to discuss drainage issues. However, Hull is unlikely to be alone in leaving these issues unaddressed.

**4.22** The Review has been told that the Government had been looking at this issue before the summer 2007 floods and was advocating a joined-up approach to drainage management – especially in high-risk urban areas – which would bring together the various bodies concerned with drainage (including the Environment Agency, local authorities, water companies, internal drainage boards, the Highways Agency and British Waterways). In light of this summer’s events, the Review believes that this work should now be speeded up.

**4.23** The weight of evidence suggests that a partnership approach is the best way forward given the range of interests involved – it would not be practical, for example, to move responsibility for all assets to one body. Nevertheless, a partnership will need strong leadership, at both local and national levels, if it is to be effective. At the local level, the Review believes that local authorities are best placed to take a stronger role in managing local flood risk, particularly in relation to surface water flooding. Local authorities act as local planning authorities, with a substantial role in risk management, and are heavily engaged in the Local Resilience Forums which undertake emergency planning. Moreover, as part of their ‘place-shaping’ role, they are well positioned to launch dialogues with their local communities and other partners about the risks of flooding and possible responses.

**IC 17** – The interim conclusion of the Review is that local authorities should lead on the management of surface water flooding and drainage at the local level with the support of all responsible organisations including the Environment Agency, water companies and internal drainage boards, the Highways Agency and British Waterways.

**4.24** In delivering their local leadership role, local authorities will require a range of capabilities including technical, analytical, communication and influencing skills. However, many local authorities have seen some relevant services (such as engineering departments) shrink with the move to greater outsourcing. While it may not be necessary to have full expertise in-house, the Review believes that authorities should at least have staff who can perform an ‘intelligent customer’ role, for example knowing when to challenge contractors and consultants and what modelling to commission to aid decision-making. The Review is encouraged that, in higher-risk areas, the capability should in many cases already be there. In Leeds, for example, which saw flooding of 250 properties in June and July 2007, the council has recognised that flood risk is a significant issue and has developed strategies to address this and taken on more technical staff. This kind of upskilling might have implications for the overall supply of technical experts, something which the Review will consider in time for its final report.

**IC 18** – The interim conclusion of the Review is that local authorities in flood risk areas should assess their capabilities to deliver their wide range of responsibilities in relation to local flood risk management.

**4.25** This enhanced local leadership role for local authorities will work best within a

broader framework which provides them with relevant advice and guidance. The Review considers that the Environment Agency is best placed to deliver the national, strategic role in relation to surface water flooding, which will involve developing maps, warning systems, options for modelling and the standard analytical framework around which the risks are understood. This will be consistent with the Agency’s national role in relation to coastal and river flooding. Such an approach has been suggested both by a number of submissions received by the Review and as part of Defra’s Making Space for Water programme. The Agency would accordingly need to provide a toolkit to local authorities to enable them to work to a consistent standard and deliver an effective approach to managing and understanding local flood risk.

**IC 19** – The interim conclusion of the Review is that the Environment Agency should have a national overview of all flood risk and that, Defra’s work on the development of a national overview role for the Agency in relation to surface water flooding should be progressed.

### **Better co-ordination and information**

**4.26** PPS25 and other recent changes to the planning system should provide an effective approach to managing surface water risk through the requirement for Strategic Flood Risk Assessments and Surface Water Management Plans (SWMPs). Planning guidance states that SWMPs should focus on flood risk management and the optimisation of sustainable drainage infrastructure. They should also take account of the risks of surface water and sewer flooding and how these might affect an area in combination with flooding from rivers and (where relevant) canals, reservoirs, the sea or groundwater. Under recent planning

changes the Environment Agency has a role in scrutinising Strategic Flood Risk Assessments, which will inform SWMPs, to ensure that they adequately address all flood risk issues.

**4.27** By considering both underground and overland systems, these plans should help local authorities and their partners to manage surface water flood risk more effectively, including reducing the potential for surface water run-off and overloading of the underground system. They should thereby ensure that the drainage system as a whole is able to cope with a bigger event than any individual part of the system alone. Figure 12 below demonstrates how understanding of the whole urban system is important for managing the risk.

**4.28** Plans should also be used to improve flood risk management, inform Community Risk Registers and aid emergency planners in identifying high-risk areas. They should also be used to inform land-use planning

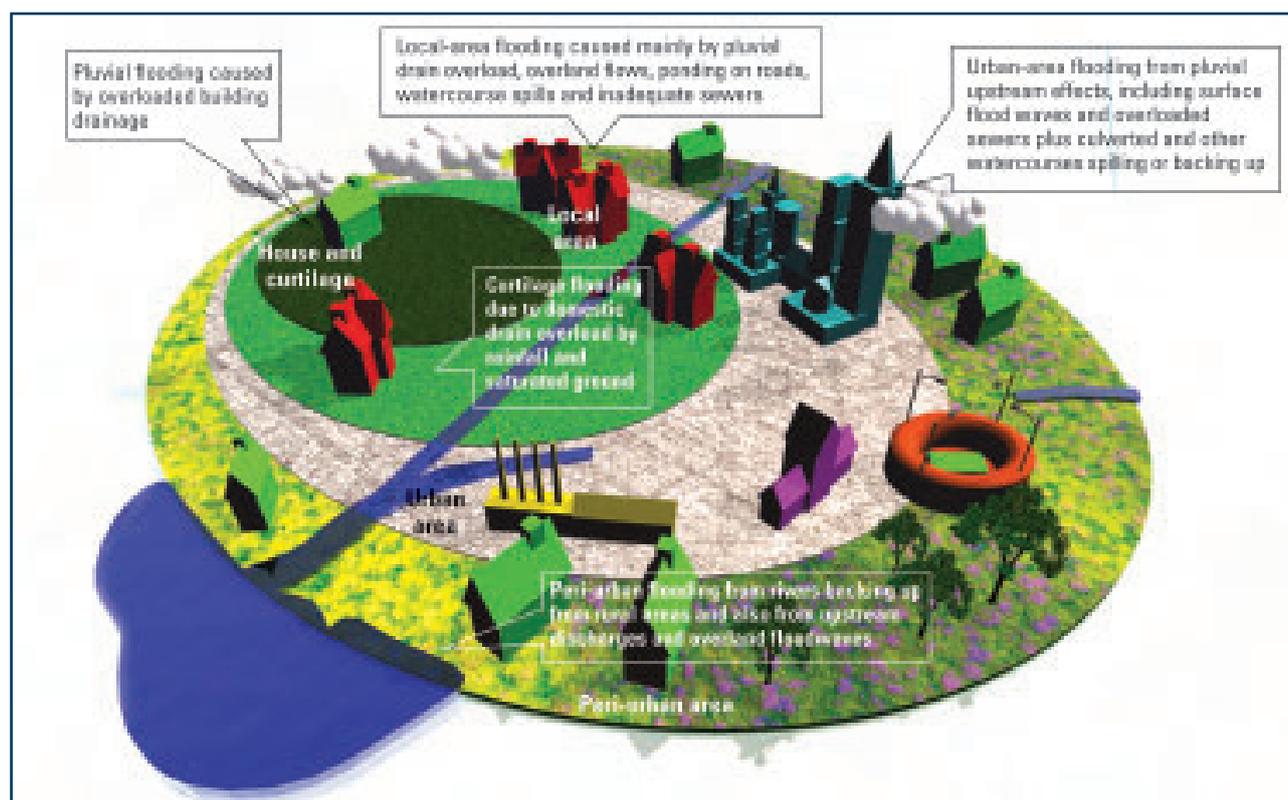
for both new and existing development, including identifying options for flood storage and sustainable drainage systems, and to provide an overall framework for directing resources in terms of both new assets and prioritisation of maintenance on the basis of risk.

**4.29** The production of SWMPs should be coordinated by the local authority with data provided by all those organisations with assets within the drainage area in question.

**IC 20** – The interim conclusion of the Review is that local Surface Water Management Plans, as set out under PPS25, should provide the basis for managing surface water flood risk. These plans should be coordinated by the local authority and be risk-based, considering all sources of flooding.

**4.30** One of the concerns raised during the floods was the lack of overall knowledge of

**Figure 12 – Flood risk management in an urban system**



Source: Foresight Future Flooding 2004

the location and condition of flood defence and drainage assets and who was responsible for their maintenance. At the main river and coastal level, the Environment Agency has the National Flood and Coastal Defence Database in which details of all known river and coastal flood defences, Environment Agency-owned or otherwise, are held. During the summer 2007 floods, British Waterways (see case study below) was able to use its canal system to assist in lowering water levels. If information on its systems were to be made part of an overall register and plan, identification of important assets for flood risk management and decisions on when it would be appropriate to use those assets would be facilitated.

**4.31** Following the floods in Harlow in 2006, the local authority scrutiny committee recognised the value of sharing information between partners and the need to create a register of drainage assets. Leeds City Council has also developed an asset register to ensure more effective management of the drainage system. Moreover, a number of submissions to the Review have continued to raise the issue of who is responsible for what within a given area.

**4.32** To support the production of SWMPs, the Review considers that, local authorities

should lead and co-ordinate the development of a register providing information on local drainage systems. This register should include all watercourses, culverts, drains and gullies, and any other relevant assets such as pumping stations, sewerage infrastructure, canals and flood defences, with an assessment of their condition and ownership. Such a register will be a vital first step in addressing the current fragmented understanding of local drainage systems.

**IC 21** – The interim conclusion of the Review is that a local register of all the main flood risk management and drainage assets (overland and underground) should be compiled by the relevant local authority, including an assessment of their condition and details of the responsible owners.

**4.33** Each SWMP should be accompanied by an action plan setting out the actions to be taken by all those engaged in flood risk management and with responsibilities in this area, which may often include the Environment Agency in its local capacity. These action plans should be developed in partnership with the relevant organisations and led by the local authority.

### Case study – British Waterways

British Waterways manages and operates the inland waterways system of canals and discharge structures which are intrinsically linked with the UK's land drainage and river systems. During the summer 2007 floods, British Waterways played an important role in a number of different ways, including:

- managing canal levels to create extra capacity to help cope with the flood volume. The most significant case was the lowering of the Gloucester and Sharpness Canal, which created sufficient capacity to enable the emergency services to pump water from Walham electricity switching-station in Gloucester in order to prevent it from flooding;
- helping to source water for a number of boat-dwellers in Gloucester; and
- assisting the emergency services and residents in areas such as Yorkshire and the East Midlands by supplying sandbags and other flood materials.

**4.34** Water companies will have a crucial role in the development of effective registers and action plans, providing information relating to the location and condition of their drainage infrastructure. They should also be able to provide basic modelling of the flows of water through their networks and what would happen if these were exceeded. Other organisations, such as the Highways Agency and British Waterways, will also need to provide similar information on their assets.

**4.35** The resulting actions should be risk-based and form part of a coherent strategy for managing the local risk of flooding; such a strategy should in the longer run bring benefits for all parties, as the impact and cost of flooding are reduced. Government guidance should be developed that establishes clear roles and responsibilities so that organisations can be held accountable, and the benefits of cooperation be clearly understood.

**IC 22** – The interim conclusion of the Review is that Defra should issue guidance on how all organisations can be brought together to work with local authorities on surface water flood risk management, sharing information, modelling and expertise on a consistent basis.

#### **Tools for surface water flood risk management – slower water and better drainage**

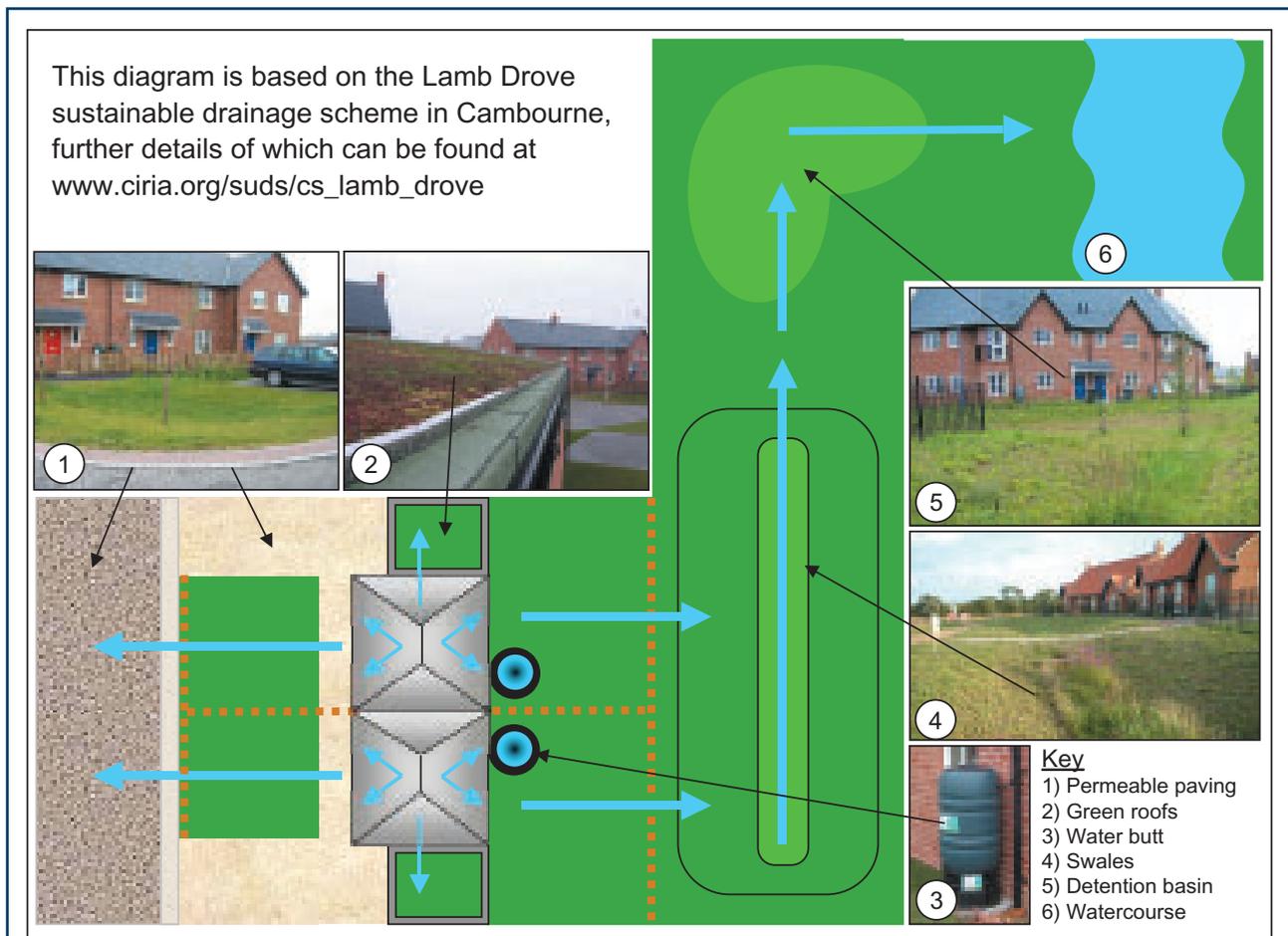
**4.36** The Review has taken evidence on some of the practical ways in which local planning might tackle surface water flooding risk. The events of summer 2007 exposed certain limitations and showed that certain kinds of approach were particularly effective.

**4.37** Management of surface water through the overland system is generally considered more effective and efficient than relying solely on the capacity of underground systems. Slowing down the water and storing it before it reaches the piped system can greatly reduce the potential impact of surface water flooding. In less extreme circumstances than summer 2007, this approach should be able to prevent flooding.

**4.38** Sustainable drainage systems mimic natural drainage patterns and help to deal with 'exceedance' water from existing drainage and sewerage systems. They cover a wide range of structures and techniques for surface water drainage, which are considered to be more sustainable than conventional piped systems. Figure 13 illustrates some of these systems which can, and have been, incorporated into new housing developments.

**4.39** The major obstacles to the wider uptake and implementation of such systems revolve around arrangements for their ownership, maintenance and funding. The barriers to uptake have been considered by the Government and stakeholders for several years. Many submissions to the Review have indicated that decisions now need to be made to remove these barriers.

**IC 23** – The interim conclusion of the Review is that the Government, as part of its Water Strategy, should resolve the issue of which organisations should be responsible for the ownership and maintenance of sustainable drainage systems.

**Figure 13 – Diagram of how SuDS can be used on a local scale**

Source: Diagram based on CIRIA Website – Lamb Drove Case Study ([www.ciria.org/suds/](http://www.ciria.org/suds/)) – Photos by Royal Haskoning and Cambridgeshire County Council

When Sheffield County Council carried out a survey among people who had been flooded in the area, the most common issue mentioned in relation to prevention of and protection against floods was that drains need to be cleaned on a regular basis (35 per cent of respondents).

“I don’t know when they [drains] got cleaned last. They stopped maintenance a few years ago.”

**Business, East Riding of Yorkshire**

**4.40** A number of submissions to the Review raised concerns about the ability of drainage systems to cope with the volume of rain that fell during June and July 2007. It is generally accepted that there were

multiple causes of flooding and that the summer’s flooding was extreme. However, a number of people believe that poor maintenance of drainage systems was the primary cause. The main issues raised by those who provided evidence was that local authorities no longer cleared drains, that some drains were visibly blocked and that, even when these had been reported there had been no response.

**4.41** There are currently no mandatory standards for flood protection in drainage systems. Water companies and developers are commonly installing sewers to cope with events that have a 1-in-30 chance of occurring in one year. This is in accordance with Sewers for Adoption guidance issued by Water UK, but it is not a mandatory requirement. The network also includes a legacy of older sewers which still function

well in general but operate at lower standards.

**4.42** The Review found that the issue of sewer capacity was often dismissed as a reason for urban flooding in the June 2007 emergency because the rainfall in one day appeared much more severe than a 1-in-30 chance event.

**4.43** However, the Review also found other evidence that sewer systems in many urban areas should have coped better. The flooding in Hull illustrates this and underlines the importance of the design, operation and maintenance of the drainage system as a whole. The recent final report of the Independent Review Body into the summer 2007 floods in Hull<sup>7</sup> found that Yorkshire Water's 2001 Humbercare modernisation works had significantly reduced the capacity of drainage systems in east and west Hull from an ability to cope with a 1-in-30 chance storm event to around a 1-in-2 chance event. Permanent solutions had been suggested in 2004 and 2006, but a temporary solution was implemented instead which resulted in serious operational difficulties during the summer 2007 floods. The Hull report found that, although the summer storm event was severe, many properties were flooded with only a few centimetres of water. It concluded that, had earlier recommendations been followed to maintain the standard of flood protection of the drainage system, some of the flooding would not have occurred.

**4.44** This Review found that there also seemed to be wide-spread confusion about what standards for protection against sewer flooding actually means. The Independent Review Body report into the Hull floods and submissions to the Review highlighted the apparent large difference in the standards of protection offered by flood defence

schemes (typically a 1-in-100 chance event, or worse) and drainage systems (1-in-30 chance event at best) and that this discrepancy was unreasonable. However, other evidence indicates that the difference is less than it might appear because whilst rainfall over a one-day period or longer may be a 1-in-100 chance rainfall event which flood defences have to cope with, it is not necessarily more severe than a 1-in-30 sewer design flow, which is based on a much shorter rainfall duration. Whilst this may be true, it is clear that there is large variability in the standards of drainage systems, with confusion over what the standards actually mean in reality and that there is a need for more consistent, higher standards for drainage systems.

**IC 24** – The interim conclusion of the Review is that Defra should work with Ofwat and the water industry to explore how appropriate risk-based standards for drainage systems (including pumping stations) can be achieved.

**4.45** Implementation of the recommendation above will, however, only improve the capacity of drainage systems over time. It would clearly be prohibitively expensive to replace the entire network in a short period of time. In the interim, increasing the capacity in one place while restrictions remain elsewhere in the system may result in the transfer of flooding and pollution further downstream. Consideration therefore needs to be given to how best to improve the existing network without adversely affecting other areas.

**4.46** There are a number of other measures that water companies could take to assist in the mitigation of surface water and sewer flooding. These measures could be implemented and encouraged through Ofwat's 2009 Price Review (PR09). The

<sup>7</sup> *The June 2007 Floods in Hull*, Final Report by the Independent Review Body, November 2007

Review will be putting forward these recommendations to Ofwat before it finalises its approach to PR09 in March 2008:

- **Charging for surface water run-off** – Currently, four water companies charge businesses for surface water run-off on the basis of the area of impermeable land surface at their site. Severn Trent Water charges for surface water drainage by type of property.
- **Rebates for not requiring surface water drainage** – The current water service charge includes the collection and treatment of surface water drainage from run-off. If customers can demonstrate that they do not receive or require this service then they should be entitled to a rebate. This policy could be extended to provide customers with a rebate if they take measures to reduce the amount of run-off going into the drainage network.
- **25-year Strategic Direction Statements** – At Ofwat’s instigation, each water company is preparing, and will publish, a 25-year statement which will describe how it plans to run its business in a more sustainable way and how it proposes to tackle the challenges that climate change will bring. These statements should be linked into the SWMPs described above.

**IC 25** – The interim conclusion of the Review is that, as part of the forthcoming water industry pricing review, the water companies, in conjunction with local authorities and other partners, should develop proposals for investment in the existing drainage network to deal with increasing flood risk.

### **The role of Drain Maintenance**

*“Two days after the flooding the council sent out drain cleaning teams in our area – I believe most residents would consider this a little late.”*

#### **Householder, Humberside**

Many responses to the Review felt that poor maintenance of drains was a major reason for the extensive surface water flooding. In extreme events such as those seen in the summer, drain maintenance is not thought to be a significant factor. Firstly, with very intense, prolonged rainfall, the water will not channel quickly enough down the drains and will find alternative routes; secondly, even if the drains were totally clear to begin with, they can very quickly become filled with debris swept in by the floods; thirdly, if the outfall area, for example the river, is high, water may not be able to drain out of the system; and fourthly, some of the drainage system can simply be overwhelmed by the sheer volume of water.

However, drains do play a significant role in preventing flooding from the vast majority of events, which are less extreme, and operators should ensure that an appropriate maintenance regime is in place.

### **Effective scrutiny**

**4.47** A number of local authority scrutiny committee hearings were held following the summer 2007 floods, including in the East Riding of Yorkshire, Gloucestershire, Doncaster and Berkshire. These focused on the lessons to be learned for the future and provided useful information for this Review. The Review considers that holding scrutiny meetings in flood risk areas as a matter of routine would send a powerful leadership message. Such an approach would give locally elected members the opportunity to ask questions about decisions concerning the management of

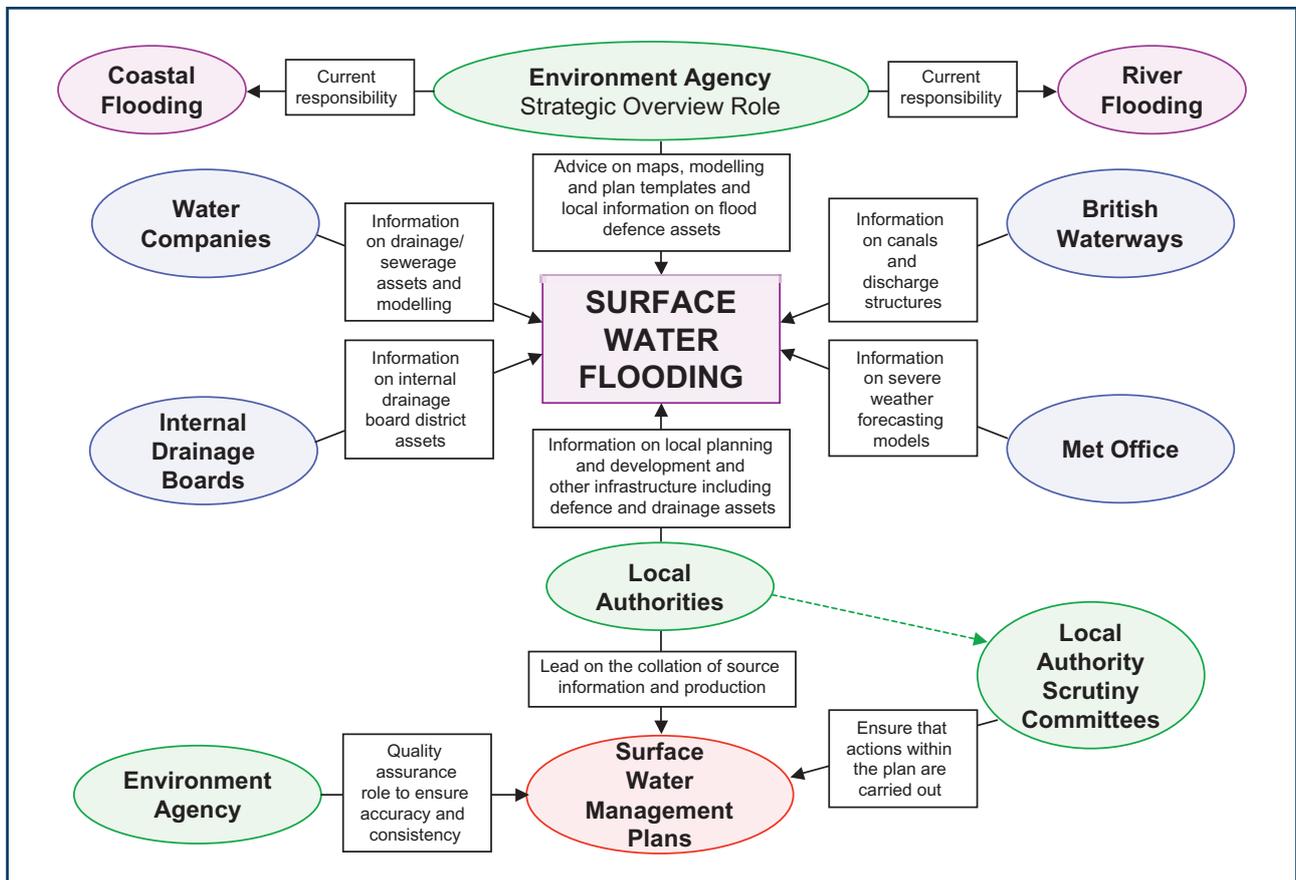
local flood risk, based upon actions within a number of public documents such as the SWMPs, Local Development Frameworks and Community Risk Registers.

**4.48** If all those with responsibilities were asked to attend, including representatives from water companies, local authority drainage officers and the local Environment Agency, scrutiny meetings would also provide local authority members with the opportunity to engage with all relevant parties and monitor progress. Local authority scrutiny has the benefit of giving greater impetus to ensuring that risk-based actions, once decided, actually take place. It should also ensure a greater understanding of both local issues and the national context. Scrutiny should lead to greater transparency for the public, including better understanding of local maintenance regimes, risk and options for

managing risk. Finally, it should establish whether proposed local schemes are likely to proceed and, if not, the reasons for this. A possible partnership model to achieve these ambitions is set out at figure 14 below. In order to deliver this scrutiny role effectively, the Review will consider whether a duty on responsible bodies to co-operate with and have regard to the policies and scrutiny of local authorities is needed, and will return to this issue in the final report.

**IC 26** – The interim conclusion of the Review is that local authority scrutiny committees should review SWMPs and other linked plans, such as Local Development Frameworks and Community Risk Registers, to ensure that flood risk is adequately considered and to ensure greater transparency and progress in the management of that risk.

**Figure 14 – A model of how different authorities could work together to deal with surface water flooding**



## Flood Defence

**4.49** The most direct and well-understood model for managing flood risk is flood defence. In deciding where river and coastal defence schemes should be built, the Government has developed prioritisation approaches that aim to provide a fair and transparent means of distributing investment to get best value across a wide range of projects. That analysis is done on a national basis, using an objective system based on the benefit each proposal is likely to provide compared to its cost. It reflects the fact that it is not possible to justify defending all locations to the same standard – or even at all.

**4.50** One consequence of the events of summer 2007 has been a substantial increase in the demand for flood defence works, particularly for those areas most directly affected. However, not all areas can be protected, and the Review is of the opinion that a risk-based approach has to be taken. The infrequency and uncertainty of flooding means that decision-making has to be based on estimates of future risk. A significant number of river flood defences were overtopped during this summer's events. This has led to some submissions querying whether recommended standards of protection for flood defences should be reviewed by Government; the Review will consider this issue in time for the final report.

**IC 27** – The interim conclusion of the Review is that it is appropriate for the Environment Agency and other local organisations to continue to focus investment on areas of highest assessed long-term risk, whether or not they have been recently flooded.

**4.51** As set out in Chapter 3, adaptation to flood risk will take a generation. Government and society need to manage risk within a framework that encourages the development and implementation of a range

of measures, rather than simply the building of individual flood defences, and that sets out a roadmap of how risk management will be funded over a greater time period than current Government three-year spending cycles. Defra and the Environment Agency are developing proposals for a Long-Term Investment Strategy, which is likely to include proposals for a long-term capital investment programme.

**4.52** The Review recognises that creating a long-term investment programme will give greater certainty as to which strategies will be delivered and enable fuller consideration of longer-term options and outcomes. It should also encourage local authorities and other partners to think across the longer term and consider what further adaptation and resilience strategies are required for their communities.

**IC 28** – The interim conclusion of the Review is that the Government should commit to a strategic long-term approach to its investment in flood risk management, planning up to 25 years ahead.

### Maintenance of defences and watercourses

“I don't think they (the EA) count it as flooding if farmland is flooded – they just see it as a reserve to be flooded – and quite rightly to save towns from being flooded.”

**Farmer, East Riding of Yorkshire**

### Dredging and clearing river channels

“I asked the workers ‘are you clearing the silt?’ and they said ‘no’ which I think is quite monstrous because homes are being flooded over and over again, some six times, some eight times in the last seven years”

**Landowner, Gloucestershire**

The Review found through panel research and other evidence that the public were often concerned about an apparent lack of channel maintenance and its possible role in making flooding worse.

Channel maintenance involves: dredging (mechanical removal of earth and silt from the river bottom); removal of aquatic weeds; and clearing of blockages from the river. The Environment Agency spends around £3 million a year on dredging and £8 million on weed control of its “main” rivers.

The Agency considers such measures to have limited benefit. This is because:

- a. river channels generally convey water within their banks only at low to medium flows. Above these flows the river will spread onto the floodplain, which is a part of the river. So clearing the channel adds only a small proportion to the flow capacity; and
- b. widening and deepening channels beyond their profile encourages erosion and deposition, by which the river seeks to return to its natural profile. Dredging only increases capacity for a short period and also adds to downstream flood risk.

The Agency normally clear weeds from mid-June to mid-March to avoid disturbing nesting birds. Before the summer floods, they had cut weeds on only a few watercourses. Although the Agency believes this had only a minor effect on overall flooding, many farmers and rural communities do not agree. With an increasing risk of summer flooding, the Agency has said it will reconsider the timing and frequency of certain maintenance works.

**4.53** Concerns have been raised in rural areas that poor maintenance may have contributed to the severity of the floods, with properties and land flooding more quickly than expected; and that watercourses and ditches were not being cleared as a result of environmental and/or financial factors. Submissions to the Review have also suggested that the undervaluing of agricultural land means that much land is either undefended or, where there are defences, that maintenance is being reduced.

**4.54** The Review has received information on the risk-based system by which the Environment Agency decides where to focus maintenance, which can lead to decisions in some low-risk areas to withdraw from maintenance or reduce maintenance significantly. This approach was recently supported by the National Audit Office in its report to the Public Accounts Committee.<sup>8</sup> In some cases where decisions to reduce maintenance are made (such as in Kent), the Environment Agency discusses its proposals with key stakeholders such as landowners. But this is not the case everywhere.

**4.55** By contrast, where the Agency decides to withdraw from maintenance, it must give adequate notice to the landowner. In some cases the landowner can take over the maintenance task. Guidance on this process has recently been produced by the Agency, aimed at both river and coastal maintenance. The Review welcomes this guidance, which needs to be effectively disseminated to enable an open dialogue with those affected. However, the Review is concerned that where maintenance is being significantly reduced, but not stopped, a similar dialogue may be necessary. Those in affected areas should be made aware of increasing risk and landowners should be

<sup>8</sup> *Environment Agency: Building and maintaining river and coastal flood defences in England*, NAO, June 2007

given opportunities to carry out enhanced maintenance themselves.

**IC 29** – The interim conclusion of the Review is that the Environment Agency should open dialogue with all those landowners who will be affected by either a withdrawal from or significant reduction in maintenance of rural watercourses.

### Temporary and demountable defences

**4.56** Following the floods of 2000, the Environment Agency began a trial to evaluate different types of temporary and demountable defences in a number of areas which have historically suffered from frequent flooding but where a full permanent defence could not be justified, including Carlisle, Upton-on-Severn and Worcester. During the summer 2007 floods, plans to deploy some of these defences had mixed results. Temporary barriers were deployed on the waterside at Upton-on-Severn in June and successfully held back 1.15m of water. During the July floods, however, the workforce, plant and materials were deployed to Upton-on-Severn and Worcester but, despite a police escort, severe disruption to transport infrastructure caused by surface water flooding prevented their arrival. The Agency is currently reviewing its deployment procedures.

**4.57** The Agency has told the Review that it has concluded from its trials that temporary and demountable defences do not at present offer a large-scale alternative to permanent defences. The significant lead time involved in deploying and building temporary defences, especially at a time when resources will inevitably be stretched, coupled with the increased potential for disruption to transport infrastructure during flooding events, means that there is a significant risk of such defences not being deployed. That risk compares unfavourably with general public expectations. The Agency is therefore currently considering

that temporary defences should not be used except in the short term, in suitable locations, while permanent schemes are built or repaired or where a permanent barrier is not justified. However, this does not preclude other organisations or agencies from using them.

**4.58** Responses received by the Review indicate that the pilot nature of some of the temporary defence schemes is not well understood, so that the Agency's withdrawal from the provision of temporary defences would in many cases be a cause for local concern. It is therefore important that the Agency engages with those currently benefiting from or partnering in the schemes, including discussion of alternative means by which they might be taken forward.

**REC 3** – The Review recommends that the Environment Agency should urgently develop and implement a clear policy on the use of temporary and demountable defences.

**4.59** During the summer 2007 floods, temporary barriers were successfully used in more novel ways to protect critical infrastructure, including at Walham switching-station in Gloucester. They were used again to protect electricity infrastructure during the East Coast storm surge event in November. The Review will consider the role that temporary defences could play, including the case for regional or national strategic reserves, in order to make a recommendation in its final report.

### The role of sandbags

“It really was a joke. We did get some sandbags in the end but only after the floods had arrived. They were a nightmare to get hold of. We got our own sand and mud and filled up plastic bags to use like sandbags.”

**Householder, North East Lincolnshire**



Temporary defences set up to protect Walham electricity switching station – preventing around 450,000 domestic and commercial customers losing power



Sandbags being deployed in preparation for flooding

**4.60** The Review found extensive evidence of public over-reliance on sandbags, which often proved to be of little value in protecting against flooding. Indeed, many householders and business owners put time and energy into obtaining and installing sandbags which would have been better spent on other activity such as moving possessions to safety and deploying door boards. While it is clear that sandbags have a useful role in certain types of flood when used strategically, their benefits are less clear when they are used by householders to protect individual properties. This weakness is further heightened by their relative inefficiency and ineffectiveness when compared with alternative dedicated flood defence products that have been developed in recent years, such as floodgates and airbrick covers. Despite these developments, some evidence suggests that at present only the sandbag seems to have an established place in the public's mind as an effective flood protection measure.<sup>9</sup>

<sup>9</sup> Can people learn to live with flood risk?, Harries, T. (Flood Hazard Research Centre) and Borrowes, P. (University of Middlesex), paper tabled for the 42nd Defra and Environment Agency Flood and Coastal Management Conference, July 2007

“The distribution of sandbags is costly, fraught with difficulties and largely ineffective.”

**District council officer, Oxfordshire**

**4.61** The Environment Agency has an agreed framework with the Local Government Association covering joint working in flood incidents. This includes a policy on the provision of sandbags. The Agency does not as a matter of course provide sandbags and, under this policy, it is up to individual local authorities whether they provide sandbags to the public, and whether they charge for them. As a result of the confusion and mixed performance in relation to sandbags during the summer 2007 floods, the Review believes it is time for an update of this policy. The government publication *Preparing for floods*<sup>10</sup> should be amended to provide further guidance on the use and effectiveness of sandbags.

“But we had the warning again for the Saturday after and we phoned up asking for sandbags, saying we were high priority, and they wouldn’t bring us any sandbags.”

**Householder, Sheffield**

**IC 30** – The interim conclusion of the Review is that the Government should develop a single national set of guidance for local authorities and the public on the use and usefulness of sandbags and other alternatives, rather than leaving the matter wholly to local discretion.

### Working with natural processes

**4.62** It is generally recognised that it is not sustainable from an economic, environmental or engineering perspective to

manage all risk through the building of bigger and more extensive flood defences. Hard flood defences clearly have a role to play in protecting homes and businesses but complementary natural solutions in the wider catchment must also be used to take the pressure off flood defences. In many locations, working with natural processes through better land-use planning and management – for example creating washlands and wetlands – can also reduce the need for extensive, costly hard flood defences, offering a more sustained, long-term solution to flooding problems.

**4.63** Greater use of washlands and wetlands, realignment of river channels and reconnection of rivers with their floodplain can all help store and slow water to reduce flooding downstream and mitigate peak flows. The Government’s Making Space for Water strategy recognises the value of this approach, as did several submissions to the Review. Natural England noted that “re-creation of wetlands can, if properly designed, provide increased capacity at times of peak floods and help protect urban areas.” At the same time, more can be done in urban areas to encourage ‘green corridors’ and flood storage. Current planning guidance (PPS25) identifies active floodplains as a land-use category, which should make it easier to identify sites for flood storage.

**4.64** Many of the responses to the Review were supportive of the Government’s general approach to managing risk, but felt that this was not being translated into results on the ground. Several submissions suggested that more effort was needed to encourage and incentivise their implementation, both in relation to designing schemes in the first instance and then finding and obtaining the use of the land needed to make them a reality. Submissions

<sup>10</sup> *Preparing for floods: interim guidance for improving the flood resistance of domestic and small business properties*, London: Office of the Deputy Prime Minister, 2003.

### Case study – Washlands preventing major flooding from rivers at Lincoln

The flood washlands upstream of Lincoln, along with associated defences, provide flood protection from the rivers Witham, Brant and Till to approximately 7,000 residential, commercial and industrial properties. During the June 2007 event they were operated successfully to avoid major flooding from these rivers. The flooding which did occur in Lincoln was from surface water and highway sources.

The Lincoln scheme comprises two washland areas to the south (Witham/Brant) and north-west (Till) of the city. The defences within Lincoln can safely protect against an event that has a 1-in-10 annual chance of happening. However, by using the washlands to store water, the risk of flooding is reduced to approximately 1-in-100.

Critical to success is timing the use of the washlands. If they are employed too early, their storage capacity can be used up, leaving no capacity for flows that follow. If they are used too late, the safe flow through Lincoln may be exceeded and flooding will occur. During the summer 2007 floods, the Environment Agency had a team forecasting and monitoring the conditions in order to determine the optimum time for operation of the various control structures. This included raising gates in the rivers themselves to control how much water passed downstream and opening gates in the riverbanks to fill the washlands. The River Till washland stores up to 3.2 million cubic metres of water and was filled to 80 per cent capacity in June 2007. The combined Witham/Brant washlands have a larger capacity of 6.3 million cubic metres and were filled to 12 per cent capacity.



Till washland in flood – the embankment and control sluice (foreground) hold back the water from passing downstream to Lincoln.

from rural and farming groups felt that rural areas had a big role to play, but that incentives to landowners were currently inadequate. It has been suggested that in some areas farmland was being flooded deliberately to manage the event without financial support being given. However, the Review found no evidence of deliberate flooding of land that had not previously been designated for flood storage.

“We’ve got the feeling the powers that be don’t seem to mind flooding us – it’s a bit discriminatory, because we can’t get anything back.”

Farmer, East Riding of Yorkshire

**IC 31** – The interim conclusion of the Review is that Defra, the Environment Agency and Natural England should work with partners to establish a programme and framework to achieve greater working with natural processes, including the identification of appropriate sites and the development of more incentives for creating water storage, restoring the natural course of rivers and establishing green corridors.

### Land management measures

**4.65** The way in which rural land is used and managed can reduce rural and urban flooding at the local level. Relevant factors include better soil management and cropping and livestock practices at farm level, which can all help retain water in the soil and slow down water flow and reduce run-off. Some submissions to the Review identified extensive drainage in both upland and lowland areas, along with other farming practices, as leading to a reduction in the ability of the land to store water.

**4.66** There are a number of research programmes looking at the value of land management practices in managing flood

risk. Research currently suggests that these measures can have an impact at the local level but not at the wider catchment scale; but further study is needed before definitive conclusions can be drawn. The recent move to the Single Farm Payment scheme has brought an additional focus on good agricultural and environmental practices, some of which may have flood risk management benefits.

**IC 32** – The interim conclusion of the Review is that the Environment Agency should provide an analysis of the effect that land management practices had or would have had on the impact of flooding during the summer 2007 floods.

### Modernising responsibilities for flood risk management

**4.67** Changing risk levels mean that society will face choices about flood risk management which will have to be properly co-ordinated. The foundation for this co-ordination has to be the range of powers that relate to flooding and water management.

**4.68** Flood risk management is a complex area and the lack of clarity of responsibilities is equally challenging. Defra has policy responsibility for flood risk management in England, while Communities and Local Government (CLG) has policy responsibility for land-use planning. Delivery on the ground in relation to river and coastal flooding is the responsibility of operating authorities – the Environment Agency, local authorities and internal drainage boards. Once responsibilities for surface water and sewer flooding are brought in, organisations include local authorities and the Highways Agency (as highway authorities), water companies (as sewerage undertakers) and British Waterways (canals). In addition, private landowners have duties in relation to riparian ownership. Submissions to the Review have suggested that this complexity

can be unhelpful, for example in terms of understanding who is responsible for what during an actual event, or in relation to identifying maintenance responsibilities for a given stretch of drainage asset or watercourse. Figure 15 sets out the range of responsibilities for flooding and drainage in England.

**4.69** A range of legislation governs flood risk management, most of which comes under permissive powers (i.e. there is no obligation to provide defences). The main legislation includes the Land Drainage Act 1991, the Water Resources Act 1991, the Water Industry Act 2003 and the Environment Act 1995. The emphasis within this legislation is on flood defence and drainage rather than flood risk management, whereas the recent EU Floods Directive promotes a risk-based approach. EU legislation such as the Water Framework Directive 2000 brings in various

environmental duties and considerations. The Civil Contingencies Act also brings duties in relation to emergency response (as set out in Chapter 5). This patchwork of legislation and responsibilities is not helpful and needs addressing.

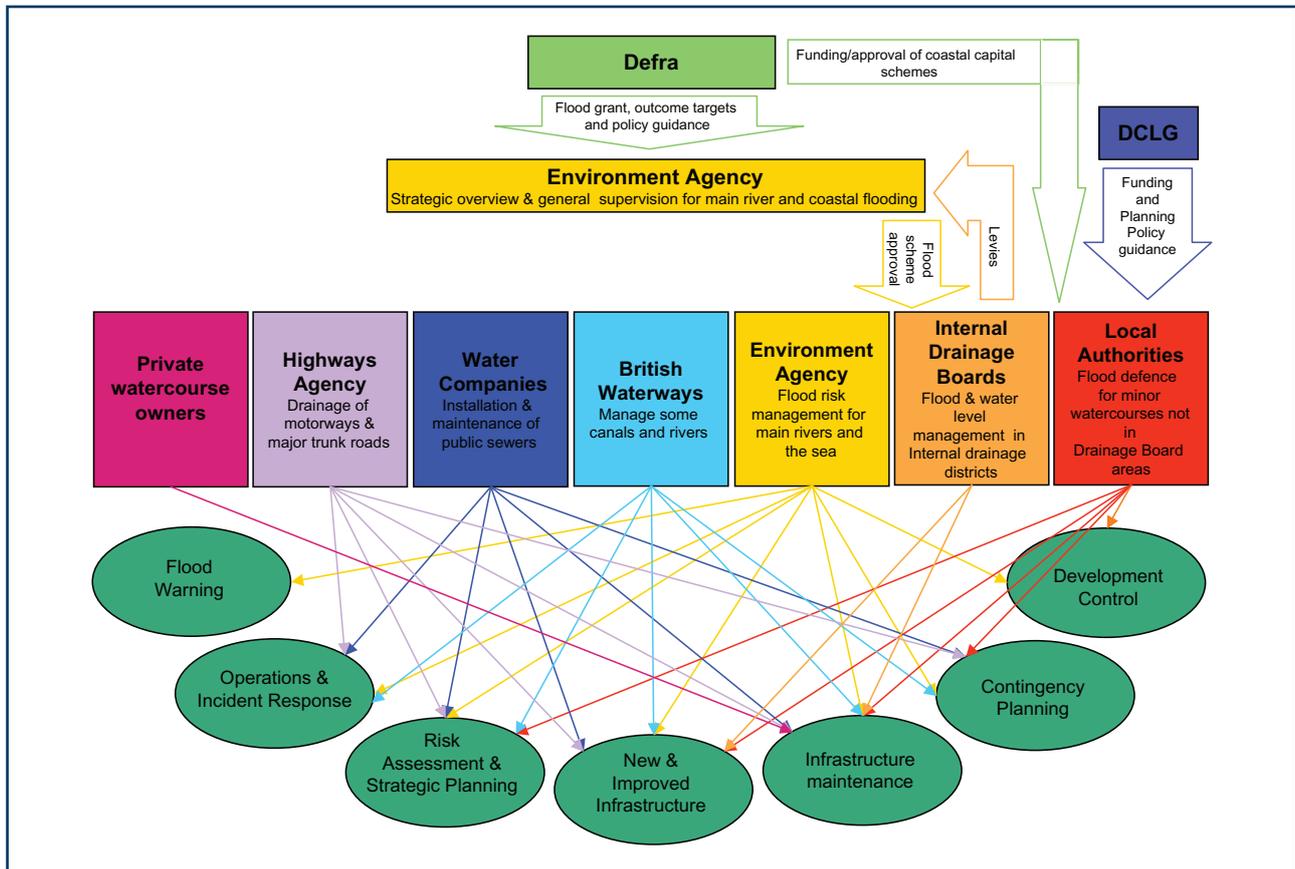
**IC 33** – The interim conclusion of the Review is that flooding legislation should be updated and streamlined under a single unifying Act that among other outcomes addresses all sources of flooding, clarifies responsibilities and facilitates flood risk management.

### Insurance

“You just think ‘When we’ve got some extra cash, I’ll get it sorted. Next year, or the year after.’”

Householder, West Berkshire

**Figure 15 – The Complex Landscape of Flood Risk Management Responsibilities**



**4.70** Insurance is the system through which risk is shared. The UK is in an unusual position in that flood risk is usually covered as a standard part of business and household insurance and the UK Government is not the insurer of last resort, unlike in many other countries. Continued provision of flood insurance is based on a voluntary agreement between members of the Association of British Insurers (ABI) (comprising around 400 companies) and Government, known as the Statement of Principles.<sup>11</sup> Under this agreement, ABI members will continue to offer insurance cover to existing customers where the risk of their properties being flooded in any single year is 1-in-70 or less, or for those properties where flood defences are planned in the next five years to bring the probability down to that level. The Review welcomes this partnership approach between the insurance industry and the Government.

**4.71** While risk in the UK is in part shared, it is not currently fully shared by all those at risk. The ABI estimates that around 78 per cent of households nationwide have contents insurance, but that in some of the areas affected by the summer 2007 floods the figure is barely over a quarter. A further issue is that those who have insurance are often underinsured. A number of the major insurers have reported underinsurance of home contents in particular.<sup>12</sup>

**4.72** Underinsurance appears to have been a major problem for businesses, especially small businesses, affected by the summer 2007 floods, many of which apparently lacked business continuity insurance. A survey conducted by AXA Insurance<sup>13</sup> in 2006 indicated that 90 per cent of small

businesses were underinsured for buildings cover and 41 per cent had no business continuity or loss of earning insurance.

**IC 34** – The interim conclusion of the Review is that the Government and the insurance industry should work together to deliver a public education programme setting out the benefits of insurance in the context of flooding.

**4.73** For some households the decision not to have insurance will simply have been a matter of affordability. Some councils, in association with insurance companies, run low-cost insurance schemes for low-income households. In Wigan, for example, the local council has teamed up with an insurance company and a local housing association to provide a tenants' and leaseholders' insurance scheme. The Review saw other examples of similar schemes when visiting areas of the country affected by the 2007 floods, such as Doncaster. Tenants generally pay for these low-cost schemes through their rent bills, making it simple and effective process.

**4.74** The insurance industry and the Government's Financial Inclusion Taskforce<sup>14</sup> are also looking at the issue of insurance for low-income households. A recent ABI report<sup>15</sup> suggests that 35 per cent of people in very low-income households (less than £10,000 per year) do not have any insurance at all and only 44 per cent have contents insurance. The Review welcomes the ABI's plans to encourage awareness of affordable insurance schemes, such as insurance-with-rent schemes.

<sup>11</sup> *ABI Statement of Principles on the provision of insurance*, ABI, November 2007

<sup>12</sup> Research by Zurich insurance company in 2005 revealed that one in five households was at risk of being underinsured because they were unsure of the value of their home contents ([www.uk.biz.yahoo.com/moneyweekly/underinsurance.html](http://www.uk.biz.yahoo.com/moneyweekly/underinsurance.html), 2 March 2005)

<sup>13</sup> *Preparing for climate change. A practical guide for small businesses*, September 2006, AXA Insurance UK

<sup>14</sup> [www.financialinclusion-taskforce.org.uk/](http://www.financialinclusion-taskforce.org.uk/)

<sup>15</sup> *Access for all: extending the reach of insurance protection*, ABI, October 2007

**IC 35** – The interim conclusion of the Review is that the Government and the insurance industry should work together to develop options to improve the availability and uptake of flood risk insurance by low-income households, and assess the costs, benefits and feasibility of these options, before the Review’s final report.

“My insurance have been fantastic, absolutely fantastic. All my work is finished and I have paid out for everything I’ve put down – they have never said they needed proof or anything.”

Householder, Darfield, Barnsley

“What annoys me is that it’s been, what is it now, 118 days, something like that, since the first flood came – and we still haven’t had anything from the insurance. We’ve had all the schedules and everything, but we’ve had no response from that at all.”

Householder, Darfield, Barnsley

**4.75** As a consequence of the 2007 floods, insurers received around 165,000 claims across the UK (120,000 household, 27,000 commercial and 18,000 motor claims), equivalent to four years’ claims in normal circumstances.<sup>16</sup> The overall cost to insurers is expected to be around £3 billion – the largest single claims event in UK history. As of mid-November, 40 per cent of household and over 25 per cent of commercial claims had been settled.

**4.76** In general, the Review considers that the insurance industry has responded well to the summer 2007 floods, with many companies bringing in staff from outside

the region, and in some cases from overseas, to ensure that claims are dealt with promptly. However, while the claims experience was generally positive for many, the service received by some claimants was less impressive. During visits to the affected areas, the Review came across many households and businesses that had experienced or were still experiencing difficulties. Some complaints were the result of comparisons with neighbours and reflected the individual services offered. However, some related more to poor general standards of claims handling service, such as length of time before first visit by a loss adjustor, length of time for claims to be dealt with and advice on what could be done with damaged goods.

**4.77** The aftermath of flooding can be as stressful as the event itself. During events as severe as those experienced during summer 2007, there will inevitably be strains on companies dealing with a large number of claims. There is a range of options that could be developed to ensure that the good service experienced by many is received by all in the future. The insurance industry could, for example, put plans in place to speed up the technical assessment of claims, by allocating loss adjustors to affected areas rather than by policyholder.

**4.78** The Review also saw a number of examples of neighbours receiving conflicting advice from their insurers. A common set of guidelines for people who are affected and insured could be developed, to be followed by all insurance companies after a flood, and covering such issues as waste disposal and levels of evidence required for a claim. There may also be scope for the development of a voluntary industry code alongside the Statement of Principles, setting out minimum standards of service that all

<sup>16</sup> *Summer floods 2007: Learning the lessons*, ABI, November 2007

insured individuals and organisations should expect to receive in the event of flooding. Or companies may begin to include information about their performance during large-scale events like the summer 2007 floods to attract customers, so dealing with the issue through competition. The Review will work with the insurance industry to consider how the prompt and efficient handling of floods claims experienced by many after the summer 2007 floods can be ensured for all policyholders. The Review will develop a range of options with the ABI with the intention of providing a recommendation for its final report.

**4.79** Most insurance companies have access to flood risk information. The provision of information by the Environment Agency is covered under the Statement of Principles and must be kept up-to-date. It is used to inform the pricing of insurance premiums and in determining other elements such as excesses. It is this process which can often represent the first or most detailed point at which a business owner or householder considers flood risk. The Review considers that this provides an opportunity to increase the understanding of flood risk among householders and businesses and that this should be developed further.

**IC 36** – The interim conclusion of the Review is that, in flood risk areas, a note on flood risk and the simple steps that could be taken to mitigate it should be included with all insurance renewal notices. Moreover, if Flood Warning Direct is available in a customer's area, one of the conditions of renewal could be sign-up to this service.



## Chapter 5: The Emergency Response

### Summary

This chapter examines:

- the performance of weather forecasts, flood warnings and flood defences;
- the local, regional and national response; and
- the transition to recovery.



**5.1** From the first flooding in mid-June 2007 to the restoration of drinking water supplies in Gloucestershire in mid-August, responders were faced with a string of major emergencies, many of them going well beyond all previous experience. As Chapter 1 has noted, these included the largest surface water flooding event ever experienced in the UK; record levels of flooding along the River Severn; and, with the loss of Mythe water treatment works in Gloucestershire, the most serious loss of essential services since the Second World War.

**5.2** Despite the UK's well-developed emergency planning frameworks, emergency plans and procedures were tested to their limits and beyond. Inevitably, the events exposed weaknesses and areas that need improvement. These are identified in this chapter. But the Review considers it appropriate to pay tribute at the outset to the dedication and commitment of all organisations involved in the response. In extremely testing situations, responders including the police, the fire and rescue services, ambulance and health services, the Armed Forces, local authorities, the Maritime and Coastguard Agency and a wide range of voluntary organisations, including the Red Cross, St John Ambulance, the RNLI, Search and Rescue Assistance in Disasters (SARAID) and Rotary International in Great Britain and Ireland, were highly effective in offering practical help, support and reassurance to affected communities.

### Met Office forecasts

**5.3** Generally, the exceptional levels of rainfall in summer 2007 were well predicted, with the weather forecasts preceding the major July flooding in particular being the most detailed and accurate provided for any major flooding event in the UK.

**5.4** Early severe weather warnings were distributed direct to emergency response

organisations via email and fax, and Met Office advisors located around the country worked with responders to manage the impact of the severe weather, with sufficient lead time for some mitigation plans to be put in place.

**5.5** The forecasts followed the timeline below:

- **17–20 June** – There were a number of localised torrential downpours with many flash warnings issued.
- **22 June** – An early warning was issued to National Severe Weather Warning Service (NSWWS) recipients and the public, giving three days' notice of severe rainfall.
- **23 June** – Further warnings were issued, with an update to the early warning given on 22 June.
- **24 June** – A further update correctly focused on the worst-hit areas and accurately estimated the rainfall totals.
- **27 June** – Another early warning was issued, giving three to four days' notice of potential further disruption over the weekend due to slow-moving rain bands.
- **16 July** – Medium-range forecast model output suggested that a potentially severe weather system was developing, but confidence was only considered moderate at this stage.
- **18 July** – Confidence in the likelihood of the event increased as the week progressed and a NSWWS early warning was issued in the morning.
- **19 July** – Confidence was now sufficiently high to focus warnings about the area of greatest risk of disruption on the south-west Midlands, Gloucestershire and Oxfordshire.
- **20 July** – NSWWS flash warnings were issued widely for southern and central England.

**5.6** Although the summer's rainfall was generally well forecast, a number of submissions to the Review have suggested that more use should be made of probabilistic forecasting (based on the likelihood of weather change rather than actual rainfall levels). With the development of higher-resolution models, this would allow forecasts to be given with more confidence and greater precision. Submissions also suggest the issuing of early warnings at defined – and possibly lower – levels of probability. Such a step could be of potential value, especially for extreme weather events, in giving emergency responders more time to prepare. However, it will inevitably result in more false alarms. Nevertheless, the Review considers that the idea has sufficient potential to merit further examination. Chapter 3 describes the absence of an effective warning system for surface water flooding, the prevalent form of flooding in June, with the result that responders had to deal with unexpected flooding. It also makes recommendations for the development of tools and techniques which will allow that gap to be closed.

**IC 37** – The interim conclusion of the Review is that the Met Office and the Environment Agency should produce an assessment of the options for issuing warnings against a lower threshold of probability, including costs, benefits and feasibility; this will be considered further in the final report.

## Flood Warnings

**5.7** For each type of flood warning (Flood Watch, Flood Warning, Severe Flood Warning), the Environment Agency has a predetermined activation threshold, based for example on river depths and rainfall levels over a catchment area. Lower thresholds are used to initiate supporting actions, such as the staffing of incident

rooms, increased monitoring of river gauges and enhanced flood forecasting activities. The trigger for issuing a Flood Warning or Severe Flood Warning is based on the Agency's assessment of whether any watercourse or part of a watercourse will reach a level at which the Agency judges that significant property flooding will take place. Since the trigger is usually calculated by the use of flood modelling studies or by looking at the behaviour of past floods, unexpected behaviour of rainfall or river water can lower the accuracy of warnings.

**5.8** The Environment Agency's flood warning system has service standards which aim to issue warnings more than two hours ahead of potential flooding and to deliver them to the public through its Flood Warnings Direct system by a number of different media (in several languages). Warnings are also issued to the emergency responder community and the broadcast media. The lead time available is almost entirely dependent on the type and behaviour of a river and the location of the flood warning area on that river (more time may be available to issue warnings to downstream areas than those upstream near the headwaters of rivers). It is dependent on the type and location of the rainfall that will lead to flooding. For coasts and tidal rivers it will also be dependent on the accuracy of sea surge and wave forecasting.

**5.9** The Environment Agency provided the Review with an initial assessment of more than 500 flood warnings issued during June and July 2007. This shows that:

- around 80 per cent were issued to target – that is more than two hours before the threshold was reached.
- around 20 per cent were not issued to target – that is, they were issued either less than two hours before, or after the threshold was reached.

- In about 20 per cent of cases the river concerned did not in the event reach the threshold level.

**5.10** The Review is aware that the generation of flood warnings cannot be an exact science. As assessments will always be affected by variations in rainfall forecasts, data from river telemetry and ground saturation levels. However, there is scope for a higher percentage of warnings to meet the target. As noted in Chapter 3, revised flood risk maps are vital to improve the accuracy of risk registers and the effectiveness of emergency planning, and the Review makes a recommendation in this respect.

## Flood Defences

**5.11** The majority of flood defences and other flood risk management assets – both those on rivers and those which defend against coastal surges – are maintained by the Environment Agency, with others being maintained by local authorities, Internal Drainage Boards, businesses and individuals. The Agency has investigated the performance of all these assets during the summer 2007 floods to check that they operated to their design standard, which is typically to withstand a 1-in-100-chance event.

**5.12** This investigation found that in England and Wales during June and July 2007:

- 9 per cent (1,016 kilometres) of man-made raised flood defences were tested by the summer floods.
- About 50 per cent (525 kilometres) of the raised flood defences tested were overwhelmed.
- Less than 0.2 per cent of the defences failed physically (nine sites) or suffered a breakdown or power failure which meant that they did not operate as expected (six sites):
  - There were four sites whose physical failure led to an earlier onset of

flooding: these were flood walls at Worksop, Chesterfield and Sheffield and an embankment at Auckley. However, the same level of flooding would have occurred anyway due to the extent of the flooding.

- There were five sites which failed physically after being overwhelmed: these cases were all embankment breaches in the north of the Anglian region; at North Kelsey Beck, Waddingham Catchwater, Barlings Eau, Stainfield Beck and Winterton Beck. Flooding was already significant at the time of failure.
- The six sites that did not operate as expected due to a loss of power (which occurred after they were overwhelmed) comprised a flood gate at Canklow (Rotherham), pumping stations at Great Clough (North Yorkshire), Winestead (Hull) and Hempholme (Humberside) and two pumping stations in Doncaster. Flooding was severe when power was lost and was therefore not made worse.
- In addition, a sea gate at Goxhill Haven (Humberside) could not close properly due to a blockage, and agricultural land was flooded leading to several hundred pigs being killed. Trash screens (which prevent culverts and pump stations from blocking) at Cox's Meadow, (Cheltenham) and Paradise Road (Boscastle) did not function properly. Flood defence improvement work was underway in Tirymynach (Pool Quay, Welshpool) and defences could not be restored effectively. As a result up to ten properties may have flooded.

**5.13** The Review, on occasion, heard suggestions that individual communities were deliberately allowed to flood to protect other communities. The Review found no direct evidence of this happening. The fact that 50 per cent of the raised flood defences were overwhelmed illustrates the

extreme nature of the summer's events. The number of assets physically failing or suffering a breakdown or power failure is encouragingly low, and the Environment Agency judges that in none of these cases was the flooding made worse as a result. However, these assets should be examined to establish why these failures occurred to see if lessons can be learnt.

## The Local Response

### Readiness and alerting

**5.14** The scale of the 2007 floods stretched resources to the limit and beyond, and responders in some areas were not as ready as they might have been. In part, this can be explained by the unprecedented nature of the events, especially when set against a historic pattern of more localised, low-impact flooding events. The absence of a warning system for surface water flooding contributed. The frequency and volume of severe weather warnings received by responders (including a number of false alarms) will have played a part. But it is also clear that, in some areas, there were no agreed protocols between responders, setting out responsibilities for assessing the potential impact of a specific severe weather event and triggering an appropriate multi-agency response. This gap, crucial to the initiation of an effective emergency response, needs to be filled.

**5.15** The Met Office has an improving understanding of how its warnings are used by the different members of the multi-agency responder community. Met Office advisors are the natural starting point for the improved arrangements. The Review judges that, if Local Resilience Forums were to designate the police and local authorities as the primary points of contact for the Met Office advisors before and during an emergency, this would ensure a focused use of this valuable resource at a critical time.

**5.16** By extension, there would be a benefit in designating a single organisation as

being responsible for triggering emergency response arrangements. In some areas, there was a degree of confusion between responders about whose responsibility it was to consult with partners and to advise whether multi-agency response arrangements should be triggered in light of severe weather and flood warnings. While most Local Resilience Forums have generic plans in place to respond to emergencies, and some key responders in flood-prone areas have specific flood plans in place, few set out collectively agreed arrangements for assessing the impact of an emergency such as flooding, where the effects can be felt over a wide area and take many forms.

**5.17** 'Upper tier' local authorities are well placed to assess the potential impact of floods across their area, liaising with neighbouring local authorities as appropriate to gather input on the basis of local visual assessments and previous experience. In light of this, the Review considers that 'upper tier' local authorities are best placed to be given 'lead responder' status, with a duty to advise partners on whether multi-agency response arrangements should be triggered, perhaps initially on a precautionary basis. Such assessments would be carried out in close consultation with local partners, including 'other' local authorities and the emergency services. The police, unless agreed otherwise locally, should then convene and lead the multi-agency response.

**IC 38** – The interim conclusion of the Review is that unless agreed otherwise locally, 'upper tier' local authorities should be the lead organisation in relation to multi-agency planning for severe weather emergencies at the local level, and for triggering multi-agency arrangements in response to severe weather warnings.

## Case study – Warnings in Gloucestershire

In the July floods, the main challenge proved to be river flooding, particularly on the Rivers Severn, Thames and Avon and their tributaries. Following unprecedented levels of rainfall, Gloucestershire Gold Command met at 6pm on Friday 20 July and was informed by the Environment Agency that no significant river flooding was expected. The same evening the Met Office issued a weather warning stating that heavy rain would continue overnight in Gloucestershire. On Saturday 21 July at a 10.30am Gold teleconference, the Environment Agency said that there would be little or no serious flooding and Gold was stood down following a further meeting at 6pm. Early on Sunday 22 July Mythe water treatment works was submerged by rising flood water and shut down, affecting water supplies to 350,000 people in Tewkesbury, Cheltenham and Gloucester. Serious urban and rural flooding also occurred. Gold was reconvened.

**IC 39** – The interim conclusion of the Review is that where a Gold Command is established, the police, unless agreed otherwise locally, should convene and lead the multi-agency response.

### Advice

**5.18** A number of emergency responders told the Review that the Environment Agency's flood warnings can be difficult to interpret. They also noted that, in some areas, Environment Agency staff who engaged with Gold Commands during the 2007 floods had a limited understanding of their role and purpose, and in some cases were unable to present their assessments clearly. Chapter 3 covers the development of visualisation tools which should help significantly in providing emergency responders with a rapid summary of the likely impact of forecast flooding. But their use, and the interpretation of underlying data, will clearly be aided if the Environment Agency commits staff to Gold Commands (and to prior work by Local Resilience Forums) who are knowledgeable about their functions and able to explain scientific material lucidly.

### Gold Commands

**5.19** Gold Commands activated in the summer were effective in co-ordinating the local response, often with reassuring and high-level visible leadership.

**5.20** However, in some areas, some responder organisations had difficulty in engaging effectively with the local response effort, possibly because Silver Commands were activated instead of Gold. Although these areas coped, the strategic perspective brought by Gold Command would have allowed more effective engagement by the full range of potential responders and hence the easier procurement of external resources.

**5.21** There is a clear benefit in Gold Commands being activated at an early stage on a precautionary basis when assessments indicate that significant disruption is likely. Precautionary Gold Commands need not physically convene at the outset: conference telephone calls, or other appropriate means of multi-agency communication, could be used to share and assess information on the extent of the emergency.

**5.22** The Review has received positive feedback from responder organisations on the emergency facilities at Gloucestershire Constabulary's purpose-built headquarters in Gloucester, which can accommodate a Gold Command at short notice in the event of a major incident. The Gold Command suite's IT and communications systems, including immediate Gold e-mail addresses for all responders, were said to work well. The Gold suite was also complemented by

an adjacent flexible open-plan space to accommodate agencies and Gold support services.

**IC 40** – The interim conclusion of the Review is that Gold Commands should be established at an early stage on a precautionary basis where there is a risk of serious flooding.

**IC 41** – The interim conclusion of the Review is that Local Resilience Forums should assess the effectiveness of their Gold facilities, including flexible accommodation, IT and communications systems.

## Involvement of Category 2 responders

**5.23** A number of submissions to the Review drew out the way in which inconsistencies in the level of engagement of Category 2 responders, particularly utilities companies, in the work of Local Resilience Forums contributed to a lack of preparedness in some aspects of the response. This weakness was compounded by the irregular level of engagement of Category 2 responders in Gold Commands. Moreover, some Category 2 responders who attended Gold Command meetings were clearly unfamiliar with emergency response procedures, and unable to engage effectively. Chapter 6 returns to these issues.

## Flood rescue

**5.24** Organisations carrying out flood rescue, including the fire and rescue services, the Maritime and Coastguard Agency, the RNLI, river police and SARAID, are highly valued by the public and were generally praised for their effective operations over the summer. However, the Review notes that there is currently some ambiguity as to which organisations have

responsibilities for flood rescue. The fire and rescue services usually attend to such situations, as all fire and rescue crews are trained to work safely near water and are provided with suitable equipment to assist people in difficulty in water. Selected stations have also been trained to offer a full water rescue capability, involving crew members working in water, using inflatable boats when the circumstances necessitate it.

**5.25** However, the fire and rescue services have no explicit statutory duties for flood rescue. Similarly, although the Maritime and Coastguard Agency is a Category 1 responder for casualties at sea, on the coast and in estuaries, and the RNLI has a statutory duty on the Thames, neither organisation has a legal responsibility for flood rescue. However, both organisations played an active role in the response to the summer 2007 floods and deployed crews to assist the local response in a number of the affected areas.

**REC 4** – The Review recommends that all Local Resilience Forums urgently review their current local arrangements for water rescue to consider whether they are adequate in light of the summer's events and their local community risk registers.



A Sea King helicopter from RAF Kinross searches for people in floods in Tewkesbury, Gloucestershire  
© Rex Features

“The emergency services didn’t know who was in or out of the property, it was a case of people opening their windows and shouting to people. The people in the rubber dinghies were brilliant. They were paddling up and down and even when people had been moved out they kept an eye out to make sure properties were safe.”

**Householder, Toll Bar, Doncaster**

**5.26** The Review considers that this perceived ambiguity should be addressed, although that does not mean that a specific statutory duty is necessarily the appropriate solution, particularly given the range of organisations with experience and expertise in this area. The issue to be considered is the provision of resources needed specifically to undertake flood rescue, including personal protective equipment, pumps, rescue craft and, especially, trained personnel.

**5.27** The Review is aware that Communities and Local Government (CLG) is considering flood rescue as part of the review it is undertaking into the Fire and Rescue Service’s response in the summer. The Review will consider CLG’s report in due course and will return to flood rescue in the final report. In doing so, it will also

examine whether there would be advantages in establishing a single search and rescue emergency response co-ordinating authority for land-based emergencies, rather than the present system co-ordinated by the Ministry of Defence, the Maritime and Coastguard Agency and the police.

### Mutual aid

**5.28** The Review is aware of many examples of effective mutual aid in response to the flooding events of June and July 2007 (see case studies below). Effective mutual aid arrangements enable organisations engaged in the response to an emergency to request urgent support from other parts of the country – a particularly useful arrangement during wide-area emergencies which can severely deplete resources locally.

**5.29** Mutual aid can come in many forms, including equipment (such as pumps or boats) and people. Well-established and effective arrangements already exist for the provision of mutual aid between police forces, with all requests for assistance routed through and co-ordinated by the Police National Information Co-ordination Centre in London. Arrangements also exist in the fire and rescue services, administered through a national coordination centre in West Yorkshire,

### Case study – Flood rescue of a carer and three men with learning disabilities

Mark Overall is responsible for the care of three men with learning disabilities, who, prior to the flood, lived in the property next door to the family’s home. When the waters rose, the men were brought into the house with the family while they waited to be rescued by boat. This was a very difficult time for everyone in the household, but especially for the men, who had difficulty coping with situations out of the ordinary. The rising floodwater and its entry into the house upset them and they became agitated and anxious.

In the early afternoon a boat arrived at the house to rescue everyone and they managed to get two of the men into the boat with other family members and their pets. The third man was so distressed that it was decided that it was unsafe for him to go in the boat at that time. Mark stayed with him until the boat returned to fetch them both in the late afternoon, by which time the man was calmer and it was therefore safe to help him into the boat and take him to safety.

## Case studies – Examples of effective mutual aid

1. When significant parts of Herefordshire and Worcestershire were badly affected by flooding in both June and July, in addition to local crews, the rescue effort involved fire and rescue teams from Buckinghamshire, Mid and West Wales, Greater Manchester, Cheshire and Merseyside.
2. During the June floods in South Yorkshire, a representative from Carlisle Council contacted Doncaster City Council to offer its assistance and the expertise gained from its experiences during the 2005 Carlisle flood. As a result, Carlisle loaned an experienced member of staff for the duration of the response phase, which Doncaster described as being invaluable. Afterwards, the Mayor of Doncaster suggested the compilation of a national register of people with expertise in handling similar events, which could be referred to by responders during emergencies.

supplemented by an Emergency Information Support Group in London. The provision, mobilisation and effectiveness of high-volume pumps during the 2007 floods were widely praised by local fire and rescue service officers.

**5.30** Beyond the emergency services, however, there are few structured arrangements for mutual aid. Where it does happen, it is usually ad hoc. Local authorities generally rely on neighbouring authorities to provide support with equipment and personnel in an emergency. The wide range of potential roles can make it difficult to identify the right people with the right skills to assist during an emergency. Moreover, during summer 2007, many local authorities found that they could not rely on assistance from neighbouring authorities either because they too were also affected by floods or because they feared being affected. Furthermore, shared inventories of equipment were not available, so that local authorities were unaware what help neighbouring authorities might provide.

**5.31** In its submission to the Review, and in subsequent discussions, the Local Government Association (LGA) has acknowledged that national and cross-regional mutual aid arrangements between local authorities could be improved, for example by the development of a register of experts available to assist the response

to a future wide-area emergency. The Review recommends that the LGA should take forward work to address this issue as soon as possible.

**IC 42** – The interim conclusion of the Review is that the Local Government Association should consider how best mutual support might be enhanced between local authorities in the event of a future wide-area emergency.

## Emergency accommodation

**5.32** Affected local authorities in several areas set up rest centres to provide a range of humanitarian assistance to people affected by the floods. These ranged from drop-in centres to overnight facilities in venues such as town halls catering for large numbers of evacuees.



Residents and council workers gather round the specially installed Mobile Advice Centre © Rex Features

### Case study – The experiences of a young man and his family

Mark Harris\* had responsibility for three generations – his parents living elsewhere in town, as well as his own family. He first heard about the flooding via a call from his father who called him to say “Get down here and help”, as his parent’s home was flooding. Half an hour after he arrived at his parents’ house, he had a call from his wife, saying he should get home because his own house was now flooding.

When Mark arrived, he saw that the water had smashed through the floor of his house and there were fountains of water coming up through the floor. He phoned the council, who told him that they would send sandbags. These eventually arrived a week later. He also called the fire and rescue service and got through to the service in another county, Hampshire, because the local one was so overloaded with calls. The Hampshire service was not able to respond. Because the location of his estate forms a natural basin, Mark had a metre of water sitting in the house for two days. He feels that new housing locally has meant that the old drains no longer work. He also claims that, because the water flooding his house was contaminated, nobody would agree to take it away.

During those two days, Mark decided that enough was enough and that he had to get his family out of the house. He called the council and was told that he could go to the local leisure centre with his family. He drove through the flood water with his family to get there, only to find that it was not being used as a rest centre and he had been given the wrong information.

Mark feels that there was a real lack of co-ordination, and information, which left his family feeling unsupported. He eventually received some financial help from the Parish Council, but states that they are the only organisation to have helped him at all.

\*An alias has been used to protect the respondent’s identity

“We were taken to a rest centre where four families were accommodated. I was impressed by the help that was given to us by the council – including a special sleeping bag for myself and my baby. Please pass on our thanks to the many people who helped that night. Someone generously brought us more nappies, bowls and baby wipes. There were plenty of sandwiches and breakfast the next morning as well as hot tea and coffee.”

**Householder, Pangbourne**

**5.33** These arrangements generally worked well, although a number of designated rest centres could not be used because they were flooded. So, too, were other important sites, including police headquarters, county council offices holding data on vulnerable people, and depots holding sand stocks.

**5.34** There is a clear need to check that those sites which have an important role in response to flooding (and other major emergencies) have sufficient resilience against flooding and the loss of electricity and water supplies to enable them to be used.



Floods along Molly Millars Road, Wokingham © Rex Features

**REC 5** – The Review recommends that all Local Resilience Forums should undertake an urgent review of designated rest centres and other major facilities to ensure either that they have the necessary levels of resilience to enable them to be used in the response to flooding and other major emergencies, or that alternative arrangements are put in place.

**5.35** There were many instances of people in transit being stranded away from their homes in both the June and July 2007 flooding events. For example, about 500 people were stranded at Gloucester railway station when the rail network failed. However, the largest single event occurred on Friday 20 July, when an estimated 10,000 motorists in the South-West were stranded overnight between Junctions 10 and 12 of the M5 and on some other roads. In this instance, rest centres were able to accommodate around 2,000 people overnight, and only 80 people remained at the centres the following day, testifying to the effectiveness of the local authority in helping people to resume their journeys. However, the consequences of a similar event during the colder winter months could be much more serious (and have been on other occasions). This area merits better

preparedness planning at local, regional and national levels.

**5.36** In areas close to motorways, trunk roads and major transport hubs, planning for rest centres must take account of the need to cater for a potentially large number of people left stranded. The Review notes that, although the need to make provision for people stranded in road blockages is included in guidance issued by the Cabinet Office, it is not clear that this guidance caters adequately for the range of needs of large numbers of people left stranded, as exemplified by the summer's events. This should be addressed.

**IC 43** – The interim conclusion of the Review is that Cabinet Office guidance to local planners should specifically include incidents which leave large numbers of people stranded on motorways and trunk roads.

**5.37** That said, it is clearly better to prevent people from being stranded in the first place, especially through the use of earlier, stronger, more specific warnings, or strategic road clearance and closures, perhaps beginning a long way from the actual flooded areas.

**IC 44** – The interim conclusion of the Review is that, as part of their emergency plans, Local Resilience Forums should consider the vulnerability of motorways and trunk roads to flooding, and consider the potential for earlier, stronger, more specific warnings, and strategic road clearance and closures, to avoid people becoming stranded.

**5.38** The Review is aware that the Highways Agency, through its regional control centres, has contingency plans in place to respond to serious blockages on the motorways and trunk roads. However,

these plans are focused on risks such as snowfall, ice and accidents, rather than flooding. The Review welcomes plans to enhance traffic clearance by the introduction of more ‘cross-overs’ (demountable central barriers), and the further development of the memorandum of understanding between the Environment Agency and the Highways Agency, setting out communication arrangements for flooding events.



Flood victims at the Main Tesco store in the centre of Gloucester receiving bottle water supplies © Rex Features

## Emergency supplies

**5.39** Some private sector companies made a major contribution to the emergency response through the provision of supplies for those affected, including food, water and sanitation supplies, drawing on their established and efficient distribution networks. But the response exposed weaknesses in arrangements for the provision of logistical support to emergency responders.

“We had everybody that worked here in the local charity office phoning Asda, Tesco, John Lewis – everybody you can think of donated food, candles, towels, bedding and quilts.”

**Householder, Sheffield**

**5.40** The delivery of drinking water to people in Gloucestershire who had lost

their mains supply generated an urgent need for a range of vehicles. Smaller vehicles were also required to navigate narrow roads in some areas. These were not easily found. Central Government departments also became engaged in sourcing other supplies, including wet wipes and portable toilets. The arrangements put in place to carry out this task, although broadly successful, were ad hoc, and consumables were sourced later than would have been desirable.

**5.41** The Review is aware that the Cabinet Office is now examining how best to institute arrangements to source essential supplies in a major emergency, for example through the establishment of stockpiles or the provision of call-off contracts. ‘Virtual stockpiles’, whereby necessary products and suppliers able to provide them in bulk are identified before an emergency, could have a significant role. This work should be pursued urgently.

**REC 6** – The Review recommends that the Cabinet Office, with other departments, should urgently consider the costs, benefits and feasibility of establishing arrangements for the urgent acquisition of supplies during a major emergency, including the use of call-off contracts or the creation of national or regional stockpiles of equipment and consumables.

## Emergency water provision

**5.42** On Sunday 22 July 2007, the Mythe water treatment works in Gloucestershire was submerged by rising flood water and shut down; water supplies to 140,000 properties (some 350,000 people) were lost. The Armed Forces provided support to Severn Trent Water as part of the very substantial logistical operation that was needed in order to ensure emergency water provision. After initial challenges responders coped well with the difficult

circumstances they faced. Mains supplies to all 140,000 properties were not fully restored until 2 August and not declared fit to drink until 7 August, 17 days after supplies were lost.

**5.43** The Review will consider in its final report the lessons to be learned from this episode for building better preparedness plans for the loss of drinking water. In one area, however, work needs to be taken forward as a matter of urgency.



Residents fill up their containers with drinking water from a bowser in Langford © Rex Features

**5.44** Regulations require water companies to provide a minimum of 10 litres of drinking-quality water per person per day when mains supplies fail.<sup>1</sup> Depending on the size of the water company concerned and the total population it supplies, the guidance sets in place contingency plans to ensure that in smaller incidents 8,000 to 50,000 people receive this 10-litre provision for durations of up to three days. For major incidents, the requirement rises to 200,000 people for a week.

“I think the big picture response was impressive. The speed with which they managed to get the resource together, the distribution going – the army were brought in and people were advising on that aspect. But I mean it did happen fairly quickly, and when you look at the area on the ground with the number of people that they were trying to supply, it was a big area.”

**Resident, Upton**

**5.45** With logistical support from the Armed Forces, Severn Trent Water provided the required volume of water. But the contingency plans were clearly not sufficient for the large population (350,000 people) who had to be supplied, or for the long period (17 days) for which supply was required. And it is arguable whether 10 litres per person per day is in any case sufficient. The World Health Organization, for example, recommends that a minimum of 15–20 litres per person per day be made available as soon as possible, and this figure rises greatly once sanitation is factored in; the generally quoted target is 50 litres. Even this figure does not take account of the increased needs of vulnerable people such as the elderly and those with small children.<sup>2</sup>

**IC 45** – The interim conclusion of the Review is that Defra should review the current requirement in emergency regulations for the minimum amount of water to be provided in an emergency, to reflect reasonable needs during a longer-term loss of mains supply.

## Science and Technical Advice Cells

**5.46** Science and Technical Advice Cells (STACs) were established to support Gold Commands in Yorkshire and the Humber, the West Midlands and Gloucestershire

<sup>1</sup> [www.ukresilience.info/upload/assets/www.ukresilience.info/water\\_guidance.pdf](http://www.ukresilience.info/upload/assets/www.ukresilience.info/water_guidance.pdf)

<sup>2</sup> Technical Notes for Emergencies – Minimum water quantity needed for domestic use in emergencies, Technical Note No.9, WHO 07/01/05 – [www.who.or.id/eng/contents/aceh/wsh/water-quantity.pdf](http://www.who.or.id/eng/contents/aceh/wsh/water-quantity.pdf)

during the 2007 floods. The concept worked well, but a number of issues were raised, not least in the area of public health protection where there was confusion over the respective roles and accountabilities in law of staff of the Health Protection Agency (HPA), primary care trusts (PCTs), strategic health authorities (SHAs) and, in Gloucestershire, the Drinking Water Inspectorate.

**5.47** The fundamental value of a STAC – the provision for Gold Commanders of a single point of advice on matters of public health – was reinforced by the events of summer 2007. But the current STAC guidance is not sufficiently clear about how roles within the STAC should be discharged, in large part because the law is not clear in this area. There is an urgent need to provide a clearer definition of these roles. It has been proposed to the Review that the HPA should have primary responsibility for the provision of health protection advice in an emergency, with PCTs and SHAs having lead responsibility for the direction of NHS services and resources; this proposal should be examined urgently.

**5.48** A ‘national STAC’ was also set up during the floods to advise central Government, especially debate in Cabinet Office Briefing Rooms (COBR). Some experts were asked to attend both local and national STACs, which led to competing demands on their time and stretched resources. It was unclear to some whether the role of the national STAC was to provide advice on the same issues being considered by the local STACs, or to provide support in areas that could not be handled by the local STACs. Similarly, it was unclear whether decisions made at the local level had to be signed off by the national STAC.

**5.49** The Review is aware that Department of Health guidance clarifying health roles in STACs is due to be published by the end of

2007, and recommends that this should be implemented as a matter of urgency. The Review also welcomes development work at the Department of Health to examine the roles of national and local STACs and to test the effectiveness of the new guidance through an exercise.

**REC 7** – The Review recommends that Department of Health guidance clarifying the role and accountabilities of organisations involved in providing scientific and technical advice during a major incident should be implemented as soon as possible and understood by Gold Commanders.

### Vulnerable people

**5.50** The Review has heard many accounts of humanitarian assistance offered by local authorities and voluntary organisations during the 2007 floods in order to ensure social care support for vulnerable people. The Red Cross, for example, deployed staff and volunteers to assist with the evacuation of stranded people, the provision of practical and emotional support in rest centres and people’s homes, and the delivery of humanitarian relief in the form of bottled water, food and hygiene items to those most in need. St John Ambulance provided 24-hour support to affected communities with volunteers and vehicles: some volunteers acted in support of ambulance services, responding to emergency calls, while others helped set up and staff rest centres.

“After five days the council had a wagon that fetched sandwiches and water and a Red Cross van provided hotdogs and other food... but for five days it was really scary.”

**Householder, Toll Bar, Doncaster**

**5.51** Flooding events may place higher demands on those dealing with vulnerable

### Case study – Communities helping each other

Jack Dawson\* lives with his wife and children in West Oxfordshire. His family home was not flooded but was at risk of being so. However, many of the people close to where he lives were flooded. He was aware that he lived in an area at risk of flooding but described the “shock of seeing the damage and chaos caused by the floods” that he “couldn’t have ever contemplated”.

West Oxfordshire was “split in half by the floods”. Half were severely flooded, while the other half “got lucky”. Jack’s story sticks out because it exemplifies many of the other personal stories of communities pulling together and people assisting the most vulnerable in their communities.

Like so many others, Jack’s immediate action was to protect his family. Early in the morning, he arranged for a family friend to take his family out of danger. Having done this, he stayed behind to help other local residents take care of elderly neighbours. This became a priority for him. He also helped people to move furniture upstairs contacted their relatives.

However, much of the help Jack provided for vulnerable neighbours affected by the floods came in the days after the flooding. With three friends, he helped two elderly neighbours clear up the “mess and sludge” left by the floods in the downstairs and garden. He describes himself as “having no choice... they needed help and I was able to give it”.

\*An alias has been used to protect the respondent’s identity

people than other emergencies. Indeed, the definition of who is vulnerable may itself be wider. It will cover the elderly and sick and disabled people as well as those with small children. In addition, parents of dependent children may have the added problem of collecting their children from school or nursery. Other vulnerable groups may include foreign language speakers who might not understand or be aware of flood warnings, and people who have recently moved to an area.

**5.52** The Review heard that ‘door-knocking’ to alert householders to imminent flooding risks was widely welcomed. It also provided responders with an early opportunity to identify those needing help, including by cross-referencing house calls with records of vulnerable people. A related recommendation is made in Chapter 7.

**5.53** The Review is aware of work under way by the Cabinet Office to provide local responders with advice on the definition of

vulnerable people, how best to identify them and planning to provide social care support in an emergency. This advice should take account of the lessons of the summer’s events, and then be issued urgently.

**REC 8** – The Review recommends that the guidance currently under preparation by the Cabinet Office to provide local responders with advice on the definition and identification of vulnerable people and on planning to support them in an emergency should be issued urgently.

**5.54** It is evident that some responders were reluctant to share personal information with each other for fear of contravening duties of confidence or the Data Protection or Human Rights Acts. In general, emergency responders should balance the potential damage to the individual (and where appropriate the public interest in keeping the information confidential) against the public interest in

sharing the information. In emergencies, the public interest consideration will generally be more significant than during day-to-day business. But it is clear that this message has not yet been received by all emergency responders. It is also clear that a number of myths around data protection still remain.

**5.55** The Cabinet Office has issued guidance to the emergency responder community to dispel some of the myths surrounding data protection as an aid to emergency planning, response and recovery<sup>3</sup>. One of the key principles in that guidance is that data protection legislation is not a barrier to appropriate information sharing. The guidance provides a framework within which personal information can be used with confidence that individuals' rights to privacy are respected.

**5.56** The Review encourages responders to familiarise themselves with this guidance, and the Cabinet Office to continue promoting it, in order to ensure that

appropriate relationships are established between bodies, such as social care departments, faith groups and voluntary organisations, which hold relevant data on vulnerable people.

**5.57** Another issue brought to the attention of the Review relates to animals, including livestock and domestic pets. The RSPCA is widely recognised as an important contributor to the response effort, and central guidance encourages Local Resilience Forums to use its resources. Although animal rescue must be regarded as secondary to people's safety, it has been observed that some people are reluctant to be rescued or evacuated without their pets. RSPCA capabilities thus form a welcome addition to the resources available for emergency response.

"They tried to evacuate the street, but there was me and two other houses stayed because we'd got pets, basically."

**Householder, Chesterfield**

### Case study – Evacuation and pets

Martin Brody\* lives in a rented house in Chesterfield, which he shares with his partner and their cat. At the time of the floods, he and his partner initially stayed in their house, living in their upstairs bedroom for around three weeks. There was no suitable temporary accommodation for them to stay in with their cat, and they did not want to incur the cost involved in sending the cat to a cattery. They therefore chose to stay in the house despite the extensive damage and contamination that had been caused to the ground floor by three feet of dirty flood water.

After some time living in this way, restricted to one room on the upper floor, Martin and his partner had a bout of sickness and diarrhoea, stomach pains and loss of energy. Despite their best efforts to clean up the house, he feels that their illness must have resulted from the contamination caused by the flood water.

Martin is very resentful of the lack of support from the local council in cleaning up after the floods. He received a leaflet from the council several days after the flood, with instructions on how to approach the clean-up. This was felt to be 'too little too late', and arrived at a time when practical help and support, such as equipment or help with cleaning, were required.

\*An alias has been used to protect the respondent's identity

<sup>3</sup> [www.ukresilience.info/response/recovery-guidance.aspx](http://www.ukresilience.info/response/recovery-guidance.aspx)

## The National And Regional Response

**5.58** Although flooding is predominantly a local emergency, larger-scale events, such as those witnessed during the summer, often require support at regional and national levels. The exceptionally large scale and variety of the summer 2007 floods, coupled with the consequent widespread disruption of essential services, made the regional and national efforts integral to the response.

**5.59** Central government's response to each of the string of major emergencies followed the guidance laid down in *Central Government Arrangements for Responding to an Emergency*.<sup>4</sup> This distinguishes between incidents which are primarily managed locally, with little or no central government engagement, and those that require closer working with central government, either primarily through the Lead Government Department or, where there is a need for wider government involvement, through the activation of central crisis arrangements and facilities ('COBR'). In the summer 2007 floods, the central government response was led by Defra, the lead government department for flooding.

**5.60** The Review considers that overall there was strong collaborative working and co-operation between government departments and agencies during the 2007 floods and that the central response was effective and coordinated. Certain departments played a particularly prominent role, notably Defra as the lead government department, CLG as the lead department for the recovery phase, and the Cabinet Office.

### Central government crisis machinery

**5.61** The flooding in June 2007, although undoubtedly serious, was judged on the basis of initial reporting from the

Environment Agency to be within the capacity of local responders to manage. COBR was not therefore formally activated, although consolidated briefing on the situation was produced and circulated by the Cabinet Office to all government departments, and Defra (with the Environment Agency) provided a continued oversight of the response. There was, however, recognition, based on experience from the flooding in Carlisle in 2005, that the major challenge was likely to be during the recovery phase. The central government focus was therefore placed on confirming CLG's leadership of cross-government activity to support recovery efforts in the affected areas, and ensuring that financial and other support was made rapidly available.

**5.62** COBR was activated during the July 2007 floods. The trigger was a forecast by the Environment Agency – which turned out to be broadly accurate – that the scale of the flooding would be severe and on a par with that in 1947. As well as the direct flooding emergency, COBR was used for the succeeding civil emergencies, including the prolonged interruption to water supplies following the loss of the Mythe water treatment works and the threat to Walham electricity switching-station, as well as later flooding events in the Thames Valley. Each of these events was expected to require significant central government support from a number of departments to the local multi-agency response. This proved to be the case.

**5.63** The activation of COBR was welcomed by Gold Commands, and played an important role in the achievement of improved performance. Departments felt that the response was better co-ordinated and more focused than had been the case in June. While it would be wrong to say that the non-activation of COBR in June was a

<sup>4</sup> [www.ukresilience.gov.uk/upload/assets/www.ukresilience.info/conops.pdf](http://www.ukresilience.gov.uk/upload/assets/www.ukresilience.info/conops.pdf)

failure, it is certainly right to say that its activation in July enhanced the overall response. This experience points to the desirability of earlier activation of COBR on a precautionary basis in the future in the event of serious flooding in order to facilitate access by local responders to central government and to ensure a better understanding of the evolving situation.

**IC 46** – The interim conclusion of the Review is that central government crisis machinery should always be activated if significant wide-area flooding of whatever nature is expected or occurs.

### Information management

**5.64** Although local responders generally appreciated central government's need for local information, the Review has learned that they were frustrated by the volume of information requested and the time it took to collate. On the other hand, central government was concerned by the lack of agreement on the extent of the flooding and the scale of the damage. This was exemplified by the range of information supplied on the number of properties affected by the June floods. Initial Environment Agency reports were of 3,000–4,000 properties affected, while several days later the Government Offices and local authorities were reporting 30,000 houses flooded from all sources, including surface water.<sup>5</sup> It was subsequently established that the discrepancy arose because the Environment Agency was counting only properties affected by river flooding, excluding those in urban areas affected by surface water flooding – the most significant impact in June.

**5.65** These and similar discrepancies can be partly explained by the different locations and timings of reporting and the

widespread nature of the flooding. They may also reflect instances where Gold Commands were not established to provide the strategic dimension. However, they do raise questions over the extent to which there was a coherent understanding on the scale and extent of the problems faced. While accurate figures will inevitably take time to collect and data collection must take a lower priority to saving life, rough estimates of the scale of damage need to be made available to allow scarce resources to be effectively prioritised. This data should also be sufficient for central government's immediate needs.

**5.66** The confusion experienced in June suggests that for surface water flooding events, central government should seek information via Government Offices from local authorities in the first instance. Data from the Environment Agency and the Association of British Insurers (ABI) should be used as supplementary evidence to gauge the extent of potential damage.

**5.67** It will also be helpful to be clearer about what data is needed, who is responsible for providing it and when. This could be captured in pre-agreed templates for specific scenarios, reducing the amount of work needed at the local level during an event. This model could be incorporated into central government's usual template for situation reports – referred to as a Common Recognised Information Picture (CRIP).

**5.68** One further issue is the handling of information once it reaches central government's crisis machinery. Information presented to ministers through CRIPs during the summer was on occasions inaccurate. This could be improved by simplifying information content, or by establishing a Defra/Environment Agency situation room, as discussed later in this chapter.

<sup>5</sup> CCWater report, Response to Loss of Water Supply, September 2007

**5.69** The Review considers that more work is needed on these issues and possible solutions and it will return to them in its final report.

### Defra – the role of the lead government department

**5.70** As the designated lead government department for flooding, Defra was at the heart of the Government's response to the flooding. It discharged this role with commitment, working with other departments and the Environment Agency.

**5.71** However, Defra's response took time to settle into an effective pattern. This was essentially due to the unprecedented nature of the floods and the way in which the July flooding events rapidly led on to a much more serious emergency, affecting essential services and critical infrastructure (and thus going well beyond Defra's day-to-day responsibilities).

**5.72** The careful and effective response to the possibility of East Coast flooding in November shows that both Defra and the Environment Agency have already learnt lessons and improved their level of performance. Defra also has important emergency responsibilities in relation to animal disease and other significant risks and there is now a significant body of expertise and experience within the department which should be captured and shared.

**IC 47** – The interim conclusion of the Review is that Defra extends its current departmental programme to share best practice and provide training in emergency response across the organisation.

**5.73** Defra's position was further complicated due to the split of responsibilities between it and the Environment Agency. However, the relationship was generally productive and

there is no evidence to support a need to draw the Environment Agency more closely into the department following the summer 2007 events.

**5.74** This split of responsibilities, along with the very local nature of flooding impact, means that direct comparisons with other national emergencies such as foot-and-mouth disease or pandemic influenza need to be made cautiously. Nevertheless, there are some national-level planning and response techniques used in other areas which could have obvious benefits for the response to flooding events.

**5.75** The fragmented, locally-focused nature of planning for the response to floods is one such issue. While this did not materially affect the quality and effectiveness of the local response, time was spent dealing with issues which could have been pre-determined centrally. In other areas (such as pandemic influenza), such issues are addressed within a single national framework – a model in which the lead government department brings together information, guidance and key policies in a single strand of planning, thus providing a resource for all tiers of government and key external partners. It is not an emergency plan, but it does bring coherence and identify key prior decisions. The Review believes that capturing good work on emergencies across government in this way would be sensible.

**REC 9** – The Review recommends that, in order to effectively fulfil its Lead Department role for flood risk management and emergency response, Defra needs to urgently develop and share a national flood emergency framework.

**5.76** Management of the operational-policy split between Defra and the Environment Agency was achieved through very close working relationships. Nevertheless,

experience from other emergencies shows the efficiency benefits that come from single site co-ordination of key information gathering and decision-making. A separate Environment Agency control room and individual policy teams in Defra had to work harder than necessary in order to deliver coherence. This could in future be better achieved if staff representing key divisions in Defra and the Environment Agency were co-located together to support decision-making and work with ministers in their representative role. To succeed, this enhanced co-ordination and communication effort would need to be supported directly by the top management teams of both organisations. The Review draws encouragement from analogous, very effective arrangements to bring together Defra and Animal Health in the response to major animal diseases.

**IC 48** – The interim conclusion of the Review is that Defra and the Environment Agency work together to establish a single London situation room to coordinate flooding information, to act as a focal point for cross-Defra efforts, and to support Defra ministers.

### Exercising

**5.77** The improvements which Defra was able to institute before the July floods reflect the learning experience many of those involved went through. This demonstrates the benefit of experience when framing any response. This experience can come in two ways – through dealing with actual emergencies or through exercises. Because relying on experience of actual emergencies alone may risk dissipation of experience and expertise, the Government has a wide-ranging exercise programme to ensure that experience gained is then sustained.

**5.78** The last national flooding exercise was Exercise Triton in 2004. The exercise

scenario covered an extreme event with extensive coastal flooding affecting nearly half of England and Wales. The Review notes that another national flooding exercise is not due until 2010 (although local flooding exercises do take place). The capability of central government in a serious flooding emergency would be enhanced if that exercise could be brought forward, not least because departments will be refining their arrangements in light of both their own learning and this Review.

**IC 49** – The interim conclusion of the Review is that a national flooding exercise should take place at the earliest opportunity in order to test the new arrangements which central government departments are putting into place to deal with flooding and infrastructure emergencies.

### Regional leadership

**5.79** Regional Civil Contingencies Committees (RCCC) were activated in the south west region on 23 and 24 July as a precaution against the potential wide-area impacts of power loss that would have occurred if Walham switching-station had been flooded or closed down. These were the first RCCCs activated since the Civil Contingencies Act came into force in 2004.

**5.80** The Review has heard evidence that, regionally, the reasons for activating the RCCC were not widely appreciated and there was some uncertainty in responders' minds over the RCCC's authority and relationship with COBR. Some people wrongly believed that the RCCC had a command and control function above Gold Command rather than being a structure for coordinating the regional picture and liaising with central Government. It appears to have been sensible for the RCCC to meet when it did and to step it down once it was clear that widespread power loss had been avoided. However, the Cabinet Office

and CLG should explain the situation to local responders, drawing on the events of the summer and the role and purpose of RCCCs.<sup>6</sup>

### Financial assistance

**5.81** During and after the floods, the Government made a number of grant awards to assist affected regions and help those in greatest need, totalling £63 million in November 2007. The money was used for example to repair schools and roads and to cover the replacement of essential household items for vulnerable individuals and their families. The Review has heard praise for the Government's swift award of these grants and the flexibility given to local authorities in their allocation of the funds to those in need; however, there have also been concerns raised about differences in how the schemes operated and uncertainty as to whether they will apply in the future.

**5.82** Government financial assistance was provided via four main schemes:

- the 'Bellwin' Scheme, through which CLG made emergency financial assistance available to local authorities to cover the costs of the emergency response;<sup>7</sup>
- the Flood Recovery Grant, paid by CLG, which was mainly used by local authorities to ease the plight of those affected by the floods;
- a grant to help schools and young people paid by the Department for Children, Schools and Families (DCSF); and
- a scheme to provide support for the repair of roads damaged in the floods provided by the Department for Transport (DfT).

**5.83** The Bellwin scheme may be activated where local authorities have spent money in taking immediate action to safeguard life

or property or to prevent suffering or severe inconvenience. As such, it applies to the response phase of an emergency rather than recovery activities such as repair and restoration.

**5.84** During the floods, the Government revised the 'Bellwin' rules to assist local authorities with 100 per cent (up from 85 per cent) of their eligible emergency costs over a standard threshold. This was praised, as was the scheme more generally. But the scheme has also been described as limited in that it focuses exclusively on response, with no scope for funding recovery activities. It is clear that local authorities in particular would like financial assistance to help their communities recover from exceptional events.

**5.85** The Flood Recovery Grant and the grant paid by DCSF were created following the June floods. Although this assistance was very much welcomed, local authorities have said that differences in the way the schemes operate have led to confusion. The Review has heard from a number of local authority Chief Executives who allocated funds where the need was urgent without being sure that the money would be reimbursed by the Government. This reliance on trust left the Chief Executives personally – rather than institutionally – exposed. Furthermore, following messages from government that the schemes should not be regarded as setting a precedent, local authorities are uncertain whether they will be available in future major emergencies.

**5.86** The British Chambers of Commerce (BCC) welcomed flood grants from the Regional Development Agencies (RDAs) to help businesses, but reported that businesses were sometimes unaware of them. They also highlighted the impacts on

<sup>6</sup> [http://www.ukresilience.info/upload/assets/www.ukresilience.info/err\\_chap\\_08.pdf](http://www.ukresilience.info/upload/assets/www.ukresilience.info/err_chap_08.pdf)

<sup>7</sup> <http://www.local.communities.gov.uk/finance/bellwin/bell078.pdf>

businesses which were not directly affected by the floodwaters, but who had suffered due to customers or staff being cut off by road closures. Because they were not directly flooded, insurance did not cover their losses and they were not eligible for RDA flood grants. The BCC has suggested that in such cases a contingency fund might be considered which could offer grants or short-term loans.

**5.87** Relief funds collected by voluntary organisations played an important role in helping those most in need during and after the floods. £5 million was collected by the Red Cross UK Floods Appeal and at least £900,000 was raised through Rotary International in Great Britain and Ireland. In addition, 14 local appeal schemes were set up by local authorities. While the local appeal schemes raised large sums of money and were of undoubted value, the Review has been advised that a single national fund might have gained more media coverage and raised more money. However, a possible counter-argument is that donations were intentionally made to local schemes to provide local benefits and accordingly might have been more generous. The Review does not make any recommendations in this respect, but the arguments might be considered by those setting up future appeals.

**5.88** The question of financial assistance is a complex issue. Response and recovery must be properly resourced but the right safeguards and incentive structures have to be in place. The Review is aware of forthcoming studies and will consider the findings of these and make firm recommendations in its final report. Certainly, more can be done to streamline existing arrangements.

**IC 50** – The interim conclusion of the Review is that financial assistance for local responders in relation to emergency response and recovery should be revised to improve speed, simplicity and certainty.

## Transition to recovery

**5.89** The transition from response (the actions taken to deal with the immediate effects of an emergency) to recovery (the process of rebuilding, restoring and rehabilitating the community following an emergency) flowed smoothly over the summer in most areas. However, submissions to the Review have noted that, in some cases, separate recovery sub-groups were not set up from the outset and that this led to confusion arising as to who should direct resources and negotiate with key partners.

**5.90** The Review therefore recommends that recovery sub-groups are set up from the outset. Submissions also highlight the value of a formal handover of responsibilities between Gold Command, usually chaired by the police, and the Recovery Co-ordinating Group (RCG), normally chaired by the Chief Executive of the Local Authority. The Review recommends that this approach is followed in future.

**5.91** These observations and recommendations are reinforced by recent Cabinet Office guidance<sup>8</sup> and the Review recommends that awareness of the guidance is raised at Local Resilience Forums. One other concern raised by local authorities is the ‘dropping off’ of some responders once handover to the RCG has taken place. The value of a continuing contribution by appropriate responders to the recovery phase should not be underestimated. The Review

<sup>8</sup> [http://www.ukresilience.info/upload/assets/www.ukresilience.info/recovery\\_documents/recovery\\_plan\\_guidance\\_template.doc](http://www.ukresilience.info/upload/assets/www.ukresilience.info/recovery_documents/recovery_plan_guidance_template.doc)

strongly endorses high-level representation on both Gold Command during the response phase and the RCG during the recovery phase. Local Resilience Forums should agree which responders are essential to both stages.

**IC 51** – The interim conclusion of the Review is that Local Resilience Forums should be made aware of recent Cabinet Office guidance setting out the transition to recovery. Recovery sub-groups should be established from the onset of major emergencies and in due course there should be formal handover from Gold Command to the local Recovery Co-ordinating Group(s), normally chaired by the Chief Executive of the affected local authority.

“I lost all my Christmas decorations, kids’ passports, birth certificates and photos. I have got no possible way now of getting them.”

**Householder, Sheffield**

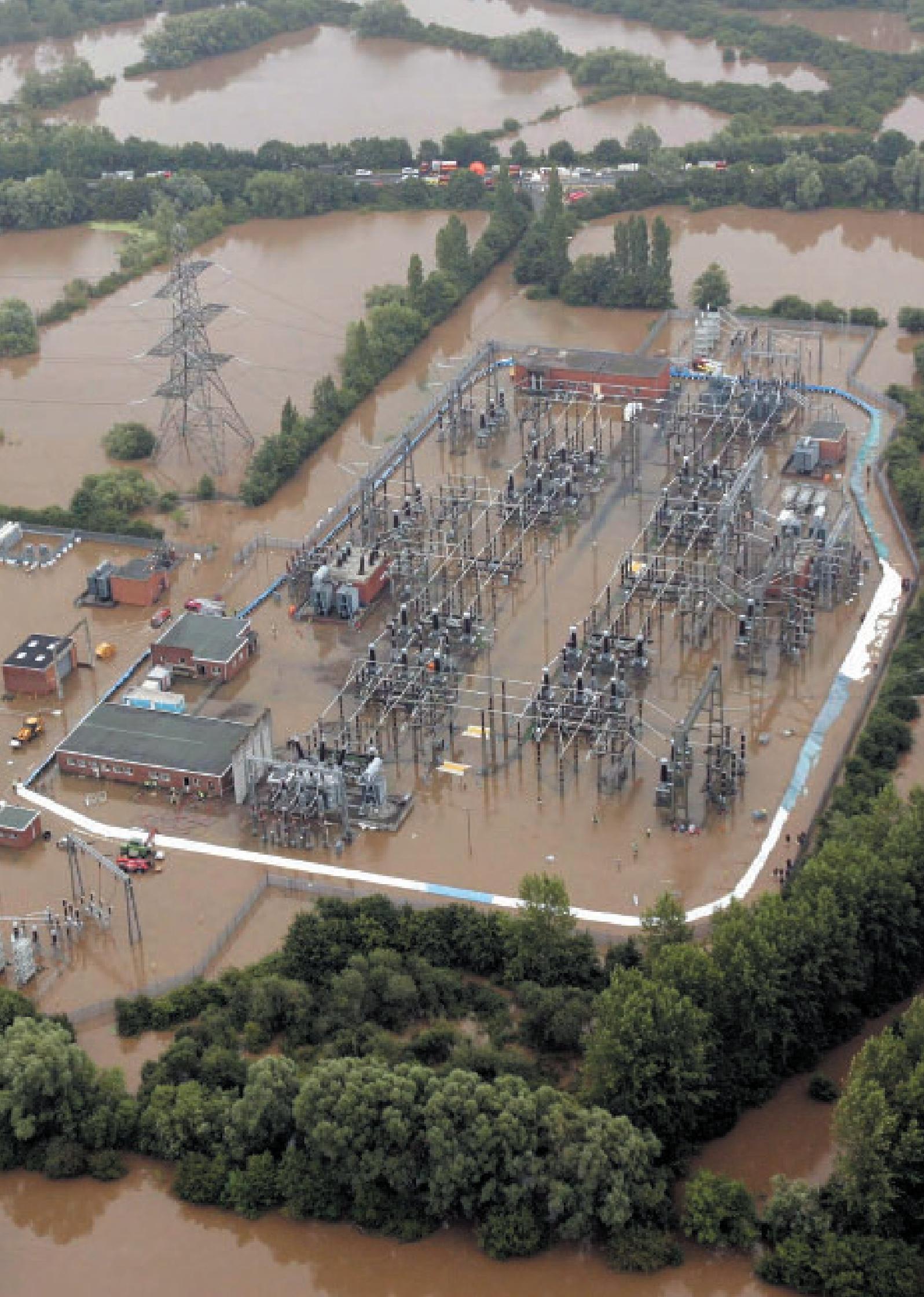
“The whole of the ground floor of our house was damaged by the flooding. Almost nine weeks on now, and we are living a nightmare day in day out. We live in the upstairs area of our house as downstairs is ripped back to brick. We have no cooker, so live on takeaways and microwave food. The thought of suffering a winter in this mess is unthinkable.”

**Householder, West Berkshire**



James Hooker, right, and his wife Liz, scrub the floor of his parent’s house which was damaged by flood water in Tewkesbury, Gloucester © Empics





# Chapter 6: Critical Infrastructure: Keeping Our Essential Services Going

## Summary

This chapter explores the issues that need to be considered to improve the resilience of critical infrastructure.

It is divided into four sections:

- understanding critical infrastructure;
- impacts on critical infrastructure;
- protecting our infrastructure; and
- managing the risks from dams and reservoirs.

Emergency teams in Gloucester try to prevent the flood water rising any further at the Walham electricity switching-station © Rex Features

## Introduction

**6.1** As Chapter 1 describes, the summer floods of 2007 were unprecedented. They were the result of exceptional and record-breaking rainfall in many areas of England, which led to record levels of flooding in some parts of the Severn catchment in July and the largest ever surface water flooding event in South Yorkshire and Humberside in June.

**6.2** Each of these events had a direct and immediate impact on people's lives. But it was the loss of essential services such as electricity and water that showed once again that, in major emergencies, responders must also deal also with the indirect effects, which can be very much greater.

**6.3** The summer's events were a reminder of the need to pay greater attention to improving the resilience of critical infrastructure against flooding if we are to avoid harm to people's social and economic well-being, not only in flooded areas but also well away from them.

## People's reactions to the loss of essential services

The overall feeling can be summed up in the comment from one person that the loss of essential services was like a "return to the Dark Ages". Another interviewee, commenting on the dependency on technology and transport, said "the floods completely overpowered everything"; others that the loss of electricity left people isolated – "We didn't have anything, we didn't have torches, we didn't have candles."

The loss of water was seen by some people as the most serious loss. People felt very strongly that loss of the water supply should not have happened and, more importantly, should never happen again. The loss led to panic buying and associated low-level public disorder. Other services and products were affected: there was panic buying of bread – "You would have thought people were going to starve" was one comment; petrol was in short supply; mobile telephones did not work and landlines were down – "... so they said if you need us ring 999, but what are we going to do, get a lighter and sit on the roof or something, it was absolutely impossible".

## Understanding Critical Infrastructure

### What is critical infrastructure?

**6.4** At the simplest level, infrastructure consists of the basic facilities and installations needed to provide services for the functioning of an advanced, industrialised society. There are many definitions, developed for specific purposes. For example, the final report by the Independent Review Body on the June floods in Hull refers to ‘hard’ (basic utilities) and ‘soft’ (intangible) social infrastructure and the assets that support it such as schools. Other definitions are sector-specific and relate to activities such as planning and development.

**6.5** Without wanting to downplay the importance of ‘soft’ infrastructure, the most relevant definition for the purpose of this Review is that developed to help direct the UK’s response to security threats. It is focused around the concept of **essential services** – the things that matter most to people for their well-being.

“The National Infrastructure comprises those sectors which supply essential services to the citizen on which normal daily life in the UK depends. These are Energy, Water, Communications, Transport, Finance, Government, Health, Food and Emergency Services. The most important sites, physical assets and information or communication networks within these sectors whose loss would have a major impact on the delivery of essential services are deemed the Critical National Infrastructure.”

**Centre for the Protection of National Infrastructure**

**6.6** An important element of this definition is the concept of ‘criticality’. Thus, whether infrastructure is ‘critical’ should be determined by the impact of its loss on the

delivery of essential services and hence people’s well-being. Distinguishing between critical and non-critical infrastructure in this way enables a risk-based and proportionate approach to work to prevent and prepare for emergencies, including flooding.

**6.7** By its very nature, this is a broad definition. For this Report, the Review has used a narrower focus on the assets and services that are provided by Category 2 responders under the Civil Contingencies Act 2004 (CCA). These include privately-owned fixed assets of companies (such as water and sewerage undertakers, power supply companies, telecommunications providers and the railways) and the state-owned road network. These have been chosen because they figured prominently in the summer’s floods but also since it is mainly on these, in combination, that maintaining other essential services such as the production and distribution of food and medical supplies largely depends. As a result, the failure of one part of the critical infrastructure can have severe knock-on effects on other parts. For example, evidence from Yorkshire Water illustrates that services outside the floodplain can be jeopardised if they have no contingency for the loss of other essential services, such as electricity, on which they rely but which are produced by installations that are at risk from flooding. An understanding of such interdependencies between infrastructure sectors is a key part of identifying what is ‘critical’.

**6.8** That is not to downplay services at a local level that are important for everyday life, including schools and the local road network. But these assets typically either include a degree of resilience, or the loss of the services that they provide has a much less immediate impact. These elements of the infrastructure need to be tackled once the basic services have been stabilised.

## The Events Of Summer 2007 And Their Impacts On Critical Infrastructure

**6.9** Tables 5 and 6 set out the number of water and electricity supply assets that were inundated during the summer floods and, where they failed, the services lost.

“The main panic over essential services focused on water. There were near punch-ups in the local Sainsbury’s over water. It was pandemonium. People were just terrified at being left without water.”

Householder, West Oxfordshire

**6.10** The loss of services in these two sectors had an enormous effect on people’s lives, as evidence to the Review has made clear. And it is now clear that the impact could have been much worse: additional substantial disruption was only narrowly avoided in a number of cases. The particular case of Walham switching-station is considered below. In addition, the dam at Ulley Reservoir, near Rotherham, very nearly failed, putting in danger life and a number of other infrastructure assets, including the M1 motorway, a major electricity substation and the gas network connection for Sheffield. Power to the Sheffield conurbation was also very nearly lost, which would have left 750,000 people without electricity.

**Table 5 – Number of water companies’ assets affected by flooding, summer 2007**

	<b>Anglian Water</b>	<b>Yorkshire Water</b>	<b>Thames Water</b>	<b>Severn Trent Water</b>	<b>Total number of assets</b>
<b>Water treatment works#</b>	1	1	1	2	5*
<b>Population affected</b>	2,500 lost their supply for 2 hours	No loss of supply due to re-zoning	No loss of supply due to re-zoning	Mythe – 350,000 without water for 10–17 days	
<b>Sewage treatment works#</b>	63	90	56	113	322
<b>Sewage pumping stations</b>	58	145	109	62	374

\* This figure does not include one water treatment works operated by Dwr Cymru, which was flooded for two days, leaving 5,000 without water.

# Information on impact is being collated by Ofwat as part of the annual returns process for managing water companies performance and will be available next year.

**Table 6 – Number of electricity transmission and distribution assets affected by flooding, summer 2007**

Affected region	South Yorkshire and Humberside	Gloucestershire and surrounding area
<b>Asset</b>	<p><b>National Grid</b> Two major substations – Neepsend and Thorpe Marsh</p> <p><b>CE Electric UK Yorkshire Electricity Distribution plc</b> Four major substations and 55 secondary substations Gelderd Road YEDL control centre evacuated Damage to low-voltage network cables</p>	<p><b>National Grid</b> Walham switching-station required emergency flood defence reinforcement and pumping to avoid loss due to flooding</p> <p><b>Central Networks</b> Three bulk supply point substations – Warndon, Timberdine and Castle Meads 400 distribution substations Damage to low-voltage network cables</p>
<b>Customers affected</b>	35,000 customers initially lost supply – most supplies quickly restored but some 9,000 customers were on rota disconnection for several days	40,000 customers supplied by Castle Meads were cut off for up to 24 hours

### Other affected sectors

**6.11** The rail sector was also substantially hit by the floods and widespread damage was caused. Several lines and stations were closed for between two and seven days, with some out of action for longer where significant repair work was needed. Lines affected included: Reading–Oxford; Cheltenham–Gloucester; Craven Arms–Shrewsbury, including services to Manchester; Oxford–Worcester; Birmingham New Street–Gloucester; Chester–Hooton; Sheffield–Doncaster; Sheffield–Leeds; Sheffield–Retford–Lincoln; Sheffield–Cleethorpes; Doncaster–Hull; and Knaresborough–York. Where possible, substitute road transport was provided, although this was limited by road closures. Network Rail estimates that the repairs, some of which have been completed, will

cost some £32 million. London Underground was also severely disrupted, with 25 stations closed.

“The floods showed us how dependent we are on technology and the transport system. The floods completely overpowered everything.”  
**Householder, West Oxfordshire**

Due to the proximity of the M1 to the Ulley Reservoir, traffic was diverted as a precautionary measure. In July, the closure of the M5 in Gloucestershire on one of the busiest days of the year left 10,000 vehicles stranded, many of them holiday-makers travelling through the area.

## Case study – Events at the Mythe water treatment works

Mythe water treatment works is owned and run by Severn Trent Water. It serves a population in excess of 350,000, providing water to Cheltenham, Gloucester, Tewkesbury and a large part of rural Gloucestershire. It is one of five water treatment works that are unable to receive water from other parts of the Severn Trent network, so their loss would result in a complete loss of supply to a significant number of customers.

Mythe is constructed on artificially raised ground on the bank of the River Severn, close to its confluence with the River Avon. Water is abstracted from the River Severn for treatment. The wide floodplain provides extensive storage for floodwaters and reduces the rate at which they rise. Mythe had been assessed as being at risk of flooding from approximately a 1-in-100 chance per year event.



The rivers Severn and Avon meeting at the Mythe water treatment works in Tewkesbury, Gloucestershire © TopFoto



Hesco Bastion in place at Mythe Water treatment works

Early on Sunday 22 July 2007, Mythe works flooded. Severn Trent undertook a controlled shutdown to limit damage to the plant. This critical procedure prevented electrical failure and saved several days in re-commissioning the works once the floodwaters had receded. By Monday 23 July, there were 70,000 properties without a piped water supply. The shutdown of Mythe and the total drawdown of the connected service reservoirs and distribution network left 350,000 people without any piped water for up to 17 days.

## Case study – Walham switching-station and Castle Meads substation



Walham switching-station is part of the UK high-voltage electricity transmission network and is owned and operated by National Grid. The site supplies power to approximately 500,000 customers across Gloucestershire and South Wales.

It is built on raised ground next to the River Severn. National Grid had previously carried out risk assessment for flooding of the network. This had concluded that Walham switching-station was at risk from events at

around a 1-in-1000 chance per year. A recent assessment carried out in 2005 put risk from flood events in the range 1-in-75 to 1-in-200 chance per year.

On Sunday 22 July 2007, water levels started to rise and threatened to inundate the site. Overnight, 1km of temporary flood barriers were erected around the site by the Armed Forces, Environment Agency, emergency services and National Grid. Although the site was inundated, the barriers, coupled with pumping, stopped the water from rising further when the water level peaked on 23 July. During this time, the site did not fail and the essential service continued.

Had the switching-station failed, there would have been a loss of electricity supply to some 240,000 homes and businesses in the Gloucester area, and reduced the resilience in the supply of electricity supply to South Wales. However, National Grid was able to anticipate and mitigate the risk by creating a circuit bypass arrangement around Walham.

National Grid has since installed a more permanent flood defence system at Walham.

The Castle Meads sub-station, which is part of the local distribution network, was shut down and power to 40,000 homes was cut for 24 hours while temporary defences were constructed and the site pumped out to facilitate re-commissioning.



Drivers negotiate a flooded dual carriageway near Brough, East Yorkshire © Rex Features

**6.12** Despite the road network's intrinsic flexibility, allowing drivers to reroute and circumnavigate problem areas, the floods had a significant local impact. For example, motorway closures affected the M1, M4, M5, M18, M25, M40, M50 and M54, and many local and trunk roads were also disrupted. Repair costs have been estimated at £40–60 million.



Flooding beside M1 motorway during the incident. Colouration of water is caused by shoulder material from Ulley Dam

**6.13** The oil industry was also affected by the floods, resulting in some delay to the bulk supply of fuel products delivered by rail to terminals and other storage facilities while rail services were suspended, although suppliers and distributors were able to maintain deliveries from alternative terminals. Distributors responded quickly to the increased demand for back-up generation in Gloucester and the surrounding areas as a result of the loss of electricity supply. The movement of oil products by pipeline was unaffected by the flooding, and road deliveries took place around flooded areas. Filling stations were closed in the flooded areas where they were not accessible or could not operate.

“I couldn’t get any petrol to go to work because there was so many people waiting to fill up. There just wasn’t enough to go around.”

**Householder, West Oxfordshire**

**6.14** Flooding affected National Grid’s gas distribution network in the Sheffield and Toll Bar areas. A number of measures were put in place by National Grid to ensure continuity of gas supply to the Sheffield area. A bridge collapsed on the main road in Ludlow, severing a gas main and causing the local area to be evacuated.

**6.15** Telecommunication operators and providers experienced a degradation of local access networks because of floodwater infiltration. But British Telecom noted that they suffered less degradation and failure than they expected, partly as a consequence of the increased use of glass fibre as a replacement for copper cabling. The interconnected nature of the network provided a degree of resilience and helped prevent significant failures.

Telecommunications companies believe that flooding has the capability to disable networks when coupled with power failure. The industry is currently considering changing the threshold at which network control centre managers become alerted to potential problems, so that they are warned when a major incident has been declared and a Gold Command is being established.

“Most of the landlines went down. Everyone had to use their mobiles.”

**Business owner, Hull**

### The legislative framework for critical infrastructure

**6.16** The Review has undertaken an initial analysis of the legislative framework currently in place for emergency planning and response, within which infrastructure providers operate. The key obligations are to be found in both the Civil Contingencies Act and sector-specific legislation.

#### The Civil Contingencies Act 2004

**6.17** The CCA places very few obligations on infrastructure providers, although they are obliged, as Category 2 responders, to co-operate with Category 1 responders and assist them in fulfilling their obligations to assess risk, maintain plans and advise the public.

**6.18** Section 2 of the CCA places a requirement on Category 1 responders to assess the risk of an emergency, maintain

plans to ensure that in an emergency they will be able to perform their functions (business continuity plans) and undertake to prevent or mitigate the effects of the emergency (emergency plans). It also sets out the role that Category 2 responders should play in that process.

**6.19** Infrastructure providers are required to attend Local Resilience Forum meetings so far as practicable, and to share information with requesting responders (subject to exemptions on the grounds of security and commercial sensitivities). There are no particular obligations on Category 2 responders about their role in planning for emergencies.

### **Sector-specific legislation**

**6.20** Sector-specific legislation contains similar sorts of obligations to plan for, prevent and respond to particular sector-specific eventualities (such as contamination, loss of supply or loss of service). The most relevant provisions are:

- The power to direct water and sewerage providers under the Water Industry Act 1991. The Secretary of State is entitled to give directions in the interests of national security, or for the purpose of mitigating the effects of civil emergency. The current direction is the Security and Emergency Measures (Water and Sewerage Undertakers) Direction 1998. It requires providers to make and revise plans to ensure the provision of essential water supplies or sewerage services.
- Obligations in the Electricity Safety, Quality and Continuity Regulations 2002. Electricity generators, distributors and meter operators are required to construct, use and protect their equipment to prevent interruption of supply so far as reasonably practicable. Generators and distributors are also required to prevent danger due to the influx of water into any enclosed space arising from the installation or operation of their equipment.
- Obligations in the Gas Safety (Management) Regulations 1996. A person who conveys gas is required to maintain a 'safety case' to plan how to deal with a gas escape, to demonstrate adequate arrangements to minimise the risk of a supply emergency, and to make arrangements to deal with dangerous incidents.
- Obligations in the Control of Major Accident Hazards Regulations 1999. Operators of installations of dangerous substances in the oil industry are required to take all measures necessary to prevent major accidents, and to limit the consequences to people and the environment.
- The power contained in the Communications Act 2003 to enable Ofcom to impose conditions on telecommunications providers regarding the provision, availability and use of the communications network and services in the event of a disaster and for the purposes of emergency planning. General Licence Condition 3 requires providers to maintain, to the greatest extent possible, the proper and effective functioning of the public telephone network. General Licence Condition 5 requires providers to restore service where practicable.
- The power to direct rail operators under the Railways Act 1993. The Secretary of State is entitled to issue a broad range of directions to the Office of Rail Regulation, owners or operators of railway assets, or people who provide railway services about the use, management or provision of assets or services in the event of a major emergency.

## Protecting our infrastructure

**6.21** Clearly, in general it is better to seek to prevent critical infrastructure being lost, whether to flooding or other natural hazards, than to have to respond to its loss. But, in contrast to the co-ordinated, systematic campaign led by the Centre for the Protection of National Infrastructure to protect critical infrastructure against acts of terrorism, it is clear from evidence submitted to the Review that the approach taken to mitigating the risk from natural hazards has largely been uncoordinated and reactive.

**6.22** The Review welcomes the work now being undertaken by industry and regulators to assess vulnerability to, and risks from, flooding. For example, the Energy Networks Association, Water UK and Ofwat all have reviews under way in the wake of the summer 2007 floods. The Highways Agency is also carrying out work to protect the motorway and trunk road network from natural hazards. These are welcome initiatives in themselves and they will provide valuable insight and potential solutions. But they are not sufficient in isolation. A key lesson of the summer is that, especially given the growing risk of severe weather events described in

Chapter 3, the Government needs to put in place a systematic campaign to reduce the vulnerability of critical infrastructure to natural hazards.

**IC 52** – The interim conclusion of the Review is that the Government should establish a systematic, coordinated, cross-sector campaign to reduce the disruption caused by natural events to critical infrastructure and essential services.

## A strategic framework to reduce vulnerability to natural events

**6.23** As with the programme to enhance the protective security of critical infrastructure, the Government has a key role in providing the framework for a consistent, proportionate and risk-based approach across and within infrastructure sectors, designed to deliver a reduction in vulnerability to natural hazards over a number of years. That framework should be rooted in central, common standards on the level of protection that should be provided – and hence the level of flood risk that is acceptable. Any such standards must take account of the costs – what is affordable in the prices charged for their

## Case study – United Utilities' approach to criticality assessment

Analysis carried out by United Utilities (UU) of the risk to its infrastructure has led to the development of a company policy that proposes that all new or critical existing facilities at risk from flooding are to be designed to withstand a 1-in-1,000 chance flood event, while all existing non-critical facilities at risk of flooding are to be designed to withstand a 1-in-100 chance flood event. A 'critical' facility has been defined as one that, if it failed, would have an impact on over 25,000 customers.

UU is currently carrying out a study to assess the current levels of flood protection at each of the facilities deemed to be at risk from flooding. This work will determine the most appropriate flood defences and the associated investment required.

UU is carrying out assessments of each of its facilities to determine the impact of the failure of each facility as a result of flooding. UU will also carry out a cost-benefit analysis and make the case for adequate funding for flood defence work in the next Ofwat price review.

**Table 7 – EA study showing infrastructure overlain on flood risk maps (river and sea floodplains)**

Asset	Number of sites in flood zone (flood risk probability)			
	Significant (1 in 75)	Moderate (1 in 75 to 1 in 200)	Low (1 in 200 or fewer)	Total in all three zones
Water and sewerage	737	223	179	1,145
Electricity (generation and distribution)	2,215	2,263	3,818	8,423
Gas (works and distribution)	5	8	10	23
Telephone exchanges	82	67	86	241
Motorways	139km	104km	132km	382km
A roads	884km	553km	809km	2,278km
Railway lines	1,470km	750km	948km	3,213km

services by the relevant industries – and the impact of losing those services. Judgements in these areas will affect decisions on the timetable for the implementation of protection measures. All of these are issues of public policy and are for the Government.

**IC 53** – The interim conclusion of the Review is that the Government should develop and issue guidance on consistent and proportionate minimum levels of protection from flooding for critical infrastructure.

**6.24** A proportionate, risk-based framework will encompass a range of options for reducing vulnerability, from a high level of physical protection for the most vital assets down to no protection at all for sites where protection would simply be uneconomic and where better contingency planning for failure is the best option. It should be based

around three core functions: assessing criticality; assessing vulnerability; and considering options for mitigation.

**6.25** The first step should draw on the revised approach to assessing criticality set out in Lord West’s recent review.<sup>1</sup> There are many synergies between work to protect infrastructure from threats from terrorism and from natural events such as flooding. For example, the impact of the loss of essential services is the same regardless of the cause of the disruption. The Government can therefore use the analysis of criticality that has been developed as part of the framework to tackle security threats to inform the development of national guidance on protection against natural hazards, and this could then be applied by infrastructure operators to their specific assets.

**6.26** The next step should be to determine the proximity of critical infrastructure assets

<sup>1</sup> [www.number10.gov.uk/output/page13757.asp](http://www.number10.gov.uk/output/page13757.asp)

### Case study – Improving resilience

It is clear that understanding potential flood risk and taking action to mitigate it has paid off. The preparations that Yorkshire Electricity Distribution Ltd (YEDL) made as a result of previous experience of extreme natural events have resulted in its infrastructure being more resistant to flooding risks. YEDL had improved the defences at a number of its highest risk electricity sub-stations in response to the 2000 flood events. YEDL believes that this investment helped to reduce the impact of the flooding on its assets and maintained essential services for customers in the North East.



Blackburn Meadows electricity substation protected by flood defences.

to the floodplain (or their exposure to other natural hazards). The results of a recent Environment Agency project to identify the vulnerability to flooding of critical infrastructure are given in Table 7 above.

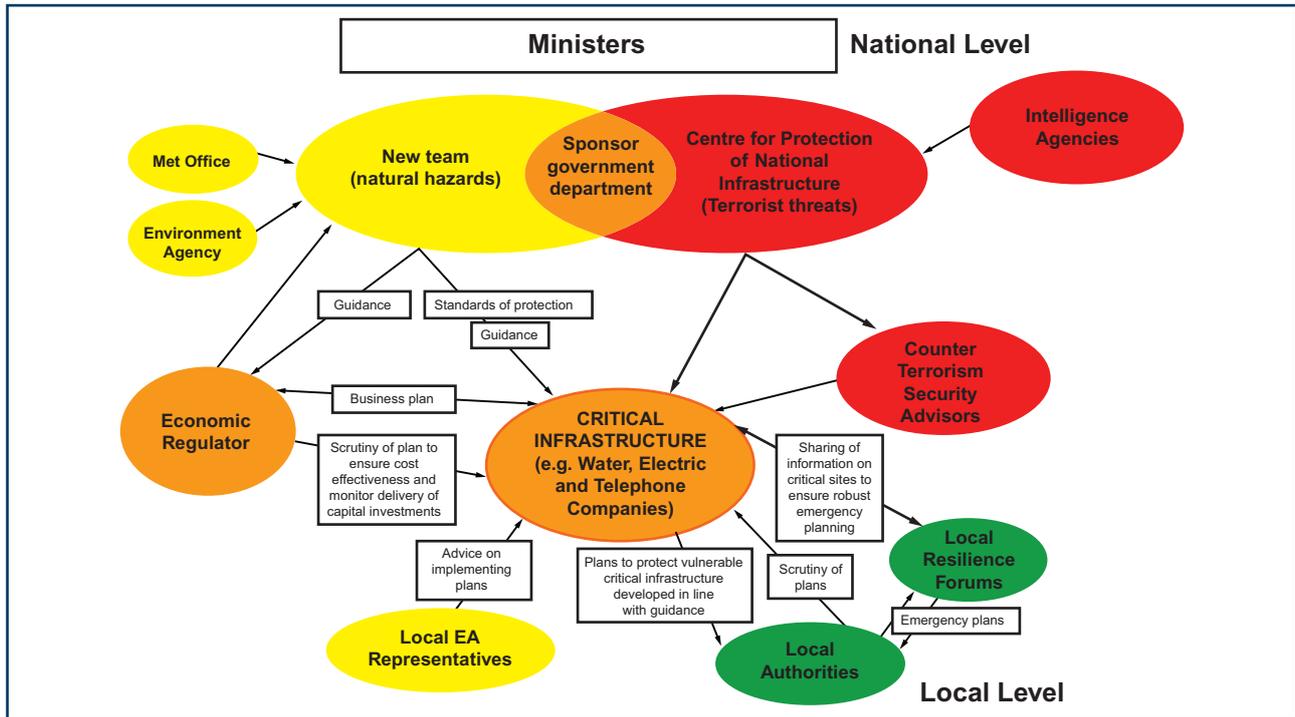
**6.27** At this stage the Agency's analysis does not take into account the degree of resilience to flooding and the data may be incomplete. So the analysis can give only a broad understanding of the scale of the task.

**6.28** Once criticality and vulnerability are known, there are a number of choices to be made about how best to mitigate the risk of future flooding. The first stage should be to consider whether vulnerability is likely to be reduced as a result of an existing or future Environment Agency flood defence scheme. If not, infrastructure

owners will need to consider a range of possible options, including:

- **Relocation of the asset.** This would involve moving high-criticality assets out of the floodplain altogether and into a low-risk area.
- **Improving the robustness of flood defences.** This could include permanent defences for high-risk sites through to demountable or temporary defences for sites at medium risk.
- **Increasing resilience of the service or asset.** This may involve making the service more resilient by building additional network connections and/or making the asset more resistant to flooding through waterproofing key components or raising them out of harm's way.

**Figure 16 – Strategic framework for protecting critical infrastructure**



**6.29** This section has focused on the protection of existing assets. As those assets reach the end of their useful lives, resilience needs to be built in at the planning stage for any replacement and new assets. Guidance on standards should therefore be framed in such a way that it can be used to inform decisions about the appropriate level of protection for future building and take into account differences between sectors. We consider that the guidance should also include allowances for predicted climate change impacts over the life of new and replacement assets.

**Costs and who bears them**

**6.30** Cost-benefit analysis will be an important element in assessing what is acceptable for both the private and the public sectors – the first important test is whether the benefits of action outweigh the costs. Not all measures that are identified to improve the resistance of particular infrastructure assets or services from flooding will pass such a test; as noted above, different, lower cost options may be more appropriate in some instances.

**6.31** Even if the test is passed, questions of affordability and prioritisation will also arise. The existing economic regulatory frameworks provide the obvious route for funding work to reduce the vulnerability of infrastructure assets owned by the private sector. However, infrastructure operators must be able to justify that work on the basis of risks, costs and benefits, drawing on the standards set by the Government and within frameworks established by the economic regulators (including the extent to which costs could be passed on to consumers).

**IC 54** – The interim conclusion of the Review is that infrastructure operating companies should present the case for further investment in flood resilience through the appropriate regulatory process.

**6.32** Figure 16 illustrates our vision for how a national framework for protecting critical infrastructure from flooding could be combined with strong local leadership. It complements a number of structures and

disciplines used by the Centre for the Protection of National Infrastructure to protect critical infrastructure from security threats. This approach would allow the Government to identify priorities based on a common understanding of criticality and would minimise burdens on infrastructure operators.

### The need for consistent business continuity planning

**6.33** It may not be possible on practical or economic grounds to provide protection for all assets. And no level of protection can ever be complete – exceptional events can always overwhelm defences. So contingency planning for the loss of services is equally important.

**6.34** The first step is business continuity planning. Business continuity planning is a process developed to counteract systems failure and is essential to businesses regardless of size and sector. Ensuring that there is an effective business continuity plan in place is an invaluable step that can be taken to make sure that the services that infrastructure operators deliver are maintained for as long as possible or that, if they are lost, there is sufficient contingency in place and that the service is recovered as quickly as possible. The British Standards Institute has recently published a new standard (BS 25999) for business continuity management.

**6.35** Evidence to the Review so far suggests that planning for failures is patchy and inconsistent. The Hull Independent Review concluded that Yorkshire Water did not have a plan for failure of the Bransholme pumping station, which plays a key role in draining Hull. Severn Trent Water notes that Mythe is one of five water treatment works in its region that represent a single point of failure resulting in a complete loss of supply to a significant number of customers. Although some form of contingency plan exists for all the sites,

only one has been considered serious enough to merit the development of a specific scheme to ensure supplies in the event of failure. These are two specific case but they highlight a discrepancy that is likely to exist within this and other infrastructure sectors. The Review welcomes Severn Trent Water's analysis and the work that it has in hand to learn lessons from the summer, including revisiting its contingency plans.

**6.36** The work proposed on business continuity planning by Severn Trent Water needs to be undertaken consistently across relevant sectors, in conjunction with the wider emergency planning community. The Review believes that this is of sufficient importance to merit making it a legal duty.

**IC 55** – The interim conclusion of the Review is that a duty should be introduced on critical infrastructure operators to have business continuity planning to BS 25999 in place to more closely reflect the duty on Category 1 responders. This should include minimising the loss of service as far as practicable in the event of a serious emergency resulting from flooding.

### Emergency planning

**6.37** If protective measures are overwhelmed, and business continuity plans are insufficient, the final fallback is the activation of emergency plans.

**6.38** Information is the lifeblood of effective emergency planning. But it is clear from evidence provided to the Review that the amount of information available to enable emergency planning for the loss of emergency services has been insufficient.

**6.39** The Review has identified from the many emergency responders consulted during the course of the Review that they had an inadequate understanding of:

- the location of critical sites;
- the mapping of their vulnerability to flooding;
- the consequences of their loss; and
- their dependencies on other critical infrastructure assets.

**6.40** Responders considered these to be fundamental weaknesses in local emergency response. Thus, from evidence submitted to the Review, it is clear that the Local Resilience Forum and the Gloucestershire Gold Commander were initially unaware of the vulnerability to flooding and the criticality of Mythe water treatment works and Walham switching-station. Even at national level, central government did not initially have access to accurate and up-to-date data.

**6.41** The Review is concerned about this finding, not least because it is clear that some of the information is held by local police forces and some parts of government. The Review recognises that there will always be security concerns over making information on critical infrastructure sites too readily available. But experience from summer 2007 suggests that a better balance needs to be struck between security and sharing information so as to improve preparedness at all levels in order to protect the public. There is no reason why information should not be shared with key emergency planners as quickly as possible on a secure basis. We acknowledge the work underway nationally to improve the availability of information on Critical National Infrastructure during a crisis.

**REC 10** – The Review recommends that Category 1 responders should be urgently provided with a detailed assessment of critical infrastructure in their areas to enable them to assess its vulnerability to flooding.

**6.42** There is also a need for improved information-sharing and knowledge exchange on a routine basis between infrastructure operators, in their roles as Category 2 responders, and emergency planners in local authorities and other Category 1 bodies to better understand the vulnerability and consequences of failure, thus enabling effective planning for emergencies.

**6.43** The CCA gives Category 1 responders the right to request information from Category 2 responders so that effective plans can be put in place. Some Category 2 responders also have pre-existing requirements on them, for example under their licence conditions from regulators or by a direction from the relevant government minister, to assess risk and to prepare emergency plans.

**6.44** However, experience suggests that Category 2 responders are likely to rely on exceptions that relate to, for example, commercial confidentiality. The Review recognises that many of the Category 2 responders are private sector bodies, which may be in competition with other Category 2 responders within the same area. But, while it is important that these needs are respected, it is clear that this issue should not be allowed to impinge on the speed, effectiveness and co-ordination of the response.

**6.45** The Review is aware that the Cabinet Office is reviewing the operation of the CCA, including structures, duties and supporting guidance, to consolidate best practice and to draw on lessons learned from major emergencies and exercises since it came into effect. This issue is of such importance that it merits particular attention in that review, against the overall goal of achieving better information-sharing.

**IC 56** – The interim conclusion of the Review is that, in relation to information-sharing and cooperation, the Civil Contingencies Act and Regulations should be extended to require Category 2 responders to more formally contribute information on critical sites, their vulnerability and the impact of their loss.

**IC 57** – The interim conclusion of the Review is that single points of failure and the complete loss of assets need to be explicitly considered in the risk assessment and contingency planning undertaken by operators, emergency planners and responders.

**IC 58** – The interim conclusion of the Review is that Local Resilience Forums should ensure that Community Risk Registers reflect risks to critical infrastructure from flooding and other hazards.

### Involvement of infrastructure operators in Gold Command

**6.46** Evidence to the Review suggests that the involvement of Category 2 responders in multi-agency emergency response exercises has historically been patchy. As a result, the integration of Category 2 responders into Gold Commands set up to manage the response to each emergency as it arose was initially slow. Feedback from Category 2 responders who attended Gold Commands indicates that they were often unfamiliar with the Gold Command structure and attendance and arrived without knowing what facilities to expect.

**6.47** The Review has noted evidence from responders that Severn Trent Water may have been able to cope better in the early stages of the loss of Mythe water treatment works had they been more closely involved in multi-agency planning, and had both the company and its partners been better

informed about local circumstances and infrastructure.



People queue outside the Town Hall at a water collection point in Tewkesbury, Gloucestershire © Rex Features

**6.48** The Gold Command held in Gloucestershire proved the value of team members who were familiar with each other from previous exercises and meetings. Getting to know potential members of Gold Commands before an emergency, especially through exercises, speeds up multi-agency working during an incident. Training, such as the ‘Gold Standard’ training provided by the Government’s Emergency Planning College, would ensure that responders knew what to expect when attending a real Gold Command situation.

**IC 59** – The interim conclusion of the Review is that Category 2 responders should be required to participate fully at Gold and Silver Commands and that the Government should deliver this through the Civil Contingencies Act or other regulatory regimes.

### Local leadership and scrutiny of emergency plans

**6.49** The recent Hull Independent Review identified a number of serious issues with the design, maintenance and operation of the pumped drainage system in Hull. These issues had been recognised and raised as long ago as 1996, but were apparently never acted upon. The local authority should have understood the extent of

vulnerability in order to ensure that this vital service was maintained for the good of the local community and that plans were put in place for potential failure. Had there been effective information exchange, coupled with local scrutiny, it would have provided a better understanding of the risks and would have promoted earlier action and the development of contingency plans. The people of Hull would undoubtedly have benefited.

**6.50** The Government has set out its vision for stronger governance and accountability at the local level in the Local Government White Paper. The framework for this vision has been embedded by the passage of the Local Government and Public Involvement in Health Act in October 2007. The Act contains provisions to enhance local authority scrutiny and ensure closer working through Local Area Agreements and targeting to improve the economic, social and environmental well-being of the area.

**6.51** The Review notes the strengthened plans proposed for scrutiny of local bodies by local authority scrutiny committees. The Review considers this to be a valuable tool in assuring people through their elected members that emergency plans are robust and reflect their concerns, and it should

assist elected members to demonstrate leadership. This will be a vital step in turning national advice into action on the ground.

**IC 60** – The interim conclusion of the Review is that the emergency plans and business continuity plans of essential service providers should be reviewed annually by local authority scrutiny committees.

### Local capability

**6.52** The Review considers that issues around infrastructure, requiring a reasonable degree of technical understanding of the sectors involved and the need to maintain commercial confidentiality, are not ones that are typical of matters relating to emergency planning. Additionally, because of the wide potential consequences of infrastructure loss, it may be necessary to work across Local Resilience Forum boundaries. We therefore think that Local Resilience Forums will need to consider new arrangements for addressing infrastructure resilience. We are aware that the Sector Skills Councils have asked the Skills for Justice Council to develop National Occupational Standards for contingency planning. We would ask the

### Case study – Ulley and other incidents

Between 24 and 25 June 2007, 90mm of rain fell in 18 hours. The subsequent overflow at Ulley Reservoir caused failure of the masonry walls of the spillway and significant structural damage to the dam wall. It is to the great credit of the emergency services that action was taken quickly, with the M1 closed and around 1,000 people in local villages evacuated as a precaution in case the dam breached. The emergency services pumped millions of litres of water from the reservoir to ease the pressure on the damaged dam. The dam was finally declared safe some 40 hours later, after emergency works were completed.

In all, the Environment Agency recorded eight incidents at reservoirs registered under the Act over the summer period of high rainfall. In addition, although the Agency is aware of another ten incidents at reservoirs that are outside the terms of the Act, more may have occurred. For the most part, these incidents involved overtopping of the dams due to inadequate spillway capacity for the exceptional amounts of rainfall that occurred. Not all of these might be regarded as significant, and, in the event, none had to be treated as emergencies.

Councils to consider including emergency planning for critical infrastructure.

**IC 61** – The interim conclusion of the Review is that critical infrastructure planning should become a separate discipline within civil protection at the local level.

## Managing the Risks from Dams and Reservoirs

**6.53** Reservoirs are an important part of our infrastructure and perform a range of valuable functions, including helping us to maintain our water supplies. But they may also present serious risks in the event of breaches, related to the threat to human life, property and infrastructure assets from inundation as a result of catastrophic failure of dam walls.

**6.54** The last major breach that occurred in this country was in 1925 and led to the loss of 21 lives. While there have been breaches and near misses since then, there has been no loss of life. This can be attributed to the effectiveness of the enforcement regime first introduced in the 1930s and updated in the Reservoirs Act 1975. Although the risk of reservoir failure can therefore be regarded as less likely, the Review considers that there is no cause for complacency, particularly in the light of events during summer 2007.



Aerial view of Ulley Reservoir after heavy rain © Empics

**6.55** At present there are over 2,000 reservoirs registered under the Reservoirs Act 1975 in England and Wales. These are of three types:

- impounding, (a structure across a valley);
- non-impounding (a wholly bunded structure); and
- service reservoirs (enclosed structures for potable water storage).

**6.56** The majority of reservoirs are of the impounding type and are owned by the private sector, including water companies (which own 35 per cent of this stock). Water companies own reservoirs for bulk water storage to feed water treatment works and provide flow compensation, together with service reservoirs for distribution into the main water supply. A number of other organisations maintain reservoirs for water supply purposes, including farms for irrigation.

**6.57** The average age of the reservoir stock is 110 years, and many reservoirs are now used for purposes other than their original intention. For example, in rationalising their stock of reservoirs, water companies have sold off many of their smaller reservoirs, which are now used for recreation. In addition, industry maintains reservoirs associated with mines and quarries, and many of their older reservoirs built during the industrial revolution are also now used for recreational uses such as boating and fishing.

**6.58** The Reservoirs Act 1975, as amended by the Water Act 2003, provides for a safety regime for any reservoir with a capacity of over 25,000 cubic metres above natural ground level. At the heart of the regime is the responsibility on the reservoir undertaker to ensure the safety of the reservoir. Since October 2004, the enforcement authority for England and Wales has been the Environment Agency (enforcement was previously the responsibility of 136 local authorities).

**6.59** The Review has noted the latest biennial report by the Environment Agency on its enforcement of the Act in England and Wales. We commend the approach the Agency has taken, putting in considerable effort to catch up on a significant backlog of under-enforcement and in its continuing work to trace unregistered reservoirs. In doing this, it is clear that the Agency prioritised its resources by tackling the higher-risk reservoirs first.

**6.60** Nevertheless, the Reservoirs Act 1975 is not a risk-based measure. The volumetric criterion for inclusion in the Act's controls applies to all reservoirs over the 25,000 cubic metre capacity limit regardless of the risks they might pose to people and property. A number of reservoirs and dams exist to which the Act's controls do not apply for that reason (reservoirs and lagoons associated with mine workings, for example, are governed by the requirements of the mines and quarries legislation, under which a structure that is capable of holding 10,000 cubic metres of water and presents a significant hazard is regulated). However, there is no reason in principle why any dam or reservoir that falls below the volumetric criterion should be assumed to pose significantly less of a risk. What matters is the potential risk to people and property, including essential services, in the surrounding area. This situation has arisen for historic reasons to do with the way in which legislation in various areas has developed separately. But the resulting position is illogical and inconsistent. In its biennial report to the end of March 2007, the Environment Agency considers that a more risk-based approach to dams and reservoirs of all sizes and for all purposes should be implemented. The Review considers that the summer's events confirm the soundness of the Agency's view that the scope of the Reservoirs Act should be reviewed accordingly.

**6.61** The Review also notes that the Environment Agency has called for other changes to the current legislation, all designed to modernise the current enforcement regime. The Review believes that it would be helpful if the Government were to draw up such proposals in readiness, and we will give further consideration to the issues in the final report.

**IC 62** – The interim conclusion of the Review is that the Government should implement the legislative changes proposed in the recently published Environment Agency biennial report on dam and reservoir safety.

**6.62** The Review has received comments from one resident living near Ulley Reservoir that knowledge of the risks should have been more widely known. Local emergency planners should also be aware of and take action to plan for such risks. It is therefore encouraging that Defra and the Environment Agency are planning to require undertakers to prepare on-site plans for reservoir incidents and for these to be accompanied by off-site plans by local authorities and other emergency planners in the areas surrounding the reservoirs that could be affected.

**IC 63** – The interim conclusion of the Review is that all reservoir undertakers should be required by Defra to prepare inundation maps and share them with Local Resilience Forums to improve Community Risk Registers and emergency planning.





# Chapter 7: Engaging the Public

## Summary

This chapter examines:

- raising awareness before the emergency;
- weather and flood warnings;
- providing advice during the emergency; and
- the role of communities and individuals.

**7.1** The events of summer 2007 touched many lives. As Chapter 2 explains, the impact on communities which suffered flooding or the loss of essential services was in many cases severe. The emergency response described in Chapter 5 did much to alleviate the impact, but the authorities were limited by the sheer scale of events. Communities, businesses and individuals needed to take action themselves before, during and after the flooding in order to protect people and possessions.

**7.2** This chapter explores how the public were involved in the flood-related emergencies, what impact that had and what lessons can be drawn for the future.

## Raising Awareness before the Emergency

**7.3** The public's response to the summer 2007 floods differed according to whether people were aware of the risks and able to take action as a consequence. People obviously need to be aware of a flooding risk before they can act. But even this may not be enough – of those we talked to who actually knew prior to the floods that they were at risk, relatively few had done anything to prepare. This finding is backed up by evidence from other sources. Recent research<sup>1</sup> suggests that while 60 per cent of at-risk residents in England and Wales claim to be aware that they live in a flood risk area, only 39 per cent of those who had previously been flooded have taken any action to prepare for floods, falling to 6 per cent of those with no prior experience of floods.

<sup>1</sup>Harries, T. (2007) "Householder responses to flood risk: The consequences of the search for ontological security. PhD Thesis, Flood Hazard Research Centre, University of Middlesex

“When I saw on the news that there were alerts and things, I didn’t take much notice of them.”

**Business, Hull**

“We were shut for three weeks after the first flood. The second time, we were more prepared and it didn’t come in. It took a week to get back (to opening) that time. We had just re-laid carpets after the first one and we said we’re not losing all that money so we took it up.”

**(Business, East Lindsey)**

**7.4** The Environment Agency’s flood warning system has limited levels of public uptake. In the regions affected by the summer 2007 floods, only around 20 per cent of people invited had joined the Flood Warnings Direct service. The level of uptake varies significantly: for the Midlands and Thames Regions, only 35 per cent and 28 per cent respectively of the people invited to sign up to the service did so, while for the North East (including Yorkshire) and Anglian regions, the figures are 17 per cent and 9 per cent. In addition, the Agency’s analysis shows that around 27 per cent of telephone calls made under the Flood Warnings Direct system were not picked up by recipients. In England and Wales overall, only around 41 per cent of people for whom the Flood Warnings Direct service is available take up the service – approximately 276,000 properties. Take up matters; research has shown that 75 per cent of people who receive a warning go on to take some form of action.

**7.5** The Review is aware of work the Environment Agency is doing to engage members of the public and reduce levels of apparent indifference. This includes targeted awareness campaigns to get householders and businesses to sign up to the Agency’s Flood Warnings Direct service and, in high risk areas, to develop flood

plans and business continuity plans. The Agency is now looking at alternative marketing approaches that tailor messages to a range of demographic groups by, for example, offering prizes for the first people to sign up for warnings or raising initial interest via puzzles in newspapers. This approach is currently being trialled and the Agency hopes to have results back by early 2008.

**7.6** Other approaches could include making the public and businesses more aware of the impact of flooding using graphic images of flood damage, in a similar way to the methods used in anti-smoking and drink-driving campaigns. Signs about flood risk could be placed on street furniture such as bus stops, lamp posts and benches, and in shared areas of buildings such as offices. In work premises, flood drills could be run in a similar way to the more familiar fire drills.

## Flood warnings

The Environment Agency’s flood warning system consists of four codes. Each code indicates the level of danger associated with the warning:

### **Flood Watch**

Flooding of low-lying land and roads is expected. Be aware, be prepared, watch out!

### **Flood Warning**

Flooding of homes and businesses is expected. Act now!

### **Severe Flood Warning**

Severe flooding is expected. There is extreme danger to life and property. Act now!

### **All Clear**

Flood Watches or Warnings are no longer in force for this area.

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

**7.7** The Review has taken evidence that the current descriptions of areas at risk using named stretches of watercourse – for example, “between ‘x’ brook and ‘y’ stream” – are unhelpful, both to emergency responders and the public. Most people do not use watercourses as a reference point and struggle to understand information issued on that basis. Our research revealed that many people felt that a reliable alert was required that directly applied to their street or neighbourhood. The Review is aware that the Environment Agency has work underway to tailor information to individual communities.

“The websites don’t actually say Tesco’s car park is going to flood – it’s this tributary and that confluence – and for people who don’t have a geographical knowledge of the rivers and the way they’re formed, it’s almost impossible to weigh what’s at threat and what’s not.”

**(Business, East Lindsey)**

**7.8** There is a demand for personalised warning information that is tailored in its targeting, delivery method and detail. It would be helpful if these factors, could be considered and options drawn up before the Review’s final report.

**IC 64** – The interim conclusion of the Review is that the Environment Agency should produce a sliding scale of options for greater personalisation of public warning information, including costs, benefits and feasibility, before the Review’s final report.

**7.9** Along with awareness campaigns, the Environment Agency has a pilot scheme to automatically register eligible households and premises for flood warnings unless they opt out. The question has been raised

as to whether it is legally permitted for such an ‘opt out’ scheme to be rolled out more widely, for example to ex-directory telephone numbers. This needs urgent clarification and the Review hopes a solution can be found.

**REC 11** – The Review recommends that the Environment Agency should work urgently with telecommunications companies, consulting the Information Commissioner as necessary, to facilitate the roll-out of ‘opt out’ telephone flood warning schemes to all homes and businesses liable to flooding, including homes with ex-directory numbers.

## Weather And Flood Warnings

**7.10** The Review has received largely positive evidence from the public on the accuracy and timeliness of the Met Office’s Severe Weather Warnings. As described in more detail in Chapter 5, weather forecasts preceding the events of June and July 2007 were generally detailed and accurate within the limitations of current technology. The public were kept well informed, receiving warnings via the media and the Met Office’s website and Customer Centre. The Met Office also held regular briefings with its customers, including the BBC, to share the most up-to-date information.

**7.11** The Environment Agency’s Flood Warnings generally worked well in summer 2007 for river flooding, and effective and timely coastal flood warnings were issued during the East Coast surge in November. However, many of the summer’s emergencies were caused by groundwater and surface water flooding and therefore many people affected were unaware of the situation even as it unfolded.

“The first time we heard about the water coming in we were having our tea and water started coming in and we left it for a bit and then my wife was getting a bit panicky so she phoned a social worker because my son has got special needs and she said phone the council and they told us to stay in. I think we got out of the house about 8.30-9pm and we were still waiting to be picked up at 12.30am and the police took us down to Bentley and then the council took us to Don Valley.”

(Householder, Toll Bar, Doncaster)

## Methods of warning the public

**7.12** Flooding in summer 2007 disrupted electricity supplies and led to power outages, disabling mains-powered radios, televisions and computers. Fixed line telephones also failed. As a result, a diverse range of warning methods was employed to ensure warnings reached their intended audience.

**7.13** Warning methods used included:

- door-to-door calls, cross-referenced with records of vulnerable people;
- electronic message boards on major arterial roads and motorways;
- mobile loudhailer announcements;
- PA announcements in public buildings;
- sirens;
- automated telephone, fax, email and text message services (Flood Warnings Direct); and
- broadcast media announcements on television and radio.

**7.14** Door-to-door calls were viewed as particularly effective and were welcomed by residents, as also witnessed during the flooding on the East Coast in November 2007. This is a simple but effective method

which can be put into effect quickly while additional warning methods are explored.

“If I had had a radio that worked, it would have been on 24/7”.

(Householder, Sheffield)

**REC 12** – The Review recommends that Local Resilience Forums urgently develop plans to enhance flood warnings through ‘door-knocking’ by local authorities based on an assessment of the post code areas likely to flood.

**7.15** The reported lack of public awareness in many cases during the floods could be an indication that the full suite of warning methods was not used in every area. Indeed, this might not have been practicable. Although some people might have received a number of overlapping warnings by different methods, in other cases, individuals might have been missed altogether. Even where warnings were given in good time in an area, someone not tuned in to the media and not signed up to receive direct flood warnings might have been entirely unprepared when the floods hit. Raising awareness generally and systematically assessing the feasibility of all warning methods in each area could help prevent such situations arising.

**IC 65** – The interim conclusion of the Review is that the Environment Agency works with local responders to raise awareness in flood risk areas and identify a range of mechanisms to warn the public, particularly the vulnerable, in response to flooding.

**7.16** Members of the public can also take steps to improve the means by which they can access information during an emergency. For example, battery-powered or wind-up radios can be invaluable in

providing a resilient communication method when conventional means are disrupted by failed electricity supplies.

### Providing Advice During The Emergency

**7.17** Once flooding had occurred and once essential services were lost, the public needed advice on what to do. In most instances, they turned to the authorities. People needed basic information on the extent of flooding, the implications for health and welfare and advice on issues such as transport options and whether to switch off their electricity. In the absence of specific advice, ‘Go in; Stay in; Tune in’ is recognised as being the best general advice and should be incorporated in other flood-related communications as an initial message.<sup>2</sup>

### Telephone information lines

**7.18** Telephone contact with the authorities was a key source of information for many during the flooding emergencies, particularly those directly affected. But many people commented that they were

passed from organisation to organisation when seeking advice. In some instances, the publicising of several different telephone lines left people confused about which one to ring.

**7.19** In addition, there were instances of 999 calls being made when, for example, a garden or unoccupied vehicle had been affected by flooding. Although clearly distressing to the individuals affected, these kinds of events are not considered emergency situations by the police, fire and rescue services, and this contributed to the pressure on emergency call centres during the events of June and July.

**7.20** Nevertheless, there were also success stories. Members of the public were able to get information on flooding via the telephone from a variety of sources. In addition to Floodline – (0845 988 1188), the Environment Agency help-line which provides advice on flooding to the general public there were a number of other organisations such as Hull and Barnsley councils which set up flood information lines for the local community. These services

### How did the public feel the authorities dealt with this summer’s floods?

“...There were highly mixed reports of the efforts of the police and the fire and rescue services, even from within the same immediate local area. Some described highly responsive and helpful emergency services, while others had felt isolated and unsupported. Many felt that the local community had borne a great deal of the responsibility in assisting those who were more vulnerable.”

“Voluntary organisations such as the Salvation Army and parish councils provided highly valued practical and financial assistance. In contrast, many felt unsupported by their local council...in helping with the clean-up operation.”

“Overall, there was a sense of a lack of preparedness on the part of the authorities for dealing with the advent of flooding. There was a desire for evidence of co-ordinated overseeing of any future event, with co-ordinated efforts at a national and also a local level.”

*GfK NOP Qualitative research undertaken during October 2007 in areas affected by the summer floods.*

<sup>2</sup> <http://www.preparingforemergencies.gov.uk/gisiti.shtm>

made use of local authority contact centres, which are now a regular part of service delivery for most local authorities.

**7.21** In practice, information requests generally fell into two distinct areas: advice on the likelihood or scale of flooding; and details of local response and recovery services, including how to deal with the loss of essential services. This suggests that non-emergency advice by telephone during a flood emergency should come from just two sources – the Environment Agency for flooding information and local authority contact centres for local advice. (The provision of more specific advice, for example on health or utilities, is discussed below.) Work is under way to raise public awareness of the difference between emergency and non-emergency situations. This work could usefully draw on experiences of the floods, and the final output could include information on Floodline or details of local authority call centre numbers.

**IC 66** – The interim conclusion of the Review is that advice by telephone during a flood emergency should come from just two sources – the Environment Agency for flooding information and local authority contact centres for local advice.

### Internet advice

**7.22** Many people were frustrated at having to access a number of websites to find information on different flood-related issues such as the disconnection or restoration of electricity and water supplies, health notices and flood warnings. Furthermore, some people could not find the information they needed as they did not know where to start looking.

“Well if there is an advice line or internet, there are loads of ways of getting messages or being able to find information like a flood line. If there is one, I don’t know.”

(Business, Barnsley)

**7.23** It would be of great value if a single website provided links to all the websites needed for a comprehensive set of advice on flood-related matters. This could be the area’s Local Resilience Forum website, with all Category 1 responders also linking back to this ‘hub’ website. Other useful information could also be linked, for example the guidance from the Electrical Safety Council on actions to take once floodwater has subsided.<sup>1</sup>

**IC 67** – The interim conclusion of the Review is that advice disseminated via the internet should be coherent by ensuring integration and consistency between local websites, including that of the Local Resilience Forum and those of all Category 1 responders.

**7.24** The Review has also received evidence about public concern over the lack of information to customers about the water supply position. This came through both our discussions with the public and social research carried out for the Consumer Council for Water. Good engagement with the public helps to allay anxieties in an already stressful environment.

“Advice is needed to tell you how to get rid of the water, how to switch the electric off, how to stay safe.”

(Business, Sheffield)

<sup>1</sup> [www.esc.org.uk/pdf/flood\\_advice.pdf](http://www.esc.org.uk/pdf/flood_advice.pdf)

**IC 68** – The interim conclusion of the Review is that essential service providers should maintain continuous provision of public information during an emergency, through a website linked to other responders and local authority contact centres.

### Health advice

“The thing that I found most difficult, as a company trying to keep 34 people going, and in the end we relied on Severn Sound and the website, was to find out what was the truth about water. Can you drink it? Can you use it in the dishwasher? Can you boil it? They didn’t know and they said first it wasn’t drinkable.”

(Business, Tewkesbury)

**7.25** In many instances, consistent health information was hard to find. In some cases, health advisors said it was safe to

stay in flooded properties, yet in others, families were told to leave their homes immediately due to health risks from fungal spores. In the recovery phase, builders were unable to find advice as to whether renovating damp properties posed health risks. Schools and householders were not confident about using playing fields and gardens once the floodwater had receded. Television images of children playing in floodwater suggest that the dangers of contaminated water had not been widely understood by the public.

**7.26** There is a clear need for well-signposted, easily-accessible flood-related health advice. The Health Protection Agency (HPA) has suggested that it could be asked to lead this work, with support from other partners such as the Environment Agency, the Food Standards Agency, the Drinking Water Inspectorate and water companies. This should be considered. The use of a diverse range of media would help to ensure that as many people as possible see this information.



Builders clear out debris in the Canterbury Arms in Tewkesbury, Gloucestershire © Getty Images

### Case study: The provision of health advice

When the floods struck, Cheryl Maddra, a registered child-minder, was looking after six small children at her home. The logistics of reuniting the children with their parents were complicated, as the street was closed and virtually impassable. Cheryl had to rely on the parents finding a way to reach her house and then making their own arrangements to get the children through the rising water in the street and back to the main road. Her house was severely flooded, so she was unable to resume childminding for some weeks – this had a knock-on effect on the families whose children were being cared for, as without childcare, they could not return to work.

After the clear-up in her home, Cheryl resumed her childminding duties. However, she was anxious about the state the garden had been left in following the floods. Although she had cleared the debris from the garden, it still looked messy and dirty from the mud and silt left behind as the water subsided. She was anxious about allowing the children outside to play. This was a real problem with six lively youngsters in the house all day, so Cheryl decided to seek advice about this from the authorities. Despite all her efforts, she could not find anyone who could, or would, give her a definitive answer, so she decided that the safest thing to do was to keep them indoors, despite the summer weather.

Subsequently, Cheryl had a follow-up visit from the assessors. During this visit, they checked under the floorboards and found that the floodwater had risen up as far as the floor joists and the entire ground floor was condemned due to contamination. The assessors advised Cheryl and the children to leave the property as soon as possible, as there was a health risk. In any event the entire ground floor would need to be removed and replaced, so the property would need to be vacated while this work was carried out. This made it impossible for Cheryl to continue working as a child-minder as she and her family had to move into rented accommodation, where they were still living at the time of the research in mid-October.

**IC 69** – The interim conclusion of the Review is that the Government works towards a single definitive set of flood-related health advice for householders and businesses, which can be used by the media and the authorities both locally and nationally.

#### The role of the media

**7.27** Although media organisations have no statutory responsibility under the Civil Contingencies Act to communicate with the public, they do have a widely recognised role in providing information before, during and after an emergency. Radio and television organisations have a long-

standing agreement to interrupt programming with public safety advice and information in the event of a major emergency. They also support the sharing of information. Journalists and news crews often arrive early at an emergency scene, and the rolling news which follows is a valuable resource for the public and responders alike. Every emergency control centre facility, from COBR outwards, watched live news feeds closely.

**7.28** Many people interviewed for the Review highlighted the pivotal role of the media, particularly local radio, in passing important information to the public during the floods. The information broadcast was

### A guide to working with the BBC in an emergency

'Connecting in a Crisis' is an initiative by the BBC to help ensure the public has the information it needs during an emergency. It is designed to ensure that BBC local radio station producers have established appropriate contacts with emergency planners, the police and other key organisations in their local area. The online guide explains how to access the range of communication outlets offered by the BBC at local, regional and national level. Examples of information provided can include updates from the Environment Agency on river levels, from the police on roads and flooded areas and from local authorities on school closures.

[www.bbc.co.uk/connectinginacrisis](http://www.bbc.co.uk/connectinginacrisis)

often important local news, such as road and school closures. In Gloucestershire, for example, the local BBC radio station received a large number of calls from the public giving live accounts of flooding on their streets and transmitting messages to concerned listeners' friends and relatives whom they were otherwise unable to contact. Staff from Severn Trent Water

came to the station to give specific information on water supplies.

"People can actually ring in and give information and they relay that back to the town, and that was working very well"

**Householder, Cheltenham**

### Case study: Effects on a small business

Timothy Bennett runs a small cake-making company in West Oxfordshire with his wife and business partner and found his business severely affected by the floods. Talking of his life after the floods receded, he described it as: "a struggle to get set up and even bigger struggle to keep your head above water."

The impact of the flooding was both practical and emotional. The flooding destroyed the business workshop and nearly all the machinery and equipment purchased over the past decade. The couple are still working, mainly from the back of their delivery van, in order to meet previous orders and generate enough money to cover their overheads.

Timothy is extremely angry at the low levels of information and assistance he received before, during and after the floods. Most of his anger is directed at the local council who he perceived to be responsible. Before the floods, he received no warning that his business was at risk. During the flooding Timothy says he felt completely isolated and had no one to turn to. After the flooding, he expected to receive immediate advice from the council about the temporary relocation of his business. Timothy did get some assistance, but only a month after he needed the help. Temporary premises were found, which were completely unsuitable. The business whose workspace Timothy borrowed was declared bankrupt days after he relocated to it.

Months after the flooding, the business is still severely damaged by the floods. "Staff numbers have had to be cut from nine people to just the wife and me." Timothy doubts whether things will ever be back to normal and is seriously considering packing the business up. He is also seriously questioning the value of insurance. Because it is a family business, Timothy describes the flooding as 'breaking him and his family'.

“The radio’s been absolutely invaluable – if they can get it all together why can’t others?”

(Householder, East Riding)

**7.29** Local media activity also worked well in other respects. The Review notes the value of a high media profile for local leaders, as achieved by council leaders and Gold Commanders in a number of areas affected by the floods. For example, in Doncaster, the elected Mayor’s high visibility provided reassurance to the public during the severe flooding which affected the city in June. In Gloucestershire, the Gold Commander adopted a similarly successful high profile, using the media as a way of communicating advice to the public and providing visible leadership at the local level.

**IC 70** – The interim conclusion of the Review is that council leaders and chief executives play a prominent role in public reassurance and advice through the local media during a flooding emergency, as part of a coordinated effort overseen by Gold Commanders.

**7.30** National television coverage, especially the rolling news channels, was regarded more cautiously. The public felt that reports tended to move away from the local level too quickly, focusing instead on the regional or national picture and sometimes coming across as sensationalist. A number of affected people were dismayed by footage of ‘reporters in Wellington boots’ standing in flood water and regarded such reports as unhelpful unless supported by local facts and practical advice. But where that advice was forthcoming, television was a powerful medium.



A local newspaper floats in flood waters at Otney Island near Oxford © Getty Images

“I personally think the media have done quite a bit but unfortunately the national media forgot about us when Gloucester went.”

(Business, Rotherham)

“They wanted a sensational picture and you slagging off the council basically – that’s news.”

(Business, Wakefield)

**7.31** However, the events of the summer have highlighted inconsistencies and limitations in the way in which the media fulfil this public information role. Media organisations struggled at times to engage with emergency responders during the floods. While they acknowledged the



A TV camera crew report in a flooded street © Getty Images

enormous strain on responders caused by the unprecedented scale of the events, they were often unable to get the information they felt they needed to meet the public's concerns. This, in part, reflected genuine concern on the part of local responders that sensitive operational matters should be dealt with away from the glare of media coverage, as well as experience of other emergencies during which media coverage inhibited action or decision-making.

**7.32** The Review believes that in any realistic analysis of local media involvement during emergencies, the benefits far outweigh the costs if the involvement is properly organised and structured. Local media should be supported in developing

their public information role at all stages of an emergency. Reluctance to involve the media is outdated, betraying a lack of understanding of both modern news coverage and the ability of news organisations to operate effective 'Chinese walls' between production staff and journalists. This relationship-building needs to happen at the local level, although the Review is aware of general work under way by Regional Media Emergency Forums to develop links between broadcasters and the responder community, and this work should also draw upon experiences of the floods. Effective engagement with the media in many areas needs to be replicated in all, as do the opportunities such engagement offers for stronger public leadership.

**REC 13** – The Review recommends that Local Resilience Forums urgently make arrangements to involve local media representatives in local preparedness and response to support their public information role.

## The Role Of Communities And Individuals

**7.33** Much of this Report has been about the roles of public and private bodies. However, the Review considers the actions of the public to be just as important – and in some aspects more so – to effectively coping with emergencies like those of summer 2007. The Review has received many comments demonstrating that in every area affected, the extent to which communities came together to respond to the flooding events was both heart-warming and commendable. We have collected many stories which illustrate how active local leadership and positive action, by both individuals and local organisations, helped to minimise the extent of the damage to communities – and post-flood, have also helped to engender a sense of enhanced community spirit and cooperation.

“People in our community went round every home and collected medications and prescriptions and kept people up to date. But that’s from people in our community, no doctor came.”

**(Householders, Toll Bar, Doncaster)**

“It was the community that came into its own as everyone was looking after everybody else.”

**(Business, East Lindsey)**



The RNLI evacuate Francis Jarvis, 78, a resident from Abbeyfield House, Tewkesbury, Gloucestershire © Rex Features

## Actions the public should take

**7.34** So responsibility does not lie with Government or other authorities and organisations alone. The response to a major emergency is stronger if all parties work together, including communities and individuals. In major emergencies where responders are severely stretched, community resilience has an important part to play, both before, during and after the event. In preparing for an emergency, communities have an important shared local knowledge – for example, the location of doctors, vulnerable people and temporary shelter and where useful equipment is stored.

“When the flooding first happened, I wish I’d known more about how long before the flooding receded and how long it would be before I could move back into my house. If I’d know that I could have prepared myself better and I wouldn’t be in the situation I am in now.”

(Householder, Hull)

**7.35** The public need to educate themselves about flood risk. As noted above, the Environment Agency estimates around 75 per cent of people who receive a flood warning currently take some form of action. While this is encouraging, it also indicates that one in every four people

aware of the warning does not take effective action to limit the impact on themselves and their families. With climate change likely to lead to more varied weather patterns and a greater risk of flooding, householders and businesses need to take greater ownership of the risks and take precautionary action in the same way as they do against other hazards, for example fire. However, the Review acknowledges that the actions people need to take in a flood are different to other risks. The Review will return to this matter in its final report.

**7.36** A large proportion of property owners and tenants do not know if their property is on a floodplain and there is currently no

### Case study: Community assistance at the Holy Trinity Church, Tewkesbury

As the water levels rose, bursting the banks of the local rivers and tributaries around Tewkesbury in the early evening of Friday 20 July, members of Holy Trinity Church realised that they would have to cancel their planned barn dance. By 10pm, as the build-up of traffic coming into Tewkesbury trying to find a way around the congestion on the M5 came to a standstill, church members were out on the streets encouraging drivers still sitting in their cars to return the way they had come or find somewhere to spend the night, (Council offices and Tewkesbury Abbey had opened up to take in stranded travellers). By this time, the water level on the road towards the motorway was approximately 1 metre deep and was impassable to most vehicles.

The next morning, church members realised that many people had spent the night in their cars in the town centre car park and opened Holy Trinity Church for toilets, washroom facilities, free food and hot drinks for anyone who needed them. They fortunately had food already in the church in preparation for the barn dance that had been cancelled the night before.

Throughout that wet Saturday the church became used as a place of refuge and refreshment for those who were trying to leave the town before the water levels cut off any exit. They set up TV and radio communications so that people could access the latest information through BBC and Radio Gloucester news bulletins. This was a vital means of enabling people to decide whether to risk venturing out of the town or to stay put.

During the afternoon, films were put on the big screen in the church, giving stranded families the opportunity to relax in some degree of comfort and provide some entertainment for their children. As evening approached, the Red Cross delivered bedding for those unable to return to their homes. Over the next few days working in conjunction with the Town Council, the Salvation Army and the local Scout Troop, the church kept its doors open around the clock to provide food and overnight accommodation.

### How did the public respond?

“...There was a great deal of confusion and uncertainty about what action to take....Some chose to contact emergency services, and were often unable to make contact, or were told that they were a lesser priority. Many were engaged in procuring sandbags from the council, often with limited success...sandbags were seen as essential in mitigating against the effects of the flooding.”

“There was a great deal of mutual support within communities... with neighbours assisting each other in the cleanup efforts.”<sup>2</sup>

requirement for people purchasing a property to be informed about flood risk by estate agents, lawyers or the previous owner. When purchasing a house or business premises, prospective buyers or their conveyancers should find out whether the property is at risk of river or coastal flooding. If a survey is being carried out on a property, the surveyor should be asking whether the house has ever been flooded, especially if the property is near a river or in a known flood risk area. With this information, purchasers can ask more informed questions – not only of the property owner, but also of the Environment Agency or local authority – such as what flood defences exist locally and whether flood warning is available.

**7.37** The Government recently decided not to include flood risk as a mandatory search in the new Home Information Packs (HIPs). This decision has been challenged by several submissions to the Review on the basis that its inclusion could help boost awareness. The Review also sees merit in its inclusion. The Review understands that the Government plans to monitor this issue and look again at the decision once the system has been in operation for a year.

When we bought the house in 1999, the solicitor didn't tell me it was on a floodplain, but then you speak to people that lived here years and know Catcliffe, and the worse thing they say to you is 'oh, I could have told you that'.”

(Householder, Rotherham)

**IC 71** – The interim conclusion of the Review is that flood risk should be made part of the mandatory search requirements when people buy property and should form part of Home Improvement Packs.

**7.38** Property owners need to share responsibility for protecting their homes and businesses. As set out in Chapter 4, improving the resilience of property at risk from flooding would help reduce the impact of future flooding events. Immediate examples of steps that members of the public could take to increase property resilience include greater uptake of products such as door guards, air brick covers and toilet non-return valves.

<sup>2</sup> Source: GfK NOP Qualitative research undertaken during October 2007 in areas affected by the 2007 summer floods

“What I was waiting for was for someone to knock on the door and say, can we help, here’s some information for you. I didn’t have any of that and had to rely on neighbours.”

(Householder, Gloucester)

“Quarter to 12 at night the police knocked on my door to tell us to evacuate, we were out in 15 minutes, with nothing more than the clothes we were stood in.”

(Business, East Lindsey)

**7.39** Individuals and families also need to be more personally resilient. There are a number of practical measures which members of the public, including business owners, can and should consider taking to prepare for flooding. All of these require only minimal action yet can make a real difference to the impact of flooding. Some of these practical measures are outlined below and the Review recommends that

the Government consolidates these, with other measures, into a single definitive set of flood advice, which is then used to support a public information campaign.

**IC 72** – The interim conclusion of the Review is that the Government launches a public information campaign which draws on a single definitive set of flood prevention and mitigation advice for householders and businesses, and which can be used by media and the authorities locally and nationally.

**REC 14** – The Review recommends that members of the public make up a flood kit – including key personal documents, insurance policy, emergency contact numbers (including local council, emergency services and Floodline – 0845 988 1188), torch, battery or wind-up radio, mobile phone, rubber gloves, wet wipes or antibacterial hand gel, first aid kit and blankets.

### To what extent was the public prepared for flooding?

“There were very low levels of prior awareness of the risk of flooding amongst those affected. With the exception of farmers and some rural businesses, there was a generally complacent attitude towards the risk of flooding. Responsibility for managing flood risk was deferred to the authorities, and even those who had previously experienced flooding had the expectation that some action would have been taken by the authorities to prevent a recurrence. None had taken any action themselves in preparation for the advent of flooding.”

“In the hours and minutes before the flooding took place, there was a polarisation in awareness of the risk of flooding. Farmers and rural businesses were more likely to monitor the state of the weather and of the land around them, and were most likely to have been aware of the risk. Many others, often householders, were less aware. There were mixed experiences in relation to warnings. Some received flood warnings but disregarded these. Others sought information, and were reassured that there was no risk of flooding. Others did not seek or receive warnings, and remained unaware of the risk. Few, except farmers and some businesses, took any action... For many, seeing the water coming into their homes or businesses was the first awareness of the real risk of flooding.”<sup>3</sup>

<sup>3</sup> Source: GfK NOP Qualitative research undertaken during October 2007 in areas affected by the 2007 summer floods

**REC 15** – The interim conclusion of the Review is that members of the public increase their personal state of readiness and resilience to floods by following the Environment Agency’s practical advice, where appropriate, as summarised below:

- Make sure you have adequate insurance. Flood damage is included in most buildings insurance policies, but do check your home and contents are covered.
- Access the Environment Agency’s website to check flood risks to property (this can be followed up by advice from the Agency, for example whether the property in question is protected to some degree by physical defences).
- Contact the Environment Agency to be registered on their Flood Warnings Direct scheme (however, this does not apply to surface water or sewerage flooding and people should also make sure they remain alert to weather forecasts).
- Keep vital possessions, such as financial and legal documents and items of sentimental value, upstairs or stored as high as possible in waterproof containers and have plans in place to move items at short notice.
- Make a list of other useful numbers you may need – your local council, the emergency services and your Floodline quick dial number.
- Make sure you know where to turn off your gas, electricity and water. If you are not sure, ask the person who checks your meter when they next visit. Mark the tap or switch with a sticker to help you remember.

### Case study: Raising awareness – individual preparedness

Gwyneth Oxley lives in Sheffield with her husband in the house they have owned for many years. They were severely affected by the floods. The downstairs of their home was submerged in two feet of water on Monday 25 June, and the practical and financial affects of the floods were still being felt more than four months on.

The floodwater ruined all of the carpets downstairs, which needed replacing, and the kitchen had to be completely refurbished. Furthermore, the family’s cars were written off due to flooding in the garage.

But the impact extends beyond financial and practical considerations. Gwyneth and her husband left their home for a number of weeks to live with a relative. They did not want to face what they described as ‘the carnage’ left behind. Despite living in a location at risk of flooding, no preparation had been made for potential flooding and this exacerbated the impact of the floods. Despite the damage caused by the flooding, no future plans are in place or being considered in the event of future flooding.

For Gwyneth and her husband, nothing like this type of flooding has happened before and they feel it is very unlikely to ever occur again. Gwyneth feels that any preparation would be both costly and ineffective. Both Gwyneth and her husband firmly believe that there is ‘nothing anyone can do to stop things like this...you just get on with it’.





# Chapter 8: Next Steps

## Summary

The preceding chapters set out the emerging conclusions of the Review to date. This chapter explains what will happen between the publication of this Interim Report and the final report of the Review.

It has three sections:

- urgent recommendations;
- a description of how the evidence and interim conclusions of the Review will be developed, and how people can comment and contribute; and
- a full list of all the interim conclusions.

## Urgent Recommendations

**8.1** The first reason for publishing this Interim Report was to identify those issues which required urgent action. During our evidence collection period over the last four months, we have received a great deal of information, evidence and opinion. Some of this has enabled us to draw up robust, firm recommendations.

**8.2** The urgent recommendations are not just for government – local organisations, the private sector and the public also need to take action. All the evidence we have received so far strongly indicates that these recommendations should be implemented urgently in order to prevent or mitigate flooding which might occur this winter or spring. The 15 urgent recommendations are listed below.

**8.3** The Review will monitor work against these urgent recommendations and will publish commentary on progress at the end of March.

### Urgent recommendations

**REC 1** – The Review recommends that more frequent and systematic monitoring of groundwater levels at times of high risk should be undertaken by the Environment Agency, which should begin as soon as possible to predict and mitigate further serious ground water flooding from this winter onwards.

**REC 2** – The Review recommends that the Environment Agency, supported by local authorities and water companies, should urgently identify areas at highest risk from surface water flooding where known, inform Local Resilience Forums and take steps to identify remaining high risk areas over the coming months.

**REC 3** – The Review recommends that the Environment Agency should urgently develop and implement a clear policy on the use of temporary and demountable defences.

**REC 4** – The Review recommends that all Local Resilience Forums urgently review their current local arrangements for water rescue to consider whether they are adequate in light of the summer's events and their local community risk registers.

**REC 5** – The Review recommends that all Local Resilience Forums should undertake an urgent review of designated rest centres and other major facilities to ensure either that they have the necessary levels of resilience to enable them to be used in the response to flooding and other major emergencies, or that alternative arrangements are put in place.

**REC 6** – The Review recommends that the Cabinet Office, with other departments, should urgently consider the costs, benefits and feasibility of establishing arrangements for the urgent acquisition of supplies during a major emergency, including the use of call-off contracts or the creation of national or regional stockpiles of equipment and consumables.

**REC 7** – The Review recommends that Department of Health guidance clarifying the role and accountabilities of organisations involved in providing scientific and technical advice during a major incident should be implemented as soon as possible and understood by Gold Commanders.

**REC 8** – The Review recommends that the guidance currently under preparation by Cabinet Office to provide local responders with advice on the definition and identification of vulnerable people and on planning to support them in an emergency should be issued urgently.

**REC 9** – The review recommends that, in order to effectively fulfil its Lead Department role for flood risk management and emergency response, Defra needs to urgently develop and share a national flood emergency framework.

**REC 10** – The Review recommends that Category 1 responders should be urgently provided with a detailed assessment of critical infrastructure in their areas to enable them to assess its vulnerability to flooding.

**REC 11** – The Review recommends that the Environment Agency should work urgently with telecommunications companies, consulting the Information Commissioner as necessary to facilitate the roll-out of ‘opt-out’ telephone flood warning schemes to all homes and businesses liable to flooding, including homes with ex-directory numbers.

**REC 12** – The Review recommends that Local Resilience Forums urgently develop plans to enhance flood warnings through ‘door-knocking’ by local authorities based on an assessment of the post code areas likely to flood.

**REC 13** – The Review recommends that Local Resilience Forums urgently make arrangements to involve local media representatives in the local preparedness and response to support their public information role.

**REC 14** – The Review recommends that members of the public make up a flood kit – including key personal documents, insurance policy, emergency contact numbers (including local council, emergency services and Floodline – 0845 988 1188), torch, battery or wind-up radio, mobile phone, rubber gloves, wet wipes or antibacterial hand gel, first aid kit and blankets.

**REC 15** – The Review recommends that members of the public increase their personal state of readiness and resilience to floods by following the Environment Agency’s practical advice, where appropriate, as summarised below:

- Make sure you have adequate insurance. Flood damage is included in most buildings insurance policies but do check your home and contents are covered.
- Access the Environment Agency’s website to check flood risks to property (this can be followed up by advice from the Agency, for example whether the property in question is protected to some degree by physical defences).
- Contact the Environment Agency to be registered on their Flood Warnings Direct scheme (however, this does not apply to surface water flooding or sewerage flooding and people should also make sure they remain alert to weather forecasts).
- Keep vital possessions, such as financial and legal documents and items of sentimental value, upstairs or stored as high as possible in waterproof containers and have plans in place to move items at short notice.
- Make a list of other useful numbers you may need – your local council, the emergency services and your Floodline quick dial number.
- Make sure you know where to turn off your gas, electricity and water. If you are not sure, ask the person who checks your meter when they next visit. Mark the tap or switch with a sticker to help you remember.

## Working Towards the Final Report

**8.3.** The other reasons for publishing this Report were to set the direction for the remainder of the Review, and to support a process of consultation on our emerging views.

**8.4.** We need to gather more information in order to reach firm recommendations on the majority of issues which fall within the Review's Terms of Reference. This is for various reasons. In some places we have received contradictory information, or the available evidence to date has been limited by the time available for collection. Other specific reviews, by particular organisations or in relation to specific sectors, are yet to report. It is important that we fully understand the full range of options, including costs, benefits and regulatory impacts.

**8.5.** The Review Team has worked closely with government organisations and representative bodies from outside government. Visits to affected areas have proved invaluable, providing an opportunity to talk directly to local people. But these processes need to continue to add depth to the evidence base.

## How people can contribute and comment

**8.6.** We are particularly keen to hear the views of those affected by the recommendations as well as all other interested parties. We would welcome any contributions to our evidence base.

**8.7.** In order to allow proper consideration and discussion of further evidence in advance of the planned publication of the final report in summer 2008, contributions should be sent to the Review Team before 31 March 2008.

- **Written consultation:** We invite all stakeholders to comment on the Interim Conclusions. Please send all written comments to The Pitt Review, 2nd Floor, 22 Whitehall, London, SW1A 2WH.
- **E-consultation:** We also invite people to comment electronically on the Interim Conclusions via the Pitt Review website. The website address is [www.cabinetoffice.gov.uk/thepittreview](http://www.cabinetoffice.gov.uk/thepittreview). Comments can be emailed to [ThePittReview@cabinet-office.x.gsi.gov.uk](mailto:ThePittReview@cabinet-office.x.gsi.gov.uk)

**8.8.** To support this process of additional evidence gathering, the Review will also carry out a number of activities to gather comments. These are likely to include:

- **Public meetings:** Public meetings will be held in affected areas. All meetings will be advertised on the Pitt Review website in advance. If you don't have internet access, please call on 0207 276 5300 for details.
- **Practitioner panels and industry-government forums:** We will invite relevant experts and academics to 'topic forums' to discuss specific specialist topics. Our aim will be to invite people with a range of differing views, from a range of backgrounds and perspectives. We will be writing to invite individuals or their organisations to take part.
- **National and regional conferences:** The Pitt Review Team members will present the Interim Report and the initial recommendations at relevant industry conferences and events. We will list these conferences and events on the Pitt Review website.

## Full List Of Interim Conclusions

**8.9.** A full list of the interim conclusions which appear in the earlier chapters of this document follows below. Many stakeholders will choose to use these as the basis for

comment, but we would welcome all thoughts on our proposals and omissions.

**IC 1** The interim conclusion of the Review is that Government takes the lead in making the case for the need for adaptation to climate change and particularly in mitigating the potential impacts on communities.

**IC 2** The interim conclusion of the Review is that the Government develops a clear strategy and action plan to deliver the provisions of the Climate Change Bill to support adaptation to increasing impacts from flooding.

**IC 3** The interim conclusion of the Review is that the Environment Agency further develops its tools and techniques for predicting and modelling river flooding, especially to take account of extreme and multiple events; and takes forward urgently work to develop similar tools and techniques to model surface water flooding.

**IC 4** The interim conclusion of the Review is that the Environment Agency revises its flood maps to identify areas where there is a risk of significant depths and velocity of water, to improve the effectiveness of emergency planning.

**IC 5** The interim conclusion of the Review is that the Environment Agency works more closely with Local Resilience Forums to provide information drawn from flood risk modelling and mapping tools to improve the accuracy and consistency of flood risk information in Community Risk Registers.

**IC 6** The interim conclusion of the Review is that the Environment Agency progressively develops and brings into use flood visualisation tools, designed to meet the needs of flood risk managers, emergency planners and responders.

**IC 7** The interim conclusion of the Review is that the Met Office and the Environment

Agency produce an early assessment of the costs, benefits and feasibility of techniques which can predict where rain will fall and where surface water flooding will occur.

**IC 8** The interim conclusion of the Review is that PPS25 should be rigorously applied by local planning authorities, including giving consideration to all sources of flood risk and ensuring that developers make a full contribution to the costs both of building and maintaining any necessary defences.

**IC 9** The interim conclusion of the Review is that householders and business owners should no longer be able to lay impermeable surfaces as of right.

**IC 10** The interim conclusion of the Review is that the automatic right to connect surface water drainage of new developments to the sewerage system should be removed.

**IC 11** The interim conclusion of the Review is that no new building should be allowed in a flood risk area that is not flood-resilient, and that the Government should work with organisations such as the Royal Institute of British Architects and the building industry to encourage flood-resilient building and development design.

**IC 12** The interim conclusion of the Review is that the Government should incorporate flood resistance and resilience requirements for new properties in flood risk areas into Building Regulations as part of the current process of revision.

**IC 13** The interim conclusion of the Review is that the Government should incorporate requirements for resistant or resilient refurbishment of flooded properties in high flood risk areas into Building Regulations as part of the current process of revision.

**IC 14** The interim conclusion of the Review is that local authorities and housing

associations should take a more active role in increasing the uptake of flood resistance and resilience measures, leading by example by repairing their properties with appropriate materials where it is cost-effective.

**IC 15** The interim conclusion of the Review is that local authorities in high flood risk areas should extend eligibility for home improvement grants and loans to encompass flood protection and resilience products.

**IC 16** The interim conclusion of the Review is that local authorities, as they discharge their responsibilities under the Civil Contingencies Act 2004 to promote business continuity, should encourage the uptake of property-level flood resistance and resilience measures. This should be reflected in guidance from the Government.

**IC 17** The interim conclusion of the Review is that local authorities should lead on the management of surface water flooding and drainage at the local level with the support of all responsible organisations including the Environment Agency, water companies and internal drainage boards, the Highways Agency and British Waterways.

**IC 18** The interim conclusion of the Review is that local authorities in flood risk areas should assess their capabilities to deliver the wide range of responsibilities in relation to local flood risk management.

**IC 19** The interim conclusion of the Review is that the Environment Agency should have a national overview of all flood risk and that, Defra's work on the development of a national overview role for the Agency in relation to surface water flooding should be progressed.

**IC 20** The interim conclusion of the Review is that local Surface Water Management Plans, as set out under

PPS25, should provide the basis for managing surface water flood risk. These plans should be coordinated by the local authority and be risk-based, considering all sources of flooding.

**IC 21** The interim conclusion of the Review is that a local register of all the main flood risk management and drainage assets (overland and underground) should be compiled by the relevant local authority, including an assessment of their condition and details of the responsible owners.

**IC 22** The interim conclusion of the Review is that Defra should issue guidance on how all organisations can be brought together to work with local authorities on surface water flood risk management, sharing information, modelling and expertise on a consistent basis.

**IC 23** The interim conclusion of the Review is that the Government, as part of its Water Strategy, should resolve the issue of which organisations should be responsible for the ownership and maintenance of sustainable drainage systems.

**IC 24** The interim conclusion of the Review is that Defra should work with Ofwat and the water industry to explore how appropriate risk-based standards for drainage systems (including pumping stations) can be achieved.

**IC 25** The interim conclusion of the Review is that, as part of the forthcoming water industry pricing review, the water companies, in conjunction with local authorities and other partners, should develop proposals for investment in the existing drainage network to deal with increasing flood risk.

**IC 26** The interim conclusion of the Review is that local authority scrutiny committees review SWMPs and other linked plans, such as Local Development

Frameworks and Community Risk Registers, to ensure that flood risk is adequately considered and to ensure greater transparency and progress in the management of that risk.

**IC 27** The interim conclusion of the Review is that it is appropriate for the Environment Agency and other local organisations to continue to focus investment on areas of highest assessed long-term risk, whether or not they have been recently flooded

**IC 28** The interim conclusion of the Review is that the Government should commit to a strategic long-term approach to its investment in flood risk management, planning up to 25 years ahead.

**IC 29** The interim conclusion of the Review is that the Environment Agency should open dialogue with all those landowners who will be affected by either a withdrawal from or significant reduction in maintenance of rural watercourses.

**IC 30** The interim conclusion of the Review is that the Government should develop a single national set of guidance for local authorities and the public on the use and usefulness of sandbags and other alternatives, rather than leaving the matter wholly to local discretion.

**IC 31** The interim conclusion of the Review is that Defra, the Environment Agency and Natural England should work with partners to establish a programme and framework to achieve greater working with natural processes, including the identification of appropriate sites and the development of more incentives for creating water storage, restoring the natural course of rivers and establishing green corridors.

**IC 32** The interim conclusion of the Review is that the Environment Agency should provide an analysis of the effect that land management practices had or

would have had on the impact of flooding during the summer 2007 floods.

**IC 33** The interim conclusion of the Review is that flooding legislation should be updated and streamlined under a single unifying Act that amongst other outcomes addresses all sources of flooding, clarifies responsibilities and facilitates flood risk management.

**IC 34** The interim conclusion of the Review is that the Government and the insurance industry should work together to deliver a public education programme setting out the benefits of insurance in the context of flooding.

**IC 35** The interim conclusion of the Review is that the Government and the insurance industry work together to develop options to improve the availability and uptake of flood risk insurance by low-income households and assess the costs, benefits and feasibility of these options, before the Review's final report.

**IC 36** The interim conclusion of the Review is that, in flood risk areas, a note on flood risk and the simple steps that could be taken to mitigate it should be included with all insurance renewal notices. Moreover, if Flood Warning Direct is available in a customer's area, one of the conditions of renewal could be sign-up to this service.

**IC 37** The interim conclusion of the Review is that the Met Office and the Environment Agency should produce an assessment of the options for issuing warnings against a lower threshold of probability, including costs, benefits and feasibility; this will be considered further in the final report.

**IC 38** The interim conclusion of the Review is that unless agreed otherwise locally, 'upper tier' local authorities should be the lead organisation in relation to multi-

agency planning for severe weather emergencies at the local level, and for triggering multi-agency arrangements in response to severe weather warnings.

**IC 39** The interim conclusion of the Review is that where a Gold Command is established, the police, unless agreed otherwise locally, should convene and lead the multi-agency response.

**IC 40** The interim conclusion of the Review is that Gold Commands should be established at an early stage on a precautionary basis where there is a risk of serious flooding.

**IC 41** The interim conclusion of the Review is that Local Resilience Forums should assess the effectiveness of their Gold facilities, including flexible accommodation, IT and communications systems.

**IC 42** The interim conclusion of the Review is that the Local Government Association should consider how best mutual support might be enhanced between local authorities in the event of a future wide-area emergency.

**IC 43** The interim conclusion of the Review is that Cabinet Office guidance to local planners should specifically include incidents which leave large numbers of people stranded on motorways and trunk roads.

**IC 44** The interim conclusion of the Review is that, as part of their emergency plans, Local Resilience Forums should consider the vulnerability of motorways and trunk roads to flooding, and consider the potential for earlier, stronger, more specific warnings, and strategic road clearance and closures, to avoid people becoming stranded.

**IC 45** The interim conclusion of the Review is that Defra should review the

current requirement in emergency regulations for the minimum amount of water to be provided in an emergency, to reflect reasonable needs during a longer-term loss of mains supply.

**IC 46** The interim conclusion of the Review is that central government crisis machinery should always be activated if significant wide-area flooding of whatever nature is expected or occurs.

**IC 47** The interim conclusion of the Review is that Defra extends its current departmental programme to share best practice and provide training in emergency response across the organisation.

**IC 48** The interim conclusion of the Review is that Defra and the Environment Agency work together to establish a single London situation room to coordinate flooding information, to act as a focal point for cross-Defra efforts, and to support Defra Ministers.

**IC 49** The interim conclusion of the Review is that a national flooding exercise should take place at the earliest opportunity in order to test the new arrangements which central government departments are putting into place to deal with flooding and infrastructure emergencies.

**IC 50** The interim conclusion of the Review is that financial assistance for local responders in relation to emergency response and recovery should be revised to improve speed, simplicity and certainty.

**IC 51** The interim conclusion of the Review is that Local Resilience Forums should be made aware of recent Cabinet Office guidance setting out the transition to recovery. Recovery sub-groups should be established from the onset of major emergencies and in due course there should be formal handover from Gold Command to the local Recovery Coordinating Group(s), normally chaired by

the Chief Executive of the affected local authority.

**IC 52** The interim conclusion of the Review is that the Government should establish a systematic, coordinated, cross-sector campaign to reduce the disruption caused by natural events to critical infrastructure and essential services.

**IC 53** The interim conclusion of the Review is that the Government should develop and issue guidance on consistent and proportionate minimum levels of protection from flooding for critical infrastructure.

**IC 54** The interim conclusion of the Review is that infrastructure operating companies should present the case for further investment in flood resilience through the appropriate regulatory process.

**IC 55** The interim conclusion of the Review is that a duty should be introduced on critical infrastructure operators to have business continuity planning to BS 25999 in place to more closely reflect the duty on Category 1 responders. This should include minimising the loss of supply as far as practicable in the event of a serious emergency resulting from flooding.

**IC 56** The interim conclusion of the Review is that, in relation to information-sharing and cooperation, the Civil Contingencies Act and Regulations should be extended to require Category 2 responders to more formally contribute information on critical sites, their vulnerability and the impact of their loss.

**IC 57** The interim conclusion of the Review is that single points of failure and the complete loss of assets need to be explicitly considered in the risk assessment and contingency planning undertaken by operators, emergency planners and responders.

**IC 58** The interim conclusion of the Review is that Local Resilience Forums should ensure that Community Risk Registers reflect risks to critical infrastructure from flooding and other hazards.

**IC 59** The interim conclusion of the Review is that Category 2 responders should be required to participate fully at Gold and Silver Commands and that the Government should deliver this through the Civil Contingencies Act or other regulatory regimes.

**IC 60** The interim conclusion of the Review is that the emergency plans and business continuity plans of essential service providers should be reviewed annually by local authority scrutiny committees.

**IC 61** The interim conclusion of the Review is that critical infrastructure planning should become a separate discipline within civil protection at the local level.

**IC 62** The interim conclusion of the Review is that the Government should implement the legislative changes proposed in the recently published Environment Agency biennial report on dam and reservoir safety.

**IC 63** The interim conclusion of the Review is that all reservoir undertakers should be required by Defra to prepare inundation maps and share them with Local Resilience Forums to improve Community Risk Registers and emergency planning.

**IC 64** The interim conclusion of the Review is that the Environment Agency should produce a sliding scale of options for greater personalisation of public warning information, including costs, benefits and feasibility, before the final report.

**IC 65** The interim conclusion of the Review is that the Environment Agency works with local responders to raise awareness in flood risk areas and identify a range of mechanisms to warn the public, particularly the vulnerable, in response to flooding.

**IC 66** The interim conclusion of the Review is that advice by telephone during a flood emergency should come from just two sources – the Environment Agency for flooding information and local authority contact centres for local advice.

**IC 67** The interim conclusion of the Review is that advice disseminated via the internet should be coherent by ensuring integration and consistency between local websites, including that of the Local Resilience Forum and those of all category 1 responders.

**IC 68** The interim conclusion of the Review is that essential service providers should maintain continuous provision of public information during an emergency, through a website linked to other responders and local authority contact centres.

**IC 69** The interim conclusion of the Review is that the Government works towards a single definitive set of flood-related health advice for householders and businesses, which can be used by media and the authorities locally and nationally.

**IC 70** The interim conclusion of the Review is that council leaders and chief executives play a prominent role in public reassurance and advice through the local media during a flooding emergency as part of a coordinated effort overseen by Gold Commanders.

**IC 71** The interim conclusion of the Review is that flood risk should be made part of the mandatory search requirements when people buy property and should form part of Home Improvement Packs.

**IC 72** The interim conclusion of the Review is that the Government launches an public information campaign which draws on a single definitive set of flood prevention and mitigation advice for householders and businesses, and which can be used by media and the authorities locally and nationally.



Sir Michael Pitt hears Chief Constable Timothy Brain's views on the loss of critical infrastructure at Mythe, Gloucestershire.





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# MOBILE ADVICE CENTRE

# Annexes and Glossary

## **Annex A Biography of Sir Michael Pitt**

Sir Michael Pitt is the current Chair of NHS South West, the strategic health authority for the South West region. He holds a range of other appointments, including: chairing two companies (Solace Enterprises Ltd and Swindon Commercial Services); and providing consultancy advice to a variety of organisations. He was formally the national President of the Society of Local Authority Chief Executives and Senior Managers.

Sir Michael graduated from University College London in 1970 with a first-class honours degree in civil engineering. He is a Fellow of the Institution of Civil Engineers. He has worked for the Civil Service, in the private sector and for local government, with the majority of his career being spent in county council technical departments. He was appointed Chief Executive of Cheshire County Council in 1990 and of Kent County Council in 1997. He was knighted in the Queen's Birthday Honours in 2005.

Sir Michael lives near Malmesbury in Wiltshire, and is married with two daughters.

## **Annex B Terms of reference and scope of the Review**

The terms of reference for the Review are:

- a. flood risk management, including the risk posed by surface water flooding and the way in which the public and private sectors might adapt to future risks;
  - b. vulnerability of critical infrastructure, including:
    - i. the ability of critical infrastructure to withstand flooding, and what improvements might be made
    - ii. the resilience of dams and associated structures and what improvements might be made;
  - c. the emergency response to the flooding, including social and welfare issues;
  - d. issues for wider emergency planning arising from the actual or potential loss of essential infrastructure; and
  - e. issues arising during the transition period from the response to recovery phases.
- d. to establish what access to support, equipment, facilities and information is needed by those involved in the response at local, regional and national levels;
  - e. to ensure the public has as much access as possible to information on the risk of flooding to allow them to take appropriate precautions, be adequately informed on developments as an emergency unfolds, and be looked after properly in the immediate aftermath;
  - f. to establish how the transition from response to recovery is best managed;
  - g. to identify those aspects of the response that worked well and should be promoted and reinforced;
  - h. to make recommendations in each of these areas to improve the UK's preparedness for flooding events in the future; and
  - i. to make recommendations, drawing on the experience of the flooding incidents, to improve the UK's broader ability to manage the loss of essential services in any future emergencies.

The specific objectives for the Review are:

- a. to understand why the flooding was so extensive;
- b. to learn lessons on how in future we can best predict, prevent or mitigate the scale and impact of flooding incidents in a potentially changing environment;
- c. to look at how best to co-ordinate the response to flooding in future, including the significant social implications for communities;

## Annex C Organisations and individuals from the general public who have contributed to this report

### Organisations

#### Central government

Cabinet Office  
 Centre for the Protection of National Infrastructure  
 Chief Fire and Rescue Adviser's Unit  
 Communities and Local Government  
 Department for Business, Enterprise and Regulatory Reform  
 Department for Children, Schools and Families  
 Department for Culture, Media and Sport  
 Department for Environment, Food and Rural Affairs  
 Department for Transport  
 Department for Work and Pensions  
 Department of Health  
 Environment Agency  
 Government Communications Headquarters (GCHQ)  
 Health Protection Agency  
 HM Treasury  
 Home Office  
 Maritime and Coastguard Agency  
 Met Office  
 Ministry of Defence  
 National Health Service  
 No. 10  
 Ordnance Survey  
 UK Climate Impacts Programme

#### Government Offices

GO Science  
 GO East Midlands  
 GO London  
 GO South East  
 GO South West  
 GO West Midlands  
 GO Yorkshire and Humberside

#### Local government

Local Government Association  
 Barnsley Metropolitan Borough Council

Doncaster Metropolitan Borough Council  
 East Riding of Yorkshire Council  
 Flood Defence Group of Local Authorities  
 Gloucester City Council  
 Hedon Town Council  
 Hull City Council  
 Leeds City Council  
 Northampton Borough Council  
 Oxford City Council  
 Oxfordshire County Council  
 Rotherham Metropolitan Borough Council  
 Sheffield City Council  
 South Norfolk Council  
 Tewkesbury Borough Council  
 West Berkshire Council  
 West Midlands Local Government Association  
 West Midlands Regional Assembly  
 Weston-Sub-Edge Parish Council  
 Yorkshire Regional Flood Defence Committee

#### Business organisations and insurers

Association of British Insurers  
 British Chambers of Commerce  
 British Insurance Brokers' Association  
 Business Continuity Institute  
 Council of Mortgage Lenders  
 National Farmers' Union  
 Rotherham Chambers of Commerce

#### Emergency services

Association of Chief Police Officers  
 Chief Fire Officers' Association  
 Gloucestershire Constabulary  
 Search and Rescue Assistance in Disasters (SARAID)  
 Wiltshire Police

#### Media

BBC News  
 BBC Radio Humberside  
 BBC TV Look North  
*East Riding Mail*  
*Gloucestershire Echo*  
*Hull Daily Mail*  
 ITN  
 ITV West  
 ITV Yorkshire

KC FM  
*Sheffield Star*  
Sky News  
Society of Editors

*The Citizen* (Gloucester)  
Viking FM  
*Yorkshire Post*

### **Science and engineering**

Association of Drainage Authorities  
British Waterways  
Hadley Centre for Climate Change (Met Office)  
HR Wallingford Ltd  
Institution of Civil Engineers  
National Flood Forum  
Royal Academy of Engineering  
Royal Institution of Chartered Surveyors

### **Universities**

Centre for Ecology and Hydrology  
Imperial College London  
University of Birmingham  
University of Bristol  
University of Dundee  
University of East Anglia  
University of Hull  
University of Manchester  
University of Middlesex  
University of Newcastle-upon-Tyne  
University of Nottingham  
University of Oxford (New College)  
University of Sheffield  
University of Southampton  
University of Strathclyde

### **Utilities and critical infrastructure**

Beverley and North Holderness Internal Drainage Board  
British Energy  
Chartered Institution of Water and Environmental Management  
Consumer Council for Water  
Drinking Water Inspectorate  
Energy Networks Association  
National Grid  
Ofwat

Severn Trent Water  
United Utilities  
Water UK  
Yorkshire Water

### **Voluntary organisations**

Help the Aged  
Rotary International in Great Britain and Ireland  
WRVS  
Women's Institute:

- Filkins and Broughton Poggs (Oxfordshire)
- Hampton Bishop (Herefordshire)
- Hundleyby (Lincolnshire)
- Sinnington (Yorkshire)
- South Elkington (Lincolnshire)
- South Yorkshire
- Thorpe St Peter (Lincolnshire)
- Washingborough (Lincolnshire)
- Worcestershire Federation

### **Cross-cutting organisations and interest groups**

Association of Directors of Adult Social Services  
Audit Commission  
British Red Cross  
Commission for Rural Communities  
Country Land and Business Association  
Forestry Commission  
National Planning Forum for England  
National Trust  
Natural England  
Powysland Internal Drainage Board  
Public Weather Service Customer Group  
Royal Society for the Protection of Birds  
St John Ambulance  
Wildlife and Countryside Link  
Wildlife Trusts  
WWF

## Individuals from the general public

The Review Team received 238 contributions from members of the public, not all of whom wished to be named. Those who gave permission were:

C Adamson	David Edge	Stephen Mitchell
Ray Armishaw	Brian Ellis	Anil Nair
W J Bacchus	H A Elwell	R K Owen
Thomas Bailey	Peter Farley	Andrew Parris
Robin Baldwin	Roger Fell	Paul Partington
Nicki Barry	Derek Foot	Marie Peacock
Emma Beaumont	Chris Ford	Richard Perry
Tim Beckett	Andrew Fraser	Gill Pillar
R M Bennett	Lisa Frost	M J Potter
E J Birt	Andrew Garfinkel	Ann-Marie Powell
Roger Black	David Girtchen	Kevin Powell
James R Blake	Mike Glanville	Linda Preston
Gillie Bolton	Beatrice Greenfield	Graham Price
Colin Bower	Mick Gudgeon	Arthur Rabjohn
Robert E Bridges	Simon Haddrell	Leanne Raper
Howard Brier	Phil Hall	David Read
Les Britzman	Nigel Hamilton	Andy Reeley
Leon Brocard	Wayne Hardman	Charlie Rickard
Nick Brock	Liz Hicks	Mary Riley
Keith Browning	Gerry Hobbs	Ann Robinson
Roger Bruton	Simon Hogfress	Michael Robinson
Marina Bryant	John Hopf	Nicholas Robinson
Richard Burke	Geoff Howes	Steve Robson
Tony Cable	Andy Hughes	Brian Rodgers
Chris Callaghan	Emma Hughes	Doug Rodwell
Ann Calver	James Hunt	Sarah Rogers
Frances Cartwright	C H Hutchinson	Tom Rollins
Kevin Ceaser	Ken Hyde	David Royffe
Arthur Champion	Keith Jacklin	Lesley Russell
Natalie Clark	Dawn Jacklin	Jayne Salt
Richard Clark	John James	Clive Savage
Robert F Cre	Dilys Jones	Gerald Savage
David Crichton	John Jones	Joe Scianna
Robert Dale	John Kane	Adrian Shaw
Jack Davenport	John Kelly	David Sheldon
Bev Day	Mervyn Kettle	Jane Sircombe
Mary Dhonau	Colin Lambert	Gez Smith
John Dixon	Ewan Larcombe	Howard Smith
Barbara Donovan	Arthur Lawrence	Kath Smith
	Caroline Macklin	Peter Smith
	Rachael Maher	Philip Smith
	K Malone	Joe Snype
	Jeff Martin	Gary Sone
	Peter Martin	Jackie Surtees
	Michael Mcellin	David Thomas
	Terry Mcquaid	Gareth Thomas
	Edwin Miller	Richard Thomas
	Bev Milner-Simonds	Ryan Thomas

Eleanor Thorneycroft	Paul Goodman MP
Richard Tilbrook	Diana Johnson MP
Patricia Todd	John Mann MP
Peter Tomes	Anne McIntosh MP
John Tonks	Shona Mclsaac MP
Richard Trimmer	Anne Milton MP
Vincent Tully	Owen Paterson MP
D S Turner	Laurence Robertson MP
Jack Turton	
Tim Twomey	
Mr & Mrs Wakefield	
Edward Walker	
Timothy Walker	
Mark Wallace	
Christopher Waller	
Richard Ward	
Pauline Washington	
R M Watson	
V Watson	
Jonathan Weaden	
Nigel Welbourn	
Sharon Wheeler	
John Whitehead	
Paul Whittle	
Martin Wigg	
Mike Williams	
Tony Williams	
Albert Williamson	
Ann Wilson	
David Wilson	
S Woolley	
Timothy Wyatt	

**Members of Parliament**

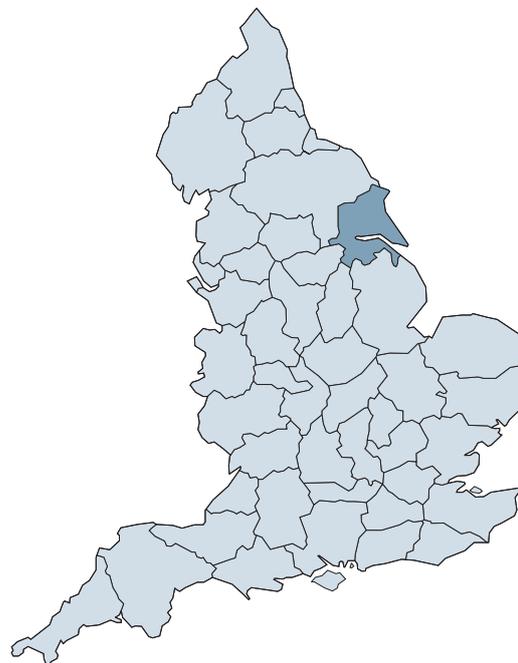
Rt Hon Hilary Benn MP  
Rt Hon Hazel Blears MP  
Rt Hon David Blunkett MP  
Rt Hon John Healey MP  
Rt Hon Charles Kennedy MP  
Rt Hon Ian Mccartney MP  
Rt Hon Ed Miliband MP  
Rt Hon John Redwood MP

Norman Baker MP  
Tim Boswell MP  
Colin Burgon MP  
Parmjit Dhanda MP  
Philip Dunne MP  
Caroline Flint MP

## Annex D Regional summaries

### East Riding of Yorkshire and Kingston upon Hull

<b>Key affected police areas</b>	Humberside Lincolnshire
<b>Key affected local authorities</b>	East Riding Hull CC North East Lincolnshire Council North Lincolnshire Council
<b>Area</b>	2,479km <sup>2</sup>
<b>Population</b>	587,100
<b>Houses flooded</b>	Approx. 15,500
<b>Businesses flooded</b>	Over 650



The area sits on a chalk formation that extends from the Humber estuary to the Yorkshire Wolds. Erosion from the North Sea is a major concern for the region, and the coastline is continually changing as a result. Much of the area is low-lying (90 per cent of Hull is below high tide level) and the drainage system for Hull is entirely pumped, which means it is particularly vulnerable to flooding. The higher ground surrounding Hull causes a 'basin effect', as the region mostly drains into the Humber. Other key rivers in the region are the River Hull and the River Ouse.

#### Weather conditions and flooding

Between 14 and 25 June, a large amount of rain fell across Humberside, causing widespread surface water flooding. Intense rainfall on 14–15 June saturated the area, and another bout of intense rainfall on 24–25 June then quickly overwhelmed the drainage systems. Between these two periods, there were a number of other

localised floods, June 2007 being the wettest on record in Yorkshire since 1882.

#### Impact on communities

The sheer scale and speed of the floods caught many local residents and businesses by surprise. Almost 15,500 properties were affected in the Humber area, including an estimated 2,336 council properties. There were also a significant number – over 3,000 – of uninsured properties. About 400 households required alternative accommodation for up to a week – and over 200 households will need alternative accommodation for more than six months.

#### The emergency response

The Environment Agency used advanced technology to monitor rainfall, river levels and sea conditions and collated the data to issue flood warnings through its flood warning system. The Agency issued an early warning on 22 June and repeat

warnings on the following few days. A Flood Watch was issued on 24 June followed by a Flood Warning, but this was not escalated to a Severe Flood Warning. By 25 June, a major incident was declared by Hull City Council, and later that day the Police set up Silver Command.

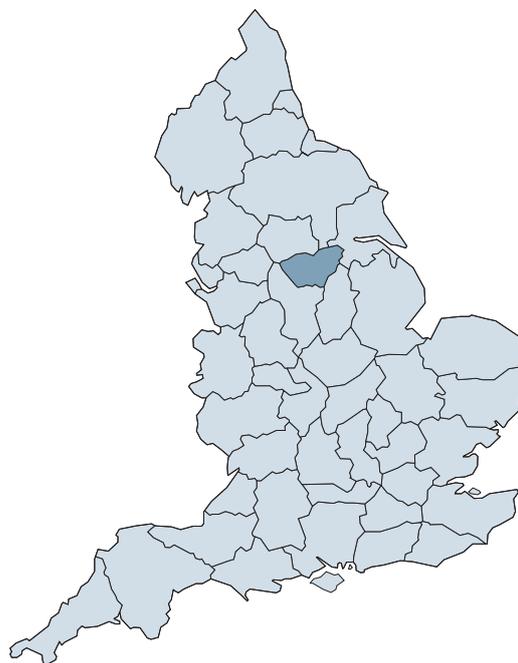
### The effect on critical infrastructure and essential services

The area experienced extensive surface water flooding which caused widespread disruption to roads and essential services. The estimated cost of damage to regional roads stands at £28 million and there are further costs associated with damage to bridges (£4–5 million) and street lighting (£500,000).

More than 90 schools were damaged and over 650 businesses were affected, disrupting food supplies and other aspects of daily life for many residents.

## South Yorkshire

<b>Key affected police areas</b>	South and West Yorkshire
<b>Key affected local authorities</b>	Barnsley MBC Doncaster MBC Leeds CC Rotherham MBC Sheffield CC
<b>Area</b>	1,552km <sup>2</sup>
<b>Population</b>	1,292,000
<b>Houses flooded</b>	Approx. 4,000
<b>Businesses flooded</b>	Approx. 1,800



South Yorkshire is a region with a major industrial history, from the coal industry to the steel industry concentrated in Sheffield. The region's principal towns and cities are Barnsley, Doncaster, Rotherham and Sheffield, and its two main rivers are the Don and the Dearne. There is also an extensive network of canals, which were built to help navigate and transport goods between the major cities.

### Weather conditions and flooding

Intense rainfall between 14 and 16 June and between 24 and 25 June resulted in two serious floods in the region. Two people died and approximately 6,000 homes and businesses were flooded.

The first flood was due to heavy rain falling over a period of three days. Many locations received one to two months' rainfall in the space of just 48 hours.

The rainfall which caused the second flood was less widespread than the first and mainly affected South and West Yorkshire,

Hull and East Yorkshire. Although 48-hour rainfall totals were similar to the first flood, the majority of the rain in the second flood fell in one particularly intense 12-hour period on 25 June.

In addition to the two major floods, there were a number of localised storm floods between 14 June and 23 July across North Yorkshire and North East England. Together, these events made June the wettest on record in Yorkshire since 1882. Surface drains and sewers became overwhelmed and rivers rose to record levels, overtopping their banks and flood defences.

### Impact on communities

In Doncaster, 50 caravans were sited at Toll Bar caravan park, and may be needed for up to 18 months. Some authorities offered to waive social housing rents and council taxes for those affected by the floods. In Barnsley, Doncaster and Rotherham, the authorities waived both rents and council tax. In Sheffield, council tax was waived,

and a £100 payment given to affected households for social housing rents.

### The emergency response

Two Silver Commands were called in Sheffield and Rotherham in the first floods on 14 June. During the second flood, Silver Commands were set up in Doncaster and Barnsley, and Gold Commands in South Yorkshire and Sheffield.

### The effect on critical infrastructure and essential services

The effects of the second flood were compounded by the fact that the first flood had not drained sufficiently, causing saturated grounds and high water levels.

During the evening of 25 June, concerns grew about the condition of the Ulley Reservoir after reports of problems with the dam wall. The spillway through which water escapes from the dam had been damaged and the dam wall was eroding. This could have led to a catastrophic failure of the dam wall and put lives, property and other infrastructure assets at risk. A major effort by the emergency services and others was mounted to reduce the water levels in the reservoir and shore up the dam wall.

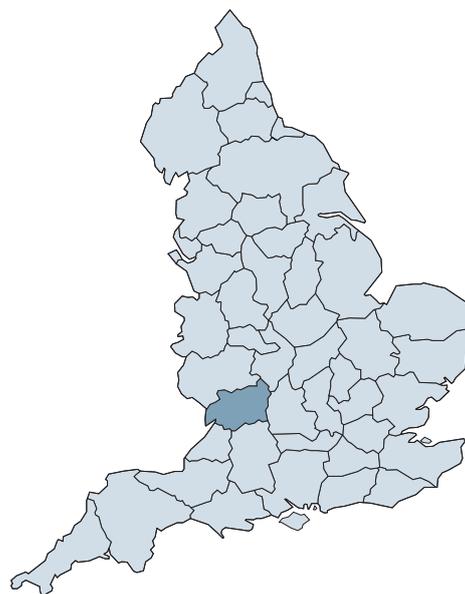
Elsewhere, Neepsend electricity sub-station was shut down with a loss of power to 40,000 people and there was further power failures in Hillsborough.

The floods caused significant damage to the local highway infrastructure. Several arterial roads to Sheffield were closed due to flooding, several bridges were washed away and a culvert collapsed on a minor road between Arnold and Swine.

Rotherham train station was closed on 25 June for almost a month, and a replacement bus service was provided.

## Gloucestershire

<b>Key affected police areas</b>	Gloucestershire
<b>Key affected local authorities</b>	Cheltenham BC Gloucester CC Tewkesbury BC
<b>Area</b>	3,150km <sup>2</sup>
<b>Population</b>	833,100
<b>Houses flooded</b>	Approx. 6,000
<b>Businesses flooded</b>	Over 1,000



The county of Gloucestershire lies between the Cotswold Hills, the Severn Valley and the Forest of Dean. The county is largely rural – the principal towns are Cheltenham, Cirencester, Gloucester, Stroud and Tewkesbury. The region has an extensive network of rivers, the principal waterways being the Severn, the Frome, the Teme and the Avon.

### Weather conditions and flooding

The days of 24 to 25 June saw heavy, persistent and frequent thundery rain in Gloucestershire, with almost a whole month's rainfall in two days. Flooding was predominantly caused by smaller watercourses which reacted quickly to local run-off – flooding from the River Severn was not significant at this stage.

A deluge of heavy and persistent rain on 20 July caused extensive flooding across the lower Severn catchment – in many places, river levels were the highest ever recorded. Gloucester recorded record flood levels as a result of the exceptional flows in the Teme and Avon rivers and heavy rainfall across Worcestershire and Gloucestershire.

River levels at the Gloucester Docks gauge reached a peak of 4.92m on 23 July. This was only 1 cm lower than the highest recorded level in 1947. Normal summer levels are around 0.6m.

### Impact on communities

Over 6,000 properties were affected by the July floods, many of which were first flooded by surface water or by watercourses which reacted quickly to local run-off. The same properties were then flooded by the River Severn a few days later. Roads and transport links were affected by the floods and seriously hampered people's travel plans. The M5 flooded and left some 10,000 vehicles and their occupants stranded on the motorway. Over 30 schools were damaged.

### The emergency response

Gold Command was set up in Gloucester to coordinate the emergency response. Some local authorities offered to waive social housing rents and council taxes for those affected by the floods.

The Environment Agency monitored rainfall, river levels and sea conditions and collated the data to issue flood warnings.

There was some criticism of the Agency's warning system. In particular, there was concern that warning of flooding at the Mythe water treatment works was very late.

### The effect on critical infrastructure and essential services

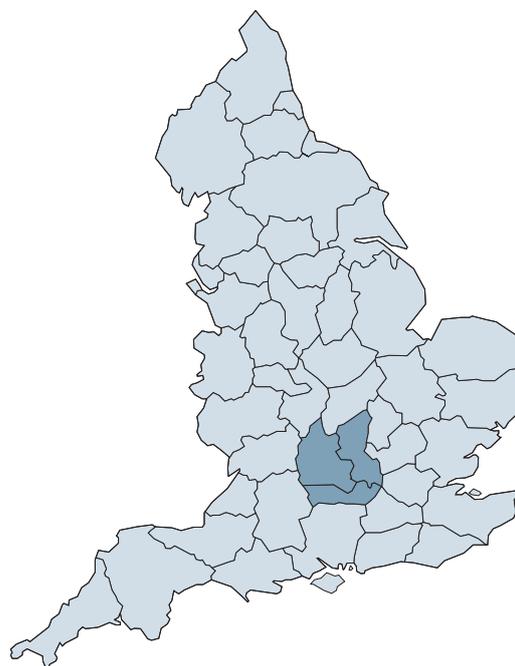
Mythe water treatment works near Tewkesbury was flooded and had to be shut down on 22 July. Mythe represented a single point of failure, as the households supplied by the works could not receive a piped water supply from any other source. This left 350,000 people across Gloucestershire without drinking water for up to 17 days – the largest loss of essential services since the Second World War. Severn Trent Water, assisted by the Armed Forces, responded with a massive effort to provide water through bottles and bowsers to numerous locations across the county.

Electricity supplies were also threatened, as Walham switching station and Castle Meads electricity sub-station became vulnerable to rising floodwater. The Environment Agency worked with the Armed Forces, fire and rescue services and the police to protect Walham switching-station. Castle Meads was shut down before it flooded, leaving over 40,000 people without electricity. The joint response from emergency responders and the Environment Agency meant that many tens of thousands of people across Gloucestershire and South Wales did not suffer from loss of power supplies.

Rough estimates suggest about 1 per cent of the road infrastructure was damaged, with a potential cost in the order of £20–30 million.

## Thames Valley

<b>Key affected police areas</b>	Thames Valley Warwickshire Wiltshire Surrey
<b>Key affected local authorities</b>	Oxford CC West Oxfordshire DC Vale of White Horse DC West Berkshire Council Royal Borough of Windsor and Maidenhead Wokingham BC
<b>Area</b>	12,800km <sup>2</sup>
<b>Population</b>	4,300,000
<b>Houses flooded</b>	Approx. 5,700
<b>Businesses flooded</b>	Approx 80



The Thames Valley covers the counties surrounding the River Thames, including parts of Berkshire, Buckinghamshire, Oxfordshire and beyond. The Cotswold hills typically mark the general landscape of the region, with steep escarpments down to the Severn Valley and Warwickshire Avon. The principal towns affected by the summer floods are Reading, Oxford and Abingdon, and the region's principal rivers include the Thames, the Cherwell and the Avon.

### Weather conditions and flooding

The Thames region experienced greater than average rainfall for most of May and June, but the majority of the rain fell on 19 and 20 July. Extremely high rainfall and already saturated ground meant that drains were overwhelmed which led to a large amount of surface water flooding. There was also fluvial flooding along the River Thames and its tributaries, which affected

Wiltshire, Oxfordshire, Berkshire and Surrey.

### Impact on communities

Flooding occurred across the Thames Valley. However, the impacts were less severe than in other parts of the country. Approximately 5,700 properties were flooded – more than half of these were due to surface water flooding rather than river flooding, with the majority of river-flooded houses to be found in the Oxfordshire and West Berkshire areas.

### The emergency response

Silver Commands were put in place in several locations including Windsor, Abingdon and Reading. A Gold Command operated for the Thames Valley region. The authorities in West Berkshire used a leaflet campaign to give advice to the public.

## The effect on critical infrastructure and essential services

Many arterial roads into major towns were affected, including a number of A-roads leading into Oxford. Rail lines were closed as a result of flooding or the risk of flooding, and the major route between Didcot and Oxford was suspended.

Utilities infrastructure was also affected, including an electricity sub-station in Oxford, and a sewage treatment works and several sewage pumping stations in or near Oxford and Abingdon.

## Annex E Glossary

**Bronze** – operational level at which the management of ‘hands-on’ work is undertaken at the incident site or at affected areas.

**Building Regulations** – the UK Building Regulations are rules of a statutory nature to set standards for the design and construction of buildings, primarily to ensure the safety and health for people in or around those buildings, but also for energy conservation and access to and about buildings.

**Business continuity management (BCM)** – a management process that helps manage the risks to the smooth running of an organisation or delivery of a service, ensuring that it can operate to the extent required in the event of a disruption.

**Business continuity plan (BCP)** – a documented set of procedures and information intended to deliver continuity of critical functions in the event of a disruption.

**Cabinet Office Briefing Room (COBR)** – government’s dedicated crisis management facilities activated in the event of a major national emergency. Key meetings are usually chaired by the Prime Minister or senior ministers covering strategic aspects of the response and recovery effort, bringing together relevant departments and/or external parties.

**Capabilities Programme** – the UK Capabilities Programme comprises a range of capabilities that underpin the UK’s resilience to disruptive challenges. These capabilities are either structural (e.g. regional response), functional (e.g. decontamination) or concerned with the maintenance of essential services (e.g. financial services).

**Capability** – a demonstrable capacity or ability to respond to, and recover from, a particular threat or hazard. Originally a military term, it includes personnel, equipment, training and such matters as plans, doctrine and the concept of operations.

**Catchment** – a geographical area in which water collects.

**Category 1 responder** – a person or body listed in Part 1 of Schedule 1 to the Civil Contingencies Act 2004. These bodies are likely to be at the core of the response to most emergencies. As such, they are subject to the full range of civil protection duties in the Act.

**Category 2 responder** – a person or body listed in Part 3 of Schedule 1 to the Civil Contingencies Act 2004. These are co-operating responders who are less likely to be involved in the heart of multi-agency planning work, but will be heavily involved in preparing for incidents affecting their sectors. The Act requires them to co-operate and share information with other Category 1 and 2 responders.

**Climate change** – the change in average conditions of the atmosphere near the earth’s surface over a long period of time.

**Coastal erosion** – the wearing away of the coastline, usually by wind and/or wave action.

**Coastal flooding** – occurs when coastal defences are unable to contain the normal predicted high tides which can cause flooding, usually when a high tide combines with a storm surge (created by high winds or a deep depression).

### Common Recognised Information

**Picture (CRIP)** – an amalgamation of all facts known at a point in time regarding a developing situation, into a single, coherent

document. It is usually produced by the Civil Contingencies Secretariat or the Defence and Overseas Secretariat in the Cabinet Office to inform the central Government response.

**Community resilience** – the ability of a local community to respond to and recover from emergencies.

**Convective rain** – occurs mainly in equatorial and tropical regions where the rate of evaporation is very high. The evaporated moisture rises along with hot air and expands due to a decrease in air pressure as altitude is gained. The wind temperature decreases, resulting in an increase in humidity levels that cause condensation of water vapour. This then falls as rain.

**Cost-benefit analysis** – a decision making technique that analyses and evaluates the implications of alternative courses of action by assigning a quantified monetary value for each positive criterion (benefits) and negative criterion (costs).

**Critical National Infrastructure** – the ‘National Infrastructure’ comprises those sectors which supply essential services to the citizen on which normal daily life in the UK depends. These are energy, water, communications, transport, finance, government, health, food and emergency services. The most important sites within these sectors whose loss would have a major impact on the delivery of essential services are deemed the ‘Critical National Infrastructure’.

**Criticality** – a relative measure that combines the consequences of a particular failure mode and its frequency of occurrence.

**Culvert** – a sewer or drain crossing under a road or embankment.

**Deep depression** – an area of low pressure in the atmosphere.

**Detention Basin** – depressions in open spaces help to slow down the run-off rate and store water on a temporary short-term basis during extreme events.

**Emergency** – an event or situation that threatens serious damage to human welfare in a place in the UK or to the environment of a place in the UK, or war or terrorism which threatens serious damage to the security of the UK. To constitute an emergency, this event or situation must require the implementation of special arrangements by one or more Category 1 responders.

**Emergency planning** – development and maintenance of agreed procedures to prevent, reduce, control, mitigate and take other actions in the event of an emergency.

**Exercise** – a simulation to validate an emergency or business continuity plan, rehearse key staff or test systems and procedures.

**Floodplain** – low-lying area adjacent to a watercourse and prone to flooding.

**Flood risk** – product of the probability of flooding occurring and the consequences of when it does.

**Flood Warning** – one of the classifications of the Environment Agency’s flood warning system: flooding of homes and businesses is expected.

**Flood Warning Codes** – the Environment Agency’s flood warning system, which consists of codes: Flood Watch; Flood Warning; Severe Weather Warning; and All Clear.

**Flood Watch** – one of the classifications of the Environment Agency’s flood warning system: flooding of low-lying land (but not

homes and businesses) and roads is expected.

**Fluvial flooding** – same as river/coastal flooding.

**Focus group** – a qualitative research technique in which a small cross-section of people are brought together to discuss issues or views on a particular topic, through unstructured but guided discussion by a moderator.

**Frontal rain** – (also known as **frontal precipitation**) is formed when two air masses of differing temperatures, humidity and density levels meet, with a layer separating them called the ‘front’, consisting of two parts – a warm and cold front. A warm front occurs when the warm, lighter air rises over the cold, heavier air, which cools causing moisture to condense and form clouds. The resulting rainfall is steady, lasting from hours to days. A cold front occurs when the cold air forces the warm air to rise rapidly, causing moisture to condense quickly. The rainfall is usually heavy and lasts for a short period of time.

**Generic plan** – a single plan designed to cope with a wide range of emergencies.

**Geographic information system (GIS)** – a computer mapping system that uses computer software, hardware, geographic data, and personnel to efficiently capture, store, update, analyse and display geographic information.

**Gold** – strategic decision makers and groups at the local level. They establish the framework within which operational and tactical managers work in responding to, and recovering from, emergencies.

**Government Offices** – represent central government in the regions. They consist of nine regional offices across England and represent 11 Whitehall departments.

**Green roof** – a roof purposely covered in vegetation to reduce and treat water runoff.

**Greenhouse gas** – a gas that absorbs infrared radiation in the atmosphere.

**Groundwater flooding** – occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.

**Hesco Bastions** – welded mesh, multi-cellular baskets filled with aggregate stones to form a barrier against flood water.

**Hydrology** – the scientific study of water, including its properties, movement and effects on the Earth’s surface, underground and in the atmosphere.

**Jet stream** – relatively strong, high-speed winds concentrated within a narrow current in the atmosphere; they mark the boundary that separates two global air masses with significant differences in temperature. This largely determines where weather systems will develop.

**Inundation** – an overflow of water.

**Land management** – This includes the way land is drained, used and farmed in the rural environment.

**Land use planning** – branch of public policy encompassing many/various disciplines seeking to order and regulate the use of land.

**Lead government department (LGD)** – government department which, in the event of an emergency, co-ordinates central government activity. The department which will take the lead varies, depending on the nature of the emergency. The Government regularly publishes a full list of LGDs.

**Lead responder** – a Category 1 responder charged with carrying out a duty under the Civil Contingencies Act 2004 on behalf of a number of responder organisations, so as to co-ordinate its delivery and to avoid unnecessary duplication.

**Lead time** – the amount of time needed to evaluate and prepare for a change. This is measured from the time the change is submitted to when it is actually implemented.

**Local resilience forums** – a process for bringing together all the Category 1 and 2 responders within a local police area for the purpose of facilitating co-operation in fulfilment of their duties under the Civil Contingencies Act 2004.

**Media emergency forum (MEF)** – group of representatives from the media (editors, journalists), government, emergency services and other organisations involved in dealing with an emergency, meeting to plan and discuss communications challenges and common interests in planning for, and responding to, emergencies.

**Meteorology** – the scientific study of weather-related phenomena, including study of the atmosphere and a focus on forecasting observable weather events.

**Multi-agency plan** – a plan, usually prepared and maintained by a lead responder, on behalf of a number of organisations that need to co-ordinate and integrate their preparations for an emergency.

**Mutual aid** – an agreement between Category 1 and 2 responders and other organisations not covered by the Civil Contingencies Act 2004, within the same sector or across sectors and across boundaries, to provide assistance with additional resource during an emergency that may go beyond the resources of an individual organisation.

**National Grid** – a network of supply lines which provide electricity generated at power stations, to places where the electricity is used.

**National Severe Weather Warning Service** – part of the Met Office's Public Weather Service Programme, established as part of their requirement to provide early warnings of potentially severe weather with sufficient lead time for mitigation plans to be put in place.

**Planning assumptions** – descriptions of the types and scales of consequences for which organisations should be prepared to respond. These will be informed by the risk assessment process.

**Planning Policy Statement 25 (PPS25)** – government planning statement relating to development and flood risk.

**Pluvial flooding** – same as surface water/run-off flooding.

**Precipitation** – for example, rain, snow, hail and sleet.

**Primary care trust** – primary care is the care provided by those professionals the public normally see when they have a health problem (eg doctor, dentist, optician, pharmacist). These services are managed by primary care trusts (PCTs).

**Probabilistic forecasting** – a weather forecasting technique which relies on different methods to establish the probability of an event's occurrence and/or magnitude.

**Probability** – the chance, or likelihood, of a certain/particular event occurring which can be expressed as a quantitative description, often ranging from 0 (rare event) to 1 (common event).

**Public weather service advisors** – liaise directly with responders, relaying early warnings of potentially severe weather from the Met Office.

**Qualitative research** – research that derives data from observation, interviews or verbal interactions and focuses on the meanings and interpretations of the participants.

**Recovery** – the process of rebuilding, restoring and rehabilitating the community following an emergency.

**Recovery working group** – sub-group of the strategic co-ordination group (SCG).

**Regional civil contingencies committee (RCCC)** – a committee which meets during an emergency when a regional response or other action at regional level is required.

**Regional media emergency forum (RMEF)** – a group of representatives from the media (editors, journalists), government, emergency services and other organisations involved in dealing with an emergency, meeting to plan and discuss communications challenges and common interests in planning for, and responding to, emergencies. The forum sits as a sub-group on every regional resilience forum.

**Regional resilience forum (RRF)** – a forum established by a Government Office to discuss civil protection issues from the regional perspective and to create a stronger link between local and central government on resilience issues. RRFs have no role in responding to emergencies, instead focusing on driving forward the development and co-ordination of planning for emergencies within each region.

**Reservoirs** – a natural or artificial lake where water is collected and stored until needed. Reservoirs can be used for irrigation, recreation, providing water supply

for municipal needs, hydroelectric power or controlling water flow.

**Resilience** – the ability of the community, services, area or infrastructure to withstand the consequences of an incident.

**Rest centre** – premises used for temporary accommodation of evacuees from an incident.

**Return period** – this is the measure of the rarity of a flood event and is the average time interval between occurrences of a flood event of a similar magnitude.

**Riparian ownership** – owning shoreline land or land on the boundary of a river or watercourse.

**Risk** – risk measures the significance of a potential event in terms of likelihood and impact. In the context of the Civil Contingencies Act 2004, the events in question are emergencies.

**Risk assessment** – a structured and auditable process of identifying potentially significant events, assessing their likelihood and impacts, and then combining these to provide an overall assessment of risk, as a basis for further decisions and action.

**River flooding** – occurs as a result of high water levels in a river channel which is caused when the volume of rainfall or water overwhelms the capacity of the ground and rivers to absorb it.

**Run-off** – water that is not absorbed into the ground and drains or flows off the land, often appearing in surface water bodies.

**Science and technical advice cell (STAC)** – brings together technical experts from the agencies involved in the response, who advise the multi-agency strategic co-ordination group (SCG).

**Severe Weather Warning** – one of the classifications of the Environment Agency's flood warning system: severe flooding is expected. There is extreme danger to life and property.

**Silver** – tactical level of management introduced to provide overall management of the response.

**Single point of failure** – the part or location in a system which, if it fails, will cause the whole system to fail.

**Standard of Protection** – the flood event return period above which significant damage and possible failure of the flood defences could occur.

**Statutory duty** – an action required by law.

**Storm surge** – abnormal rise in sea level along the shore, usually caused by strong winds and/or reduced atmospheric pressure, often resulting from storms.

**Strategic co-ordination group (SCG)** – a multi-agency group which sets the policy and strategic framework for emergency response and recovery work at local level (see also Gold).

**Sub-catchment** – a sub-section of a catchment.

**Surface water/run-off flooding** – occurs when the level of rainfall overwhelms the capacity of the drainage system to cope.

**Sustainable Drainage Systems** – help to deal with excesses of water by mimicking natural drainage patterns.

**Swales** – a shallow, trough-like depression that carries water mainly during rainstorms.

**Topographic** – a map showing the physical features of a geographical area. It can include contours, types of water, vegetation and also man-made features, such as roads, utilities and structures.

**Trunk main** – large-diameter water pipe

**Urban creep** – this refers to the effect of paving over green areas (such as gardens) with impermeable materials.

**Urbanisation** – the progressive expansion of cities.

**Utilities** – companies providing essential services, for example water, energy and telecommunications.

**Voluntary sector** – bodies, other than public authorities or local authorities, that carry out not-for-profit activities.

**Watercourses** – a channel (natural or artificial) along which water flows.

**Water table** – the upper surface of groundwater; the boundary between saturated and unsaturated soil conditions.

The Pitt Review  
Cabinet Office  
22 Whitehall  
London SW1A 2WH

Tel: 020 7276 5300  
Fax: 020 7276 5012

E-mail: [ThePittReview@cabinet-office.x.gsi.gov.uk](mailto:ThePittReview@cabinet-office.x.gsi.gov.uk)  
[www.cabinetoffice.gov.uk/thepittreview](http://www.cabinetoffice.gov.uk/thepittreview)

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