

# Severn Tidal Tributaries Catchment Flood Management Plan

Summary Report December 2009



managing  
flood risk

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# Introduction

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**I am pleased to introduce our summary of the Severn Tidal Tributaries Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the Severn Tidal Tributaries catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.**

The Severn Tidal Tributaries CFMP is one of 77 CFMP's for England and Wales. Through the CFMP's, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

The role of CFMP's is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMP's to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each other's progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The Severn Tidal Tributaries catchment area has a long history of river, tidal and surface water flooding. At present it is estimated that there are approximately

2,562 properties and 6,000 people at risk in the catchment in a 1% flood event. However, it is expected that both of these figures could rise quite significantly within the next 100 years by which point some 3,720 properties and 7,000 people could be affected by flooding in a 1% event. This is an increase of 29% and 17% respectively.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. Amongst others, Local Authorities, Natural England, the Forestry Commission, National Farmers Union (NFU) and the Lower Severn Internal Drainage Board have been involved in the formulation of this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk) alternatively paper copies can be viewed at any of our offices in Midlands Region.

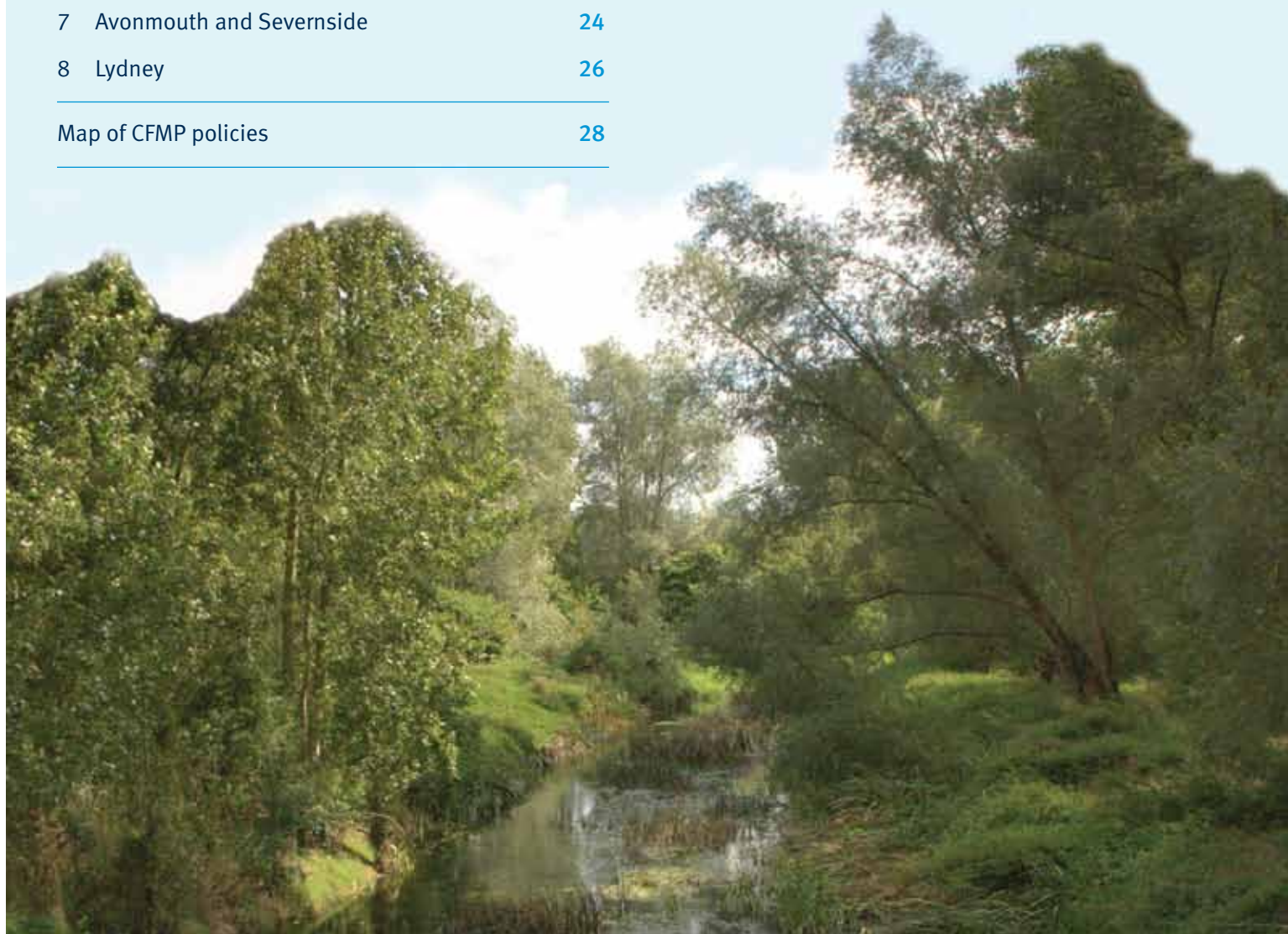
A handwritten signature in black ink, consisting of several overlapping loops and flourishes, appearing to read 'Mark Sitton-Kent'.

**Mark Sitton-Kent**  
**Midlands Regional Director**



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# The purpose of a CFMP in managing flood risk

CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

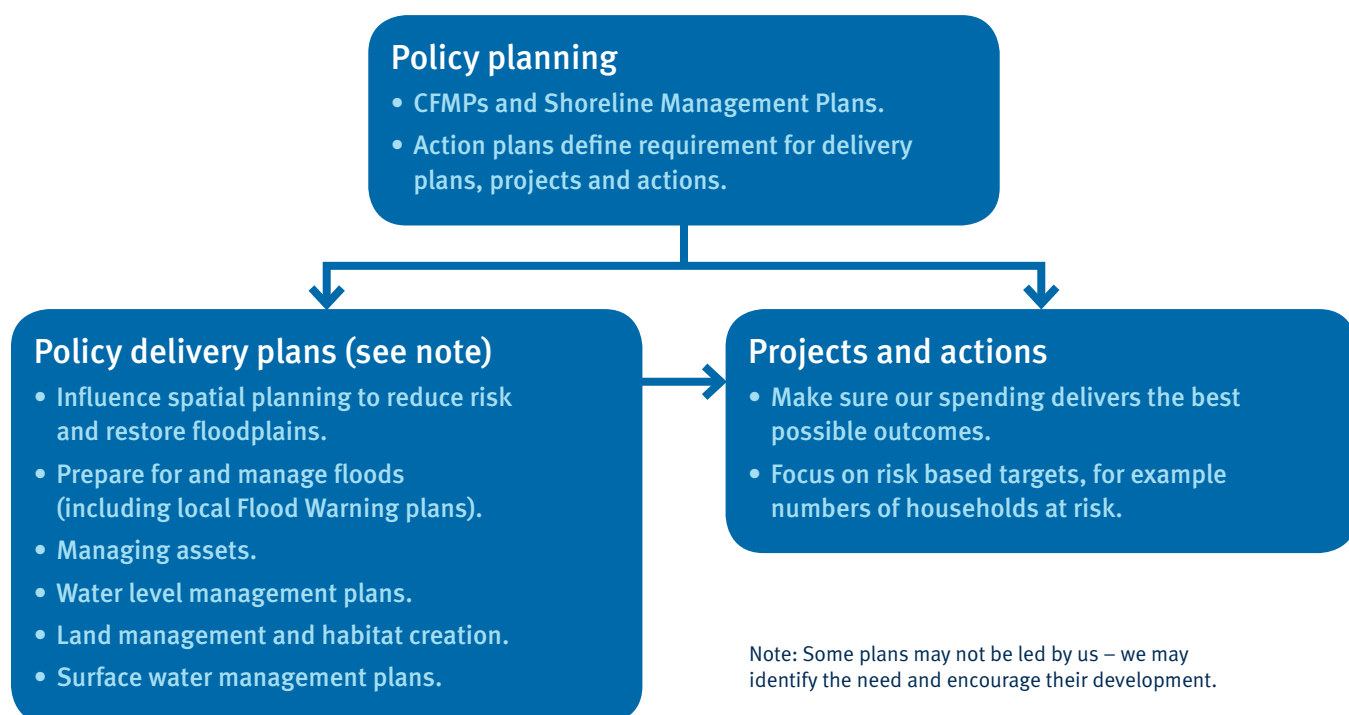
- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional Planning bodies and local authorities who can use the plan to inform spatial planning activities and emergency planning;

- IDBs, water companies and other utilities to help plan their activities in the wider context of the catchment;
- Transportation planners;
- Land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in figure 1.

Figure 1 the relationship between CFMPs, delivery plans, projects and actions



# Catchment overview

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The Severn Tidal Tributaries CFMP is located in the south west of England, it covers an area of over 1,000km<sup>2</sup> and is made up of six sub-catchments each draining into the tidal River Severn downstream of Gloucester. These sub-catchments are: Avonmouth, the Little Avon and River Cam, the River Frome, the Gloucester streams (including the Dimore Brook, Sud Brook, River Twyver, Daniels Brook and Wotton Brook), Westbury Brook and Walmore Common and the Forest of Dean (including the River Lyd and Cinderford Streams). We have produced a separate CFMP for

the River Severn from its source at Plynlimon in the Welsh mountains to the boundary with the Severn Tidal Tributaries CFMP at Gloucester.

The study area is largely rural, although there are several large urban areas, for example Gloucester in the north of the catchment and Avonmouth in the south, as well as the urban areas of Thornbury and Stroud on the eastern side of the study area and Cinderford and Lydney on the western side. Approximately 8% of the catchment is classified as urban and the catchment has a population of approximately 313,000.

A large proportion of the people that live in the CFMP area live and work in smaller towns and villages outside the main urban areas. Tourism, agriculture and small businesses are central to the financial wellbeing of these communities. Around 90% of the land use in the catchment is related to agriculture. The agricultural land is mainly Grade 3 (good to moderate quality) with isolated pockets of the highest grade soils along the Severn Valley.

The topography of the catchment can be divided into three areas: the wide, low-lying Severn Valley floodplain, the ridges and valleys of the Forest of Dean and the steep sided valleys of the Cotswolds which develop into an open, gently rolling landscape. The topography dominates river flow characteristics, with fast flowing streams draining from the high ground of the Forest of Dean to the west and the Cotswolds to the east. Drainage within the Severn Valley floodplain is much slower and is managed through a complex network of artificial and modified channels.

The Severn Tidal Tributaries CFMP is partially situated within the Cotswolds Area of Outstanding Natural Beauty (AONB). As well as this, the study area is also home to a number of internationally and nationally designated landscape habitats including Special Protection Areas (SPAs), Special Areas of Conservation (SAC), a Ramsar site and Sites of Special Scientific Interest (SSSI).



↑ Cinderford Brook





# Current and future flood risk

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## Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period, it is expressed as a percentage. For example, a 1% flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or 0.005 probability of occurring in any one year. The estimated flood risks quoted in this report take account of flood defences already in place.

The Severn Tidal Tributaries CFMP area has a long history of river, tidal and surface water flooding. The most significant event in recent years occurred throughout the catchment in June/July 2007 as a result of a period of exceptional rainfall.

Currently the main source of flood risk for people, property, infrastructure and the land in the CFMP area is tide-locking on the tributaries, as a result of tidal flooding from the River Severn. Surface water flooding largely caused by rapid run-off and insufficient local drainage capacity is also prevalent throughout the catchment, particularly in Stroud.

## What is at risk?

At present there are around 6,037 people and 3,235 commercial and residential properties at risk in the whole catchment from a 1% annual probability river flood. This means that 1.9% of the total population living in the catchment are currently at risk from flooding.

It is difficult to assess the current impact of flooding to environmental features. The catchment has a number of designated sites which are at risk of flooding. However, many of these sites contain habitats for which floods are a natural and important occurrence which can be beneficial. There are also 2 Scheduled Monuments which may also be at risk of flooding.



↑ River Frome near Stroud



## Where is the risk?

The majority of the people and properties that are at risk within the catchment from a 1% annual probability river flood are predominantly located within the more remote areas. Flooding often does not impact on major urban areas in this catchment and may therefore only affect a small number of properties.

The distribution of flood risk from a 1% annual probability river flood, is illustrated in Map 2. Table 1 summarises where there is flood risk to more than 25 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

**Table 1. Locations of Towns and Villages with 25 or more properties at risk in a 1% annual probability river flood**

Number of properties at risk	Locations
>1,000	Gloucester
500 to 1,000	-
100 to 500	-
50 to 100	Chalford, Stroud
25 to 50	Nailsworth, Wotton-Under-Edge

**Table 2. Critical infrastructure at risk:**

2 sewage treatment works
3 schools, 8 Power/Gas Stations
5 railway stations
5 stretches of rail track
6 A roads
1 B road
1 motorway



## How we currently manage the risk in the catchment

We, the Environment Agency, together with Local Authorities and the Lower Severn Internal Drainage Board (LSIDB), are the main authorities responsible for managing flood risk in the Severn Tidal Tributaries CFMP area. We engage in a number of activities with the intention of reducing the probability of flooding including:

- the construction of new flood defences in a number of locations such as the Lydney and Upper Framilode Flood Alleviation schemes;
- maintaining and improving existing flood defences and structures;
- maintaining river channels;
- maintenance of drainage networks by Internal Drainage Boards (IDBs) and landowners;
- maintenance of road drainage and sewers;

Activities that reduce the consequences of flooding include:

- understanding where flooding is likely by using flood risk mapping;
- working with Local Authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS 25).
- providing flood forecasting and warning services
- promoting awareness of flooding so that organizations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood;
- promoting resilience and resistance measures for those properties already in the floodplain.

## The impact of climate change and future flood risk

In the future, flooding will be influenced by climate change, changes in land use (for example urban development) and rural land management. In the Severn Tidal Tributaries CFMP area, climate change will have the greatest impact on flood risk. The following future scenario for climate change was used in the Severn Tidal Tributaries CFMP:

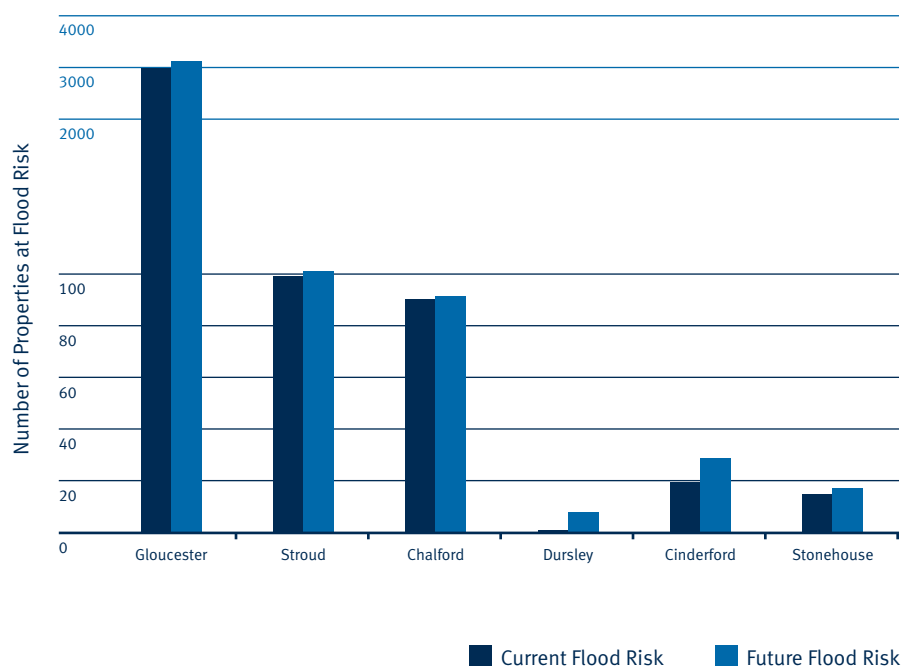
- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood events.
- 5mm a year rise in sea levels for the Severn Estuary.

Using river models we estimate that by 2100, around 7,021 people and 3,770 properties across the catchment may be at risk from a 1% annual probability river flood.

Flood risk to infrastructure and transport is also likely to increase significantly, with 25% more railways and roads likely to be affected by more extensive flooding in the future.

Figure 2 shows the difference between current and future flood risks from a 1% annual probability river flood at key locations in the catchment. Following on from the CFMP, organisations need to work together to investigate flood risk from other sources (e.g. surface water and groundwater flooding) in more detail.

**Figure 2 Current and future (2100) flood risk to property from a 1% annual probability river flood.**





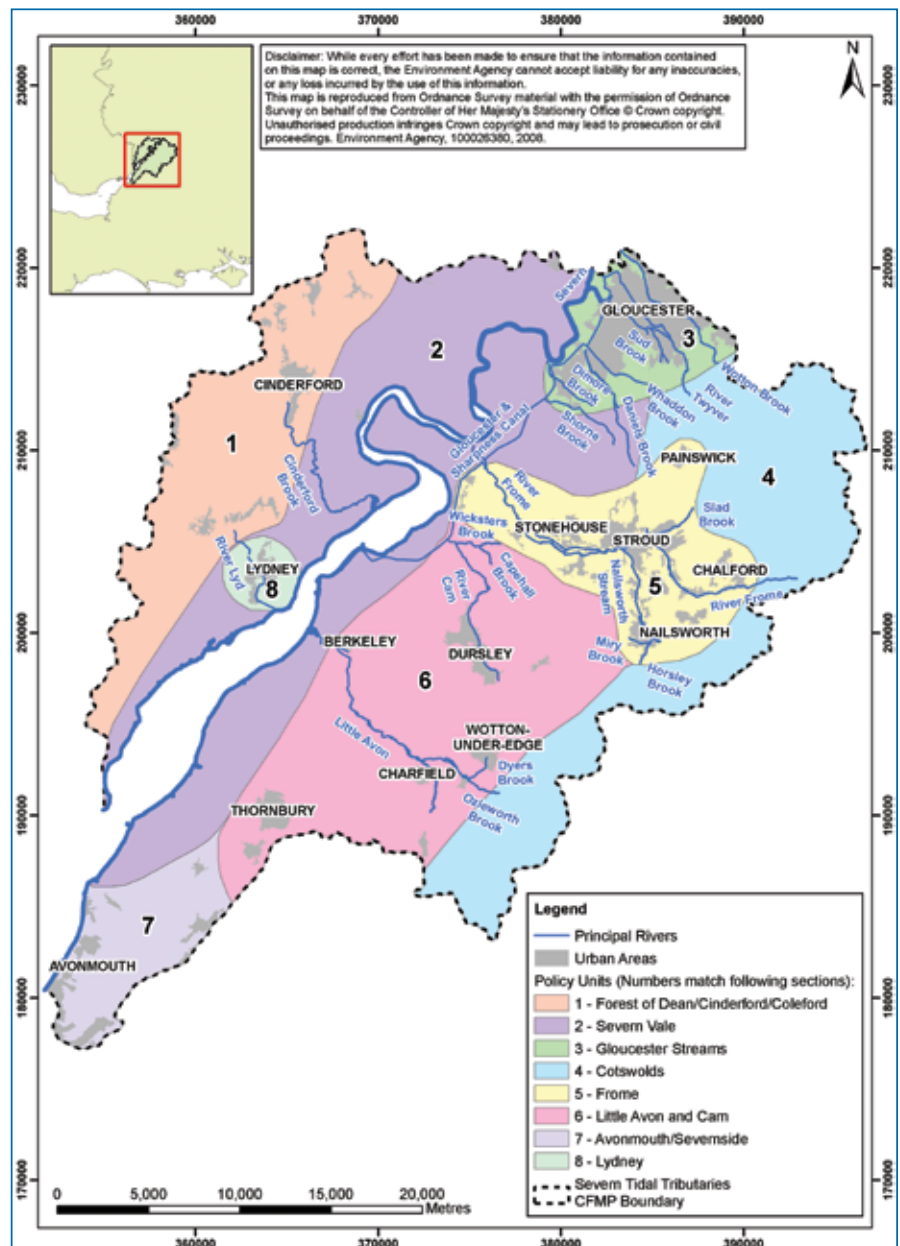
# Future direction for flood risk management

## Approaches in each sub area

We have divided the Severn Tidal Tributaries catchment into eight distinct sub areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub areas and allocated one of six generic flood risk management policies, shown in Table 2.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

Map 3. The Sub areas in the River Severn CFMP catchment



## Table 3 Policy options

### → Policy 1

#### **Areas of little or no flood risk where we will continue to monitor and advise**

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

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### → Policy 2

#### **Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions**

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

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### → Policy 3

#### **Areas of low to moderate flood risk where we are generally managing existing flood risk effectively**

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

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### → Policy 4

#### **Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change**

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

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### → Policy 5

#### **Areas of moderate to high flood risk where we can generally take further action to reduce flood risk**

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

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### → Policy 6

#### **Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits**

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

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# Forest of Dean and Cinderford Streams

## Our key partners are:

Forest of Dean District Council

Natural England

Forestry Commission

NFU

## The issues in this sub area

This sub area is characterised by steep sided valleys with fast-flowing streams. It has numerous groundwater springs which make a significant contribution to the flow in many streams. Cinderford is its largest community, although the sub area in general has a relatively low population.

There is a relatively low level of fluvial flood risk in this sub area with only 29 properties falling within the 1% flood outline. This risk can be managed at the same time as encouraging increased floodwater storage on undeveloped floodplains in order to increase attenuation and so reduce flood risk to communities. This sub area presents a good opportunity for storage, as it will benefit communities locally and downstream (Lydney and parts of the Severn Vale).

Flows in some streams and rivers rise very quickly and so flood warning is currently impractical in some locations. Therefore, it is particularly important to consider other ways of reducing flood risk.

Man-made trends in land-management and land-use have increased flood risk over time in this sub area. Working with local interest groups we need to introduce different ways of working to reverse these trends and also help to offset rising flood risk due to climate change.

In the next 50 to 100 years, it is estimated that as a direct result of climate change and urbanisation the number of properties at risk from flooding in a 1% flood event will rise by approximately 13 to 42 (a 49% rise). The social consequences of flooding will also become worse due to an increase in run-off.

## The vision and preferred policy

**Policy Option 6** – Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

We can apply this policy either locally to a flooding problem, or some distance away where flooding is not a problem. The principle is that we transfer flooding to places where it can bring benefits, reducing the risk in areas where it is a problem. This may mean that we can restore floodplains and improve habitats, reducing the negative impacts of flooding elsewhere within the catchment. This may also include changing the way we use the land, to hold water within that part of the catchment for longer, reducing flood risk elsewhere.

## The key messages

- We plan to take opportunities to restore sustainable natural storage of floodwater in the upstream area, in order to offset increasing flood risk from trends including climate change.
- This is an especially good place to store floodwater, because it would benefit many communities here and elsewhere, for example Lydney.



## Proposed actions to implement the preferred policy

- Carry out a study to investigate the feasibility and funding options for developing extra features for storing floodwater. Also, making the best use of existing storage features.
- The extra storage might include creating many widespread small features along and next to rivers. Some could be wetland habitat, possibly wet woodland. Some might be created by naturalising river channels and locally reducing their flow capacity, for instance between Cinderford and Blakeney. All extra storage would be created in a managed way that benefits the environment, for example through improvements in biodiversity, soil conservation and water quality. It may also provide benefits for recreation, tourism, and leisure activities.
- Review maintenance operations to make sure they are proportionate to flood risk. Look to reduce blockages at culverts. Also, look for opportunities between Cinderford and Blakeney to naturalise river channels, as above, whilst not increasing flood damage to agriculture.
- Support ecological improvements, for example creating additional areas of wetland habitat in a managed way, aiming to include buffer areas around existing designated areas.
- Encourage rural best practices in land-use (including increasing the area of wooded land) and in land-management (including agriculture) to restore more sustainable natural floodplains and to reduce run-off.



↑ Cinderford Brook, Rusridge

# Severn Vale

## Our key partners are:

**Forest of Dean District Council**

**South Gloucestershire Council**

**Stroud District Council**

**Tewkesbury Borough Council**

**Natural England**

**NFU**

## The issues in this sub area

This sub area borders the Severn Estuary. Much of it is agricultural land, but there are several towns and villages. It has an extremely flat coastal floodplain, much of which is below sea level. Floodplain soils are frequently saturated, and so rainfall is slow to drain away. This leads to some localised surface water flooding, in addition to the fluvial flooding.

Our responsibilities for the estuary and its coast are covered in the Severn Estuary Shoreline Management Plan (SMP). This CFMP covers tide-locking, the flooding caused when high tides prevent watercourses from flowing into the tidal estuary. Much of the sub area has complex and slow drainage, much of which is managed by Internal Drainage Boards through channels and drainage networks that are artificial or at least greatly modified.

There is a relatively low level of fluvial flood risk, but tide-locking is a significant source of this flooding, for instance around Berkeley.

Throughout the sub area there are approximately 25 properties at risk of flooding in a 1% flood event.

There is a relatively low level of risk to essential infrastructure, although the area includes a power station.

In the next 50 to 100 years, it is estimated that as a direct result of climate change and urbanisation the number of properties at risk from flooding in a 1% flood event will rise to approximately 116.

## The vision and preferred policy

**Policy Option 3** – Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

We have selected this policy because the risks are currently managed appropriately and the risk of flooding is not expected to increase significantly in the long term. We may need to review whether what we are doing currently is the best way of managing the risk in the longer term, but we are confident that we do need to manage the risks. This policy may mean we review the current Flood Warning services and/or how we manage the defences that are already in place.

Although one effect of this policy is generally to allow flood risk to increase over time (for example because of climate change), we will minimise the rise by encouraging third parties to reduce the risks posed by their activities. Benefits from improvements to land-management and land-use in other sub areas further upstream, for example Sub area 1 Forest of Dean and Cinderford Streams, where additional flood attenuation and storage may be achieved.

## The key messages

- We plan to take opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains, in order to reduce dependence on raised flood defences, as this is unsustainable in the long term, and to offset increasing flood risk from trends including climate change.
- We aim to maintain most of the existing flood defences at the current physical level.

## Proposed actions to implement the preferred policy

- Make sure floodplains are not inappropriately developed. Follow the sequential approach of PPS 25.
- Encourage rural best practices in land-use and in land-management to restore more sustainable natural floodplains and to reduce run-off.
- Review how effective and sustainable each flood defence is. Review maintenance operations to ensure they are proportionate to flood risk. Specific potential improvements include the sluices at Walmore Common.
- Initiate a study to look at opportunities to remove some flood embankments and so increase the connection of the floodplain with the rivers where it reduces overall flood risk.
- Support ecological improvements, for example at Walmore Common SSSI. Investigate the feasibility of improving its condition and increasing its size by reconnecting the river to the floodplain.



↑ Severn estuary flood defences, Fretherne



# Gloucester Streams

## Our key partners are:

**Gloucester City Council**

**Stroud District Council**

**Tewkesbury Borough Council**

**Severn Trent Water**

**Lower Severn IDB**

**Severn Trent Water**

**British Waterways**

## The issues in this sub area

This sub area is predominantly urban. It is characterised by high density urban areas including Quedgeley and Gloucester. It excludes the north-eastern part of Gloucester, as that is covered in the River Severn CFMP. This is because the Severn ceases to be tidal at the weirs in Gloucester.

There is a relatively high level of fluvial flood risk throughout the this sub area with up to 2,914 properties potentially at risk during a 1% flood event. Tide-locking is a significant source of this flooding, for example flooding from the Dimore Brook and River Twyver. There is also a risk of surface water flooding. Floodwaters can be deep or fast-flowing in some places, and so can be a danger to life.

Flows in some streams and rivers rise very quickly and so flood

warning is currently impractical in some locations. Therefore, it is particularly important to consider all possible ways of reducing flood risk.

Essential infrastructure at risk includes six electricity sub-stations, one emergency response centre, three schools and 3km of A and B class roads and a section of railway line.

Man-made trends in land-management and land-use have increased flood risk over time in this sub area. Working with local interest groups we need to promote different ways of working that can reverse these trends and also help to offset rising flood risk due to climate change.

In the next 50 to 100 years, it is estimated that as a direct result of climate change and urbanisation the number of properties at risk from flooding in a 1% flood event will rise to approximately 3,300.

## The vision and preferred policy

**Policy Option 5** – Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

This policy is about reducing the risk where the existing flood risk is too high. We need to take action in the short term to reduce this level of risk.

## The key messages

- Development/redevelopment must be managed to minimise flood risks. Methods must be sustainable over the long-term. For example, making more space for rivers through urban areas via 'blue corridors' (that is restoring access for floodwater onto key strips of floodplain. This requires redevelopment to be limited to flood-compatible land-uses, for example parkland).
- Surface water flooding is a growing problem. Local authorities are mainly responsible for managing this, but it often has to be integrated with other organisations' assets, for example their infrastructure, sewers or watercourses.
- Flooding cannot be entirely eliminated and so residents, owners, and businesses need to manage some risks themselves. For example, registering for Floodline Warnings Direct (FWD) and flood warden schemes; being aware of emergency plans; and adapting buildings that are at risk of flooding.
- We plan to offset the increasing flood risk from trends, including climate change, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains.

## Proposed actions to implement the preferred policy

- Make sure floodplains are not inappropriately developed. Follow the sequential approach of PPS 25, and consider land swapping opportunities.
- Encourage urban best practices in land-use to restore more sustainable natural floodplains and to reduce run-off.
- Maintain flood warning systems and explore opportunities to improve how effective they are and increase the number in place.
- Make sure that the run-off from all proposed development is minimised. For example, SuDS must be encouraged and targeted within planning approvals. Encourage the retro-fitting of SuDS where surface water flooding is already a problem.
- Develop better understanding of flooding from surface water, from drainage systems, and from ‘non-main’ watercourses. Produce a strategy for operation and investment, integrating all these with main rivers, including those where tide-locking causes flooding.
- Review how effective and sustainable each flood defence is. Review maintenance operations to make sure they are proportionate to flood risk. Remove sediment more frequently from key points on the Dimore Brook.
- Raise awareness of flooding among the public and key partners, especially major operators of infrastructure, allowing them to be better prepared. Encourage them all to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses at risk of flooding.
- Seek opportunities to sustain and increase the amount of floodplain grazing on lower reaches of the Gloucester Streams.



↑ Gloucester and the Docks

# Cotswolds

## Our key partners are:

Cotswold District Council

South Gloucestershire Council

Stroud District Council

Tewkesbury Borough Council

Natural England

NFU

CLA

British Waterways

## The issues in this sub area

This is a largely rural area with small market towns. The area is characterised by steep sided valleys and has numerous groundwater springs which make a significant contribution to the flow in many rivers.

Throughout this sub area there is a relatively low level of fluvial flood risk with less than 10 properties currently being at risk of flooding in a 1% flood event. There is also however a risk of surface water flooding.

Flows in some sub-catchments rise very quickly and so flood warning is currently impractical in some locations. Floodwater is a potential danger to life along some parts of a few narrow valleys, because it is deep and fast flowing.

The risks here can be managed at the same time as encouraging increased floodwater storage on undeveloped floodplains in order to increase attenuation and reduce flood risk to communities. This sub area presents a good opportunity for storage, as it will benefit communities locally and downstream, such as Stroud and Stonehouse. This sub area currently poses a particularly high risk to downstream sub areas because of the rapid rain-off from extensive steep valleys in the Cotswolds.

In the future the risk of flooding throughout this sub area is due to increase as a result of climate change and urbanisation, however this increase is not expected to be significant.

## The vision and preferred policy

**Policy Option 6** – Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

We can apply this policy either locally to a flooding problem, or some distance away where flooding is not a problem. The principle is that we transfer flooding to places where it can bring benefits, reducing the risk in areas where it is a problem. This may mean that we

can restore floodplains and improve habitats, reducing the negative impacts of flooding elsewhere within the catchment. This may also include changing the way we use the land, to hold water within that part of the catchment for longer, reducing flood risk elsewhere.

## The key messages

- Surface water flooding is a growing problem. Local authorities are mainly responsible for managing this, but it often has to be integrated with other organisations' assets, for example their infrastructure, sewers or watercourses.
- We plan to offset the increasing flood risk from trends, including climate change, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains. This sub area is particularly well-located, as it is upstream of most of the at-risk locations in the CFMP.

## Proposed actions to implement the preferred policy

- Carry out a study to investigate the feasibility and funding options for developing extra features for storing floodwater. Also, making the best use of existing storage features.
- The extra storage might include creating small features along and next to rivers. Some could be wetland habitat, possibly wet woodland. Some might be created by naturalising river channels and locally reducing their flow capacity. All extra storage would be created in a managed way that benefits the environment, for example through improvements in biodiversity, soil conservation and water quality. It may also provide benefits for recreation, tourism, and leisure activities.
- Review maintenance operations to make sure they are proportionate to flood risk. Look to reduce blockages at culverts. Also, look for opportunities between Cinderford and Blakeney to naturalise river channels, as above, whilst not increasing flood damage to agriculture.
- Review the need for maintenance operations to make sure they adequately keep pace with flood risk. Focus on cleaning the key culverts in the upper catchments. Seek opportunities to create wet woodland.
- Encourage rural best practices in land-use and in land-management to restore more sustainable natural floodplains and to reduce run-off.
- Make sure that the run-off from all proposed development is minimised. For example, SuDS must be encouraged and targeted within planning approvals. Encourage the retro-fitting of SuDS where surface water flooding is already a problem.



↑ Frampton Mansell



# Frome

## Our key partners are:

**Stroud District Council**

**Lower Severn IDB**

**NFU**

**CLA**

**Severn Trent Water**

**British Waterways**

**Canal Regeneration Consortium**

Floodwaters can be deep or fast flowing in some places, and so can be a danger to life. There is also a risk of surface water flooding, particularly in autumn when debris clogs trash screens, particularly those with closely spaced bars.

In the next 50 to 100 years, it is estimated that as a direct result of climate change and urbanisation the number of properties at risk from flooding in a 1% flood event will rise to approximately 276.

## The key messages

- Development/redevelopment must be managed to minimise flood risks. Methods must be sustainable over the long-term.
- Surface water flooding is a growing problem. Local authorities are mainly responsible for managing this, but it often has to be integrated with other organisations' assets, for example their infrastructure, sewers or watercourses.

## The issues in this sub area

This sub area is predominantly rural, with market towns and the major urban areas of Stroud and Stonehouse. It has many steep-sided valleys.

There is a moderate level of fluvial flood risk throughout the sub area with up to 257 residential and non-residential properties expected to flood during a 1% flood event. Some risk is at historic bridges and bypass channels, which are prone to becoming blocked by river-borne debris. Essential infrastructure at risk includes one electricity sub-station, a length of A-road and a length of railway line.

## The vision and preferred policy

**Policy Option 4** – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

We have selected this policy because the risk is currently managed appropriately, but is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risk.

## Proposed actions to implement the preferred policy

- Make sure floodplains are not inappropriately developed. Follow the ‘sequential approach’ of PPS 25.
- Encourage rural best practices in land-use and in land-management to restore more sustainable natural floodplains and to reduce run-off.
- Maintain flood warning systems and explore opportunities to improve how effective they are and increase the number in place.
- Make sure that the run-off from all proposed development is minimised. For example, SuDS must be encouraged and targeted within planning approvals. Encourage the retro-fitting of SuDS where surface water flooding is already a problem.
- Review how effective and sustainable each flood defence is. Review maintenance operations to make sure they are proportionate to flood risk. Remove debris more frequently from key mesh screens.
- Seek opportunities to sustain and improve the status of Frampton Pools SSSI through appropriate frequency, extent and duration of flooding. Seek opportunities to sustain and increase the amount of floodplain grazing on lower reaches of the River Frome.



↑ River Frome, Stroud

# Little Avon, Cam and Thornbury

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## Our key partners are:

Cotswold District Council

South Gloucestershire Council

Stroud District Council

## The issues in this sub area

This sub area is predominantly rural, but has urban areas including Dursley, Cam and Thornbury. Its western side is low-lying, while its east is higher and has steep-sided valleys running out of the Cotswolds.

There is a relatively low level of fluvial flood risk within this sub area, with less than 10 properties currently being at risk of flooding in a 1% flood event. There is also a risk of surface water flooding, much of which is located in Dursley and Cam.

In the future the risk of flooding throughout this sub area is due to increase as a result of climate change and urbanisation, with approximately 36 properties expected to be at risk during a 1% flood event.

## The vision and preferred policy

**Policy Option 3** – Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

We have selected this policy because the risks are currently managed appropriately and the risk of flooding is not expected to increase significantly in the long term. We may need to review whether what we are doing currently is the best way of managing the risk in the longer term, but we are confident that the risks do need managing. This policy may mean reviewing the current Flood Warning services and/or how we manage the defence that is already in place.

Although one effect of this policy is generally to allow flood risk to increase with time (for example, because of climate change), we will minimise the rise by encouraging third parties to reduce the risks posed by their activities. Benefits from improvements to land-management and land-use in other sub areas further upstream, for example Sub area 4 Cotswolds, where additional flood attenuation and storage may be achieved.

## The key messages

- Surface water flooding is a growing problem. Local authorities are mainly responsible for managing this, but it often has to be integrated with other organisations' assets, for example their infrastructure, sewers or watercourses.
- Flooding cannot be entirely eliminated and so residents, owners and businesses need to manage some risks themselves. For example, registering for Floodline Warnings Direct (FWD) and flood warden schemes; being aware of emergency plans; and adapting buildings at risk of flooding.
- We plan to offset the increasing flood risk from trends, including climate change, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains.

## Proposed actions to implement the preferred policy

- Review maintenance operations to make sure they are proportionate to flood risk. Potential increased maintenance includes unblocking mill-races and other restricted channels to prevent surface water flooding around Dursley and Cam. Potential reduced maintenance would enable managed naturalisation of lengths of rivers, in some cases leading to more wet woodland.
- Develop better understanding of flooding from surface water, from drainage systems, and from ‘non-main’ watercourses. Produce a strategy for operation and investment, integrating all these with main rivers, particularly for Dursley and Cam.
- Encourage rural best practices in land-use and in land-management to restore more sustainable natural floodplains and to reduce run-off.
- Make sure that the run-off from all proposed development is minimised. For example, SuDS must be encouraged and targeted within planning approvals. Encourage the retro-fitting of SuDS where surface water flooding is already a problem.
- Raise awareness of flooding among the public and key partners, especially major operators of infrastructure, allowing them to be better prepared. Encourage them all to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses at risk of flooding.
- Review pre-feasibility information available for Berkeley, taking account of climate change, to decide whether further work is required.
- Seek opportunities to sustain and increase the amount of floodplain grazing on lower reaches of the River Cam.



↑ River Little Avon, Berkeley



# Avonmouth and Severnside

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## Our key partners are:

South Gloucestershire Council

Lower Severn IDB

Severn Trent Water

## The issues in this sub area

This sub area is predominantly rural, but has urban areas including Avonmouth. It also has numerous large industrial and commercial sites. The area is extremely flat coastal floodplain, much of which is below sea level. Floodplain soils are frequently saturated, and so rainfall is slow to drain away. This leads to some localised surface water flooding, in addition to fluvial flooding.

Based on flood zone mapping it is estimated that there are approximately 1,043 properties at risk in this sub area from all sources of flooding, including fluvial, tidal and coastal in a 1% flood event. Most of the flooding results from tide-locking.

However, in the next 50 to 100 years, it is estimated that as a direct result of climate change and urbanisation the number of properties at risk from flooding in a 1% flood event will rise to approximately 1,304.

## The vision and preferred policy

**Policy Option 4** – Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

We have selected this policy because the risk is currently managed appropriately, but is expected to rise significantly in the long term. In these circumstances, we need to do more in the future to reduce the expected increase in risks.

## The key messages

- Development/redevelopment must be managed to minimise flood risks. Methods must be sustainable over the long-term.

## Proposed actions to implement the preferred policy

- Carry out multi-agency review of flood risk management led by the Environment Agency and involving South Gloucester Council and the Internal Drainage Board.
- Maintain flood warning systems and explore opportunities to improve how effective they are and increase the number in place.
- Review maintenance operations to make sure they are proportionate to flood risk.
- Make sure that the run-off from all proposed development is minimised.
- Support maintenance of ecological habitat. Seek opportunities to sustain and increase the amount of coastal and floodplain grazing around Avonmouth.
- Work with others so that designated sites can retain their current good status.



↑ Severn Estuary

# Lydney

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## Our key partners are:

Forest of Dean District Council

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## The issues in this sub area

This sub area includes the urban area of Lydney, and floodplain grazing marsh along the estuary and west bank of the River Lyd.

Throughout this sub area there is a relatively low level of fluvial flood risk, with less than 10 properties currently being at risk of flooding in a 1% flood event. The predominant source of flood risk within this sub area is tide locking.

There is some risk at structures that span rivers which are prone to becoming blocked by water-borne debris. Here there is an above-average chance of flooding, largely because the rivers can be particularly fast flowing.

In the future the risk of flooding throughout this sub area is due to increase as a result of climate change and urbanisation, however this increase is not expected to be significant.

## The vision and preferred policy

**Policy Option 3** – Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

We have selected this policy because the risks are currently managed appropriately and the risk of flooding is not expected to increase significantly in the long term. We may need to review whether what we are doing currently is the best way of managing the risk in the longer term, but we are confident that we do need to manage the risks. This policy may mean we review the current Flood Warning services and/or how we manage the defence that is already in place.

Although one effect of this policy is generally to allow flood risk to increase with time (for example because of climate change), we will minimise the rise by encouraging third parties to reduce the risks posed by their activities. Benefits from improvements to land-management and land-use in other sub areas further upstream, for example Sub area 1 Forest of Dean where additional flood attenuation and storage may be achieved.

## The key messages

- Flooding cannot be entirely eliminated and so residents, owners, and businesses need to manage some risks themselves. For example, registering for Floodline Warnings Direct (FWD) and flood warden schemes; being aware of locations where they might be at risk; being aware of emergency plans; and adapting vulnerable buildings at risk of flooding.

## Proposed actions to implement the preferred policy

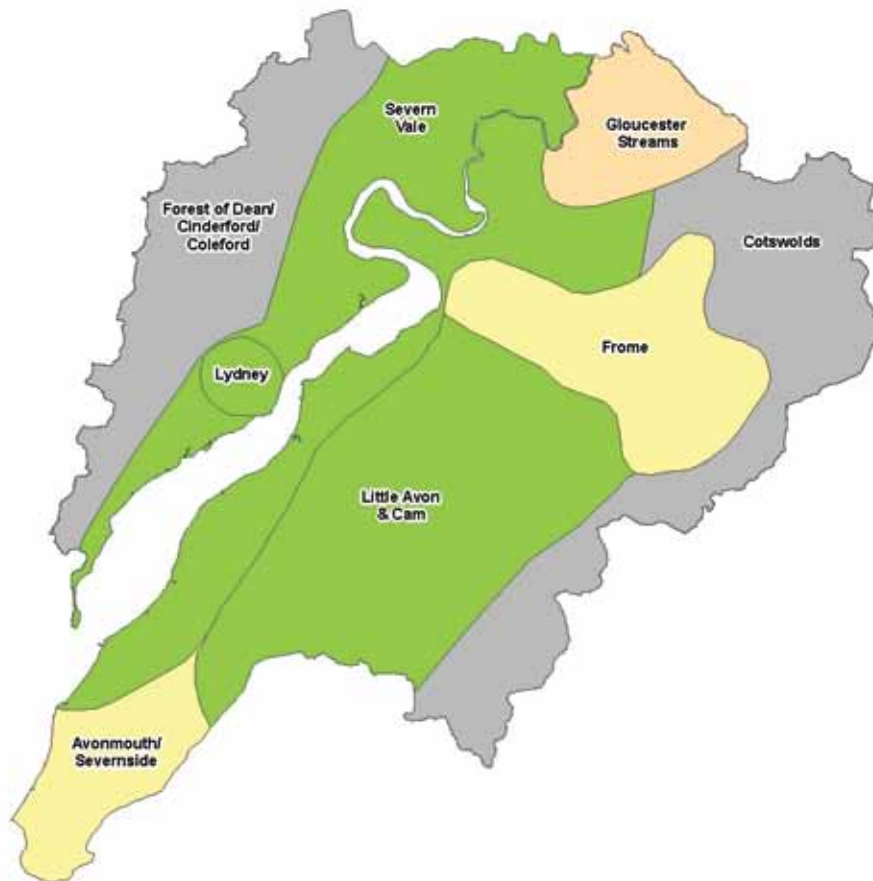
- Maintain flood warning systems and explore opportunities to improve how effective they are and increase the number in place throughout the Lyd catchment.
- Review maintenance operations to make sure they are proportionate to flood risk.
- Raise awareness of flooding among the public and key partners, especially major operators of infrastructure, allowing them to be better prepared. Encourage them all to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses at risk of flooding.
- Support ecological improvements, for example, focused localised reduction in maintenance, which will naturalise more lengths of river. Seek opportunities to sustain and increase the amount of coastal and floodplain grazing.



↑ Lydney Docks



# Map of CFMP policies



**Policy 1:** No active intervention (including Flood Warning and Maintenance). Continue to monitor and advise.

**Policy 2:** Reduce existing flood risk management actions (accepting that flood risk will increase over time).

**Policy 3:** Continue with existing or alternative actions to manage flood risk at the current level.

**Policy 4:** Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

**Policy 5:** Take further action to reduce flood risk.

**Policy 6:** Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.



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