Severn River Basin District
Flood Risk Management Plan
2015-2021

PART A - Background and River Basin District wide information

December 2015

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Severn River Basin District

Flood Risk Management Plan

December 2015

Ironbridge, 2010. Copyright John Foulds

This is a joint plan prepared by the following Risk Management Authorities:

Foreword

The 2013 / 14 winter storms and flooding had significant impacts on many communities, businesses, infrastructure and the environment within the **Severn River Basin District (RBD)**. In the future there could be more extremes in the weather with a changing climate leading to more frequent and more severe flooding.

Investment in flood risk management infrastructure not only reduces the risks of flooding but also supports growth by helping to create new jobs, bring confidence to areas previously affected by floods and creating and restoring habitats.

Risk Management Authorities (RMAs) are committed to producing Flood Risk Management Plans (FRMPs) required by the EU Floods Directive by December 2015. This FRMP is an important part of meeting that objective and aligns with the guiding principles of the National Flood and Coastal Erosion Risk Management Strategy.

The FRMP will help promote a greater awareness and understanding of the risks of flooding, particularly in those communities at high risk, and encourage and enable householders, businesses and communities to take action to manage the risks. The FRMP will provide the evidence to support flood and coastal risk management decision making. The highest priority is to reduce risk to life.

Measures (actions) in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to RMA measures based on current Government policy that gives the highest priority to the areas at highest risk. The funding for flooding is devolved so RMA measures are funded by DEFRA in England, in Wales they are funded by Welsh Government.

This document has been produced in consultation with professional partners. The Flood Risk Management Plan (FRMP) sets out the proposed measures to manage flood risk in the Severn RBD from 2015 to 2021 and beyond.

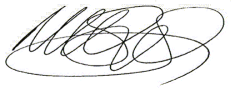
This plan should be read in conjunction with the following:

- Welsh lead local flood authority flood risk management plans, including Blaenau Gwent County Borough Council, Cardiff City Council, Caerphilly County Borough Council, Rhondda Cynon Taff County Borough Council, Merthyr Tydfil County Borough Council and Torfaen County Borough Council;
- Lead Local Flood Authority Local Strategies listed in Part B.

In England and Wales, RMAs include Natural Resources Wales, the Environment Agency, Lead Local Flood Authorities (LLFAs), district councils (where there are no unitary authorities), internal drainage boards, water companies and highway authorities. These RMAs work in partnership with communities to reduce the risk of flooding. The Environment Agency and Natural Resources Wales would like to thank the organisations listed on the previous pages for their contributions and feedback during consultation.

Flood risk in England and Wales will continue to change as a result of a growing population and a changing climate. There are many ways to manage flood risk including maintaining and building new flood defences, building flood resilient homes and working more closely with nature to restore flood plains. Flood risk management planning is not new and RMAs have been able to draw on the experience of partners and earlier plans.

The FRMP also sets out how these measures can contribute to improving the environment and how they support the objectives of River Basin Management Plans (RBMPs) and specifically the Severn RBMP that Natural Resources Wales and the Environment Agency has produced in parallel with this FRMP.



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Format of the flood risk management plan

Flood Risk Management Plans have been divided into four sections to help readers identify and access information relevant to them. This is Part A. The plan is divided into the following four parts:

Name	Audience
Summary Document	For those who want a high level overview of the plan
Part A: Background and river basin district wide information	For those who need some legislative background and RBD wide, high level information
Part B: Catchment Summaries	For those who want the detail of the sub-areas and flooding statistics. This section includes the catchments based on Water Framework Directive (WFD) management catchments, Flood Risk Areas (identified through the Preliminary Flood Risk Assessment) and other strategic areas across the RBD
Part C: Appendices	For those who want to see the detailed program of work for individual communities in England

The measures (actions) that relate to Wales only are found in the Welsh Strategic Area. The measures tables for all Welsh catchments are reported in Part B and not in the Part C: Appendices, as the Welsh measures relate to the highest risk communities by catchment. The Welsh measures are continually updated and the measures in this plan are indicative although correct at the time of publication. The RBD-wide measures that affect Welsh Catchments are found in the Appendices.

The measures that relate to the River Basin District, the English Strategic Area and English catchments are contained in the appendices.

The other parts of the flood risk management plan are located on gov.uk (https://www.gov.uk/government/publications/severn-river-basin-district-flood-risk-management-plan)

The layout of this document

This is Part A, Background and river basin district wide information – this explains what FRMPs are and how the Environment Agency and Natural Resources Wales have developed them and then describes the Severn RBD.

Section 1: What is flood risk and who manages it

This explains what flood risk is, who is responsible for managing the risk and what their roles are.

Section 2: What is a Flood Risk Management Plan

What a FRMP is, why the Environment Agency and Natural Resources Wales are producing a FRMP and describes the kind of information that is included in the FRMP.

Section 3: how has the plan been developed?

Section 3 describes how in partnership the Environment Agency, Natural Resources Wales, LLFAs and other RMAs have prepared this FRMP.

Section 4: how to manage risk

Section 4 describes some of the terminology used, such as 'conclusions', 'objectives' and 'measures', and how they relate to flood and coastal erosion risk management.

Section 5: getting to know the river basin district

Section 5 of the plan introduces the Severn RBD. The 'sub-areas' are also introduced which divide the RBD further.

Section 6: key flood risk issues in the river basin district

The flood and coastal erosion risks are set out for the RBD in section 6.

Section 7: the sub-areas

Section 7 introduces each of the sub-areas in turn. This section outlines the catchments based on Water Framework Directive (WFD) management catchments, which make up the RBD, then the FRAs (identified through the Preliminary Flood Risk Assessment) across the RBD.

Section 8: conclusions, objectives and measures for the Severn RBD

Section 8 sets out the risk conclusions, objectives and measures for the RBD.

Section 9: implementing the plan, monitoring and reporting

Section 9 sets out the proposals for implementing the plan, including co-ordination with the implementation of the RBMPs prepared under the WFD. Section 9 concludes with how the measures will be monitored and reported.

Find out more

Throughout this document you will be directed via hyperlink to more detailed sources of information using 'find out more' boxes.

Contents

Glossary and Abbreviations

AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
Catchment	The watershed of a surface water river system
CaBA	Catchment based approach: an approach to environmental planning that focuses on local engagement and partnerships
CFMP	Catchment Flood Management Plan
Coastal Groups	Voluntary coastal defence groups made up of maritime district authorities and other bodies with coastal defence responsibilities.
Cross Border Advisory Group (CBAG)	Set up under The Flood Risk (Cross Border Areas) Regulations 2012 (SI No. 1102). A statutory group made up of representatives from SEPA, Environment Agency and local authorities within the cross border areas.
Cross Border Areas	Those areas designated as 'cross border' under The Flood Risk (Cross Border Areas) Regulations 2012 (SI No. 1102).
CWS	County Wildlife Site
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EIA	Environmental Impact Assessment
EPR	Environmental Protection Regulations
EU	European Union
FCERM	Flood and coastal erosion risk management
Floods Directive	The European Floods Directive (2007/60/EC) on the assessment and management of flood risks.
Flood Risk Area (FRA)	Areas where the risk of flooding from local flood risks is significant as designated under the Flood Risk Regulations.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan – plan produced to deliver the requirements of the Flood Risk Regulations.
Government	The term government is used within this report to refer to Defra (the Department for Environment, Flood and Rural Affairs) and Welsh Government.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
Ha	Hectares
HLS	Higher Level (Environmental) Stewardship
HRA	Habitats Regulations Assessment: an assessment undertaken in relation to a site designated under the Habitats and Birds Directives
Km	Kilometres
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
Local FRM Strategy	Local flood risk management strategy produced by LLFAs under the Flood and Water Management Act 2010.
Main river	A watercourse shown as such on the main river map, and for which the Environment Agency and Natural Resources Wales has responsibilities and powers
MSFW	Making Space for Water
National FCERM Strategy	National flood and coastal erosion risk management strategy: these are strategies prepared under the Flood and Water Management Act 2010, by the Environment Agency for England and by Welsh Government for Wales.
Natural Resource Management	The taking care of (or management of) natural resources such as land, water, air, soil, plants and animals with a particular focus on how their management affects the quality of life for both present and future generations.
NNR	National Nature Reserve

NRW	Natural Resources Wales. The NRW took over the functions of the Environment Agency in Wales on 1st April 2013.
Ordinary watercourses (OW)	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, Internal Drainage Boards.
PFRA	Preliminary Flood Risk Assessment – these were required to be published by December 2011 and were the first stage in delivering the Regulations.
PU	Policy Unit
Ramsar	Wetlands of international importance designated under the Ramsar Convention
Reservoir	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.
Risk management authorities (RMAs)	Organisations that have a key role in flood and coastal erosion risk management as defined by the Act. These are the Environment Agency, Natural Resources Wales, lead local flood authorities, district councils where there is no unitary authority, internal drainage boards, water companies, and highways authorities.
RFCCs	Regional Flood and Coastal Committees
River Basin District (RBD)	These are the reporting units to the European Commission for the Water Framework Directive and the Floods Directive.
RBMP	River Basin Management Plan – plan required by the European Water Framework Directive.
River flooding	Occurs when water levels in a channel overwhelms the capacity of the channel.
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SAMP	System Asset Management Plan
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
Sewer flooding	Flooding caused by overloaded sewers or blockages or defects within the sewerage network
Surface water flooding	Flooding from rainwater (including snow and other precipitation) which has not entered a watercourse, drainage system or public sewer.
SWMP	Surface Water Management Plan
UKCIP	United Kingdom Climate Impact Projections
Working with natural processes	Taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating function of catchments, rivers, floodplains and coasts. An example of this is using land to temporarily store flood water away from high risk areas.

Part A

1. What is flood risk and who manages it?

The Flood and Water Management Act (2010) defines flooding as any case where land not normally covered by water becomes covered by water. Flood risk is a combination of two components: the chance (or probability/ likelihood) that a location will flood from any source or type of flooding, and the associated impacts (or consequences) of the flooding. Flood risk management is generally concerned with reducing harm which might take the form of property damage or physical injury to people and wildlife. However, flooding can also have beneficial effects too, in particular for wetland wildlife as well as some types of agriculture that are water dependent.

Figure 1.1: What is flood risk?

Risk captures the severity of, or related consequences produced by, a flood event. Impacts can be social, economic and environmental, for example the number of properties flooded and the level of associated economic damages. The consequences of a flood depend on the level of exposure and the vulnerability of those affected.

What is the likelihood of this happening and what does this mean?

Probability (or chance) is a measure of the likelihood that a defined event will occur. The probability of a flood event is typically defined as the relative frequency of occurrence of that flood being equalled or exceeded. Probability can be expressed as a fraction, percentage, a decimal or description, and should always make reference to a time period. For example, flood risk terminology may refer to 'a 1 in 100 chance of flooding in any given year' or 'a 1% annual probability of flooding'. Both of these expressions refer to the same likelihood of flooding.

Assessing impacts of flooding prior to an event usually involves estimating the potential impact of flooding on people, property and the environment. The theoretical probability of flooding is illustrated by the Environment Agency and Natural Resources Wales Flood Maps which show flood risk from rivers and the sea, surface water and reservoirs. Flood models which are the basis for the flood maps use uniform rainfall scenarios (the same amount of rainfall falling across the country at the same time), whereas in reality rainfall rates vary greatly from one area to another.

It is not possible to prevent all flooding, but there are a variety of actions that can be taken to manage flood risk and the impacts of flooding on communities. Flood risk managers must identify all potential options to manage flood risk and balance the needs of communities, the economy and the environment. Risk management authorities should work in partnership with each other and communities to manage flood risk, ensuring that communities understand these risks, are involved in the decision making process, and can actively prepare for the risks. By working together risk management authorities should actively seek opportunities to coordinate risk management, encourage partnership funding and deliver multiple benefits.

Roles and responsibilities

Tables 1.1 and 1.2 show the RMAs involved in flood risk management in England and Wales and their roles and responsibilities.

Table 1.1: Summary of responsibilities for risk management authorities

Flood Source	EA / NRW	LLFAs	District	Water Company	Highways Authority	Internal Drainage Boards[2]
Strategic overview for all sources of flooding & coastal erosion	✓					
Main River	✓					
The Sea	✓					
Surface Water		✓				✓
Surface Water (on or coming from the Highway)					✓	
Sewer Flooding				✓		
Ordinary Watercourse		✓	✓			✓
Groundwater		✓				
Reservoirs	✓*	✓*	✓*	✓*	✓*	✓*

*For reservoirs with a capacity of 25,000 cubic metres or more

[2]As of 1 April 2015 in Wales the 3 Internal Drainage Districts that were operated by independent boards were incorporated into NRW in April 2015.

Table 1.2: Roles and responsibilities of risk management authorities and others involved in managing flood risk

Organisation	Roles and Responsibilities
Environment Agency	The Environment Agency has a strategic overview of all sources of flooding and coastal erosion (rivers, the sea, groundwater, reservoirs and surface water). It has permissive powers to manage flood risk from 'main rivers', the sea and reservoirs. The Environment Agency can use enforcement powers to require landowners to take action to minimise flood risk to others.
Natural Resources Wales	Permissive powers to manage flood risk from 'main rivers', the sea and reservoirs. Can use enforcement powers to require landowners to take action to minimise flood risk to others.
LLFAs	Upper tier local council or unitary council. Permissive powers to manage flood risk from surface water, 'ordinary watercourses' (non-main rivers) and groundwater. Enforcement powers are similar to Environment Agency and Natural Resources Wales. Upper tier councils also manage highways.
Water Companies	Water companies manage the sewerage and water supply networks and any flood risk arising from them. Also manage flood risk to any critical infrastructure, such as water treatment plants and pumping stations.
District Council (only in England)	By agreement with the upper tier Lead Local Flood Authority, the District Council may do some work to manage flood risk. District Councils are the Local Planning Authority.
Community Council (only in Wales)	By agreement with the upper tier Lead Local Flood Authority, the Community Council may do some work to manage flood risk.

Organisation	Roles and Responsibilities
Internal Drainage Boards	Each Internal Drainage Board is a local public authority established in areas of special drainage need in England and Wales. They have permissive powers to manage water levels within respective drainage districts. Internal Drainage Boards undertake works to reduce flood risk to people and property and manage water levels to meet local needs. In Wales the 3 Internal Drainage Districts that were operated by independent Boards were incorporated into NRW in April 2015.
Maritime District Council	As District Councils, but also manage coastal erosion. As many coastal defences protect against both erosion and flooding from the sea, these Councils often do both in urban areas.
Navigation Authorities	The navigation network throughout the RBD is managed by a number of agencies, including Environment Agency, NRW, Canal and River Trust (CRT), the Avon Navigation Trust, Bristol Port Company and Bristol City Council. Although not a designated RMA, CRT manages its network in a way that minimises risk of flooding.
Highways England, South Wales Trunk Road Agency (SWTRA), North Wales Trunk Road Agency (NWTRA)	Highways England, NWTRA & SWTRA look after the motorways and major A roads focussing on the most important national routes, while councils manage the roads serving local communities. Having information about the condition of drainage assets they hold a Drainage Data Management System (also known as HADDMS) to identify flooding issues and places at particular risk, including private property, supporting a risk based programme of drainage renewal works.
Riparian Landowner	The owner of land next to a watercourse usually owns the land to the middle of the river (unless property deeds show otherwise). This 'riparian landowner' is responsible for maintaining the watercourse to allow free flow.
Individual property owners	Individual owners have primary responsibility for safeguarding their land and property from flooding. There is no legal right to be provided with protection from flooding or the effects of flooding.
Communities	Individuals at risk from flooding, or having flooded, are encouraged to form a Flood Action Group or other Community Group as a focus for understanding the issues, considering improvement options and implementing solutions.
Non- RMA owners of flood defences	Features and structures that have been designated as a flood defence cannot be altered, removed or replaced without the consent of the responsible authority.
Reservoir owners	In addition to their general duty of care for the public under common law, the owners of reservoirs with an above ground capacity of 25,000 cubic metres or more have a legal duty to have their reservoirs supervised and inspected regularly by experts; in order to prevent dam failures and the dangerous flooding that could result. Reservoir owners could fall into any of the above categories listed in the table.

Existing flood management schemes and properties protected

Risk Management Authorities work in partnership with each other and communities to manage flood risk. The Flood Risk Management Plan sets out the current and proposed measures to manage flood risk across the Severn RBD. However, RMAs have been undertaking a range of activities to manage flood risk for many years. Details of these activities can be found in Section 6.

In some parts of the Severn RBD flood risk management schemes are in place to reduce flood risk. The Environment Agency Flood Map for Planning and NRW Flood Risk Map shows the flood defences that protect against fluvial and tidal floods. This information was used to produce an overview of the flood defences within the Severn RBD. The Severn RBD contains a total of 3600 structures. The raised defences have a combined length of 390 km.

Some of the communities recently benefitting from flood management schemes are listed below;

- **Riverside, Newport, Gwent** – sheet piling and masonry wall, completed 2011. Protects appropriately 400 properties
- **Maes-Y-Felin, Rhondda Cynon Taf** – earth embankment and masonry wall, completed 2008. Protects approximately 80 properties.
- **Rhymney Bridge, Cardiff –** improvements to flood wall, completed 2014. Protects approximately 30 industrial and retail units.
- **Coleham Head, Shrewsbury** – masonry wall and demountable defence, completed 2011. Protects approximately 80 properties.
- **Broom, River Arrow, Warwickshire** – flood walls and earth embankments, completed 2012. Protects approximately 70 properties.
- **Marcliff, River Avon, Warwickshire** – flood walls, earth embankments, culvert improvement & watercourse realignment, completed 2012. Protects approximately 20 properties.
- **Hereford** – River Wye, masonry wall and demountable defences, completed 2008. Protects approximately 200 properties.
- **Upton on Severn, Worcestershire** – earth embankment and masonry wall, completed 2011. Protects approximately 65 properties.
- **Kempsey, Worcestershire** – earth embankment and pumping station, completed 2011. Protects approximately 70 properties.
- **Uckinghall, Worcestershire** – earth embankment and masonry wall, completed 2010. Protects approximately 30 properties.
- **Pershore, Worcestershire** – earth embankment and masonry wall, completed 2010. Protects approximately 60 properties.
- **Horsbere Brook, Gloucestershire** – flood storage area, completed 2011. Protects approximately 350 properties.
- **Daniels Brook, Gloucestershire** – channel works, completed 2011. Protects approximately 200 properties.
- **Lydney, Gloucestershire** – masonry wall, completed 2012. Protects approximately 60 properties.
- **Weston-super-Mare** – Seafront Enhancement Scheme completed 2010. Protects approximately 4,500 properties. North Somerset Council lead.
- **Bristol, City Centre** – Floating Harbour Tidal Flood Gate Refurbishment completed 2010. Protects approximately 400 properties. Bristol City Council lead.
- **Pill, Bristol** – Tidal Defence Scheme completed 2010. Protects approximately 100 properties.

Flood risk information

The Severn Flood Risk Management Plan covers flood risk from rivers and the sea, reservoirs and selected areas of surface water flood risk (Bristol Flood Risk Area only – as identified in Preliminary Flood Risk Assessment (PFRA)). The following section outlines flood risk classifications for the various sources.

Flooding from river and the sea

National Flood Risk Assessment (NaFRA) is an assessment of flood risk for England and Wales produced using local data and expertise. It shows the chance of flooding from rivers and the sea (both along the open coast and tidal estuaries). The data is presented in flood risk likelihood categories, which indicate the chance of flooding in any given year.

High - greater than or equal to 1 in 30 (3.3%) chance in any given year

Medium - less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year

Low - less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year

Very Low - these properties may have a greater than 1 in 1,000 chance of flooding in any given year if defences weren't present. However, in reality the chance of flooding is reduced below a 1 in 1,000 chance by defences, which NaFRA analysis includes.

The computer model used to produce NaFRA results estimates the likelihood of flooding from rivers and the sea, taking into account defences and the chance that they can fail or be overtopped. The results, which are presented in maps, databases and excel spreadsheets, can be used in conjunction with receptor data (number and type of properties and infrastructure) to estimate the consequences and economic damage associated with flooding from rivers and the sea.

Flooding from reservoirs

Reservoir flood risk maps show the area that could be flooded if a large reservoir were to fail and release the water it holds. This is a worst case scenario. A large reservoir is one that holds over 25,000 cubic metres.

Flooding from surface water

The maps and statistics contained in this plan are based on the Updated Flood Map for Surface Water (uFMfSW) published in December 2013.The uFMfSW assesses a range of flooding scenarios (annual probability of flooding is shown in brackets):

High -1 in 30 (3.3%)

Medium - 1 in 100 (1%)

Low - 1 in 1000 (0.1%)

The uFMfSW replaced the 'Areas Susceptible to Surface Water Flooding' maps produced in 2010 by the Environment Agency. For further information about how the statistics relating to surface water are generated please see Annex 4.

2. What is a Flood Risk Management Plan?

Flood risk management plans highlight the hazards and risks from rivers, the sea, surface water, groundwater and reservoirs and set out how RMAs will work together with communities to manage flood risk. Some water companies have provided measures related to sewer flooding, and it is anticipated that future cycles of the FRMP will include more information on sewer flooding.

What is the FRMP for?

Flood Risk Management Plans (FRMPs) are produced every 6 years and describe the sources and risks of flooding within a river basin district and catchment. They also include information on how risk management authorities (RMAs) plan to work together with communities and businesses to manage and reduce flood risk. Over the 6 year planning cycle the FRMP will help promote a greater awareness and understanding of the risks of flooding, particularly in those communities at high risk, and encourage and enable householders, businesses and communities to take action to manage the risks. FRMPs along with River Basin Management Plans (RBMPs) help all those involved in managing water to make decisions that are best for people and the environment.

Why are FRMPs being prepared?

This is the first cycle of implementing the Flood Risk Regulations 2009. As a result of this legislation, LLFAs must prepare FRMPs in Flood Risk Areas, where the risk of flooding from local flood risks is significant (as identified in Preliminary Flood Risk Assessments (PFRAs)) for instance from surface water, groundwater and ordinary watercourses. Natural Resources Wales and the Environment Agency are required to prepare FRMPs for all of Wales and England covering flooding from main rivers, the sea and reservoirs. Further information on what is a flood risk management plan can be found on the GOV.UK website.

Flood risk and coastal erosion management activities require careful planning to ensure that appropriate, sustainable options are selected and that they are implemented properly. Actions should be planned effectively, for the long-term, and provide a clear picture of what will be done to manage risk and provide multiple benefits. This may include, for example, linking with other plans such as river basin management plans (RBMPs) and supporting biodiversity, habitat creation or improving water quality. Natural Resources Wales, the Environment Agency and contributing LLFAs are developing FRMPs by drawing existing information together and building on existing Flood and Coastal Erosion Risk Management plans such as: Catchment Flood Management Plans (CFMPs), Shoreline Management Plans (SMPs) and Local Flood Risk Management Strategies (LFRMS) (see Figure 2.1).

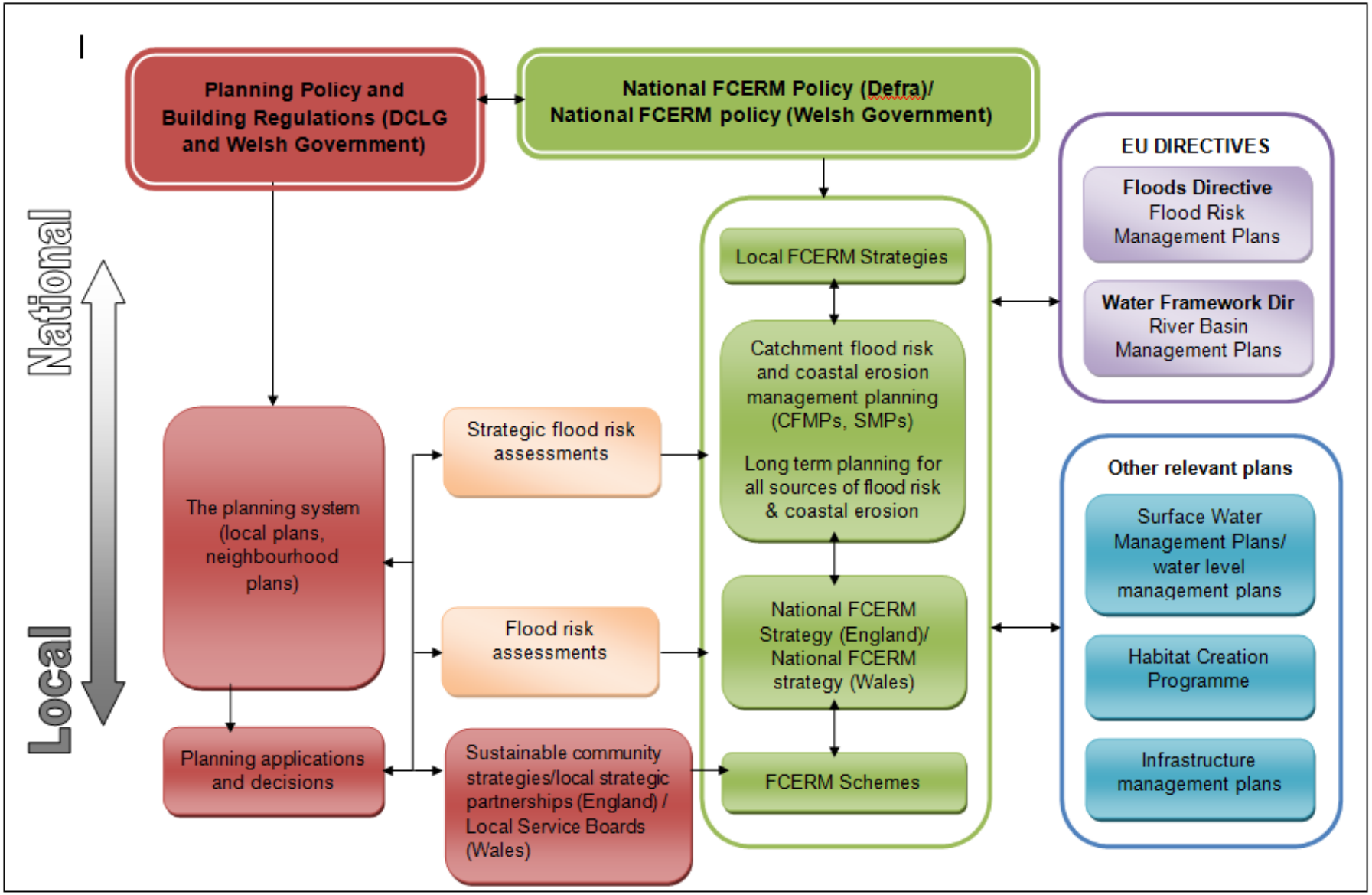


Figure 2.1: FRMPs and their relationship to other planning initiatives (taken from the National FCERM Strategies for England and Wales)

What the plan does

The FRMP will help deliver the requirements of the National Flood and Coastal Erosion Risk Management Strategy in England and the Welsh Government's National Flood and Coastal Erosion Risk Management Strategy in Wales by setting out the measures to manage flood risk now and in the future. The FRMP will:

- Help develop and promote a better understanding of flood and coastal erosion risk
- Provide information about the economic and environmental benefits to inform decision makers
- Identify communities with the highest risk of flooding so that investment can be targeted at those in most need.

Measures in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to RMA measures based on current Government policy that gives the highest priority to the areas at highest risk. The funding for flooding is devolved so RMA measures are funded by DEFRA in England, in Wales they are funded by Welsh Government.

What types of flood risk are included in the FRMP?

The FRMP covers the flood risks that the RMAs are responsible for (see table 1.2 for roles and responsibilities).

The Environment Agency and Natural Resources Wales have worked in partnership with other RMAs to pool the information needed to develop the FRMP. Some RMAs have a statutory duty to produce a FRMP as they have areas designated as Flood Risk Areas (see table 2.1: LLFAs contributing to this FRMP and table 2.3: LLFAs and Flood Risk Areas in separate FRMPs). Other LLFAs have included information on a voluntarily basis. All lead local flood authorities were invited to contribute to this plan, with those listed below in table 2.2 choosing to do so. It is hoped that other RMAs will contribute to future cycles of the FRMP, which will allow all sources of flooding to be more comprehensively captured.

Some water companies have provided measures relating to sewer flooding in this FRMP and the intention is to include more information relating to sewer flooding in future cycles of the FRMP.

Areas of significant 'local flood risk' were identified from historic flood records and analysis of potential future flooding from surface water, groundwater and ordinary watercourses. In England 'Flood Risk Areas' were designated on the basis of there being at least 30,000 people in properties at risk of flooding, or 150 critical services (for example - schools, hospitals, nursing homes, power and water services). In Wales, the threshold agreed by Ministers for 'Flood Risk Areas' is 5,000 people at risk of flooding. A lower threshold was selected in Wales to reflect the nature of risks in Wales including the smaller size settlements and the risks in the South Wales valleys.

The Flood Risk Areas were determined by locally agreed surface water flood maps produced in 2010 by the Environment Agency and supplemented with data from Lead Local Flood Authorities where available.

In the Welsh part of the RBD there were six local authorities that have Flood Risk Areas and are required to produce FRMPs. For this cycle of the FRMP production it was decided that the local authorities would produce their FRMP separately. The remaining local authorities in Wales are voluntarily producing their own separate FRMPs.

Table 2.1: LLFAs contributing to this FRMP

Flood Risk Area and Voluntary Information	Lead Local Flood Authorities
Bristol Flood Risk Area Includes voluntary information from outside Flood Risk Area from all councils	Bristol City Council North Somerset Council Bath and North East Somerset South Gloucestershire Council
West Midlands	The following LLFA's within the Severn RBD bordering the Severn FRMP have fed into the Humber FRMP: Wolverhampton City Council Dudley Metropolitan Borough Council Sandwell Metropolitan Borough Council

Table 2.2: Additional RMAs who have voluntarily provided information for the Severn FRMP

Flood Risk Area and Voluntary Information	Lead Local Flood Authorities
Lead Local Flood Authorities	Somerset County Council

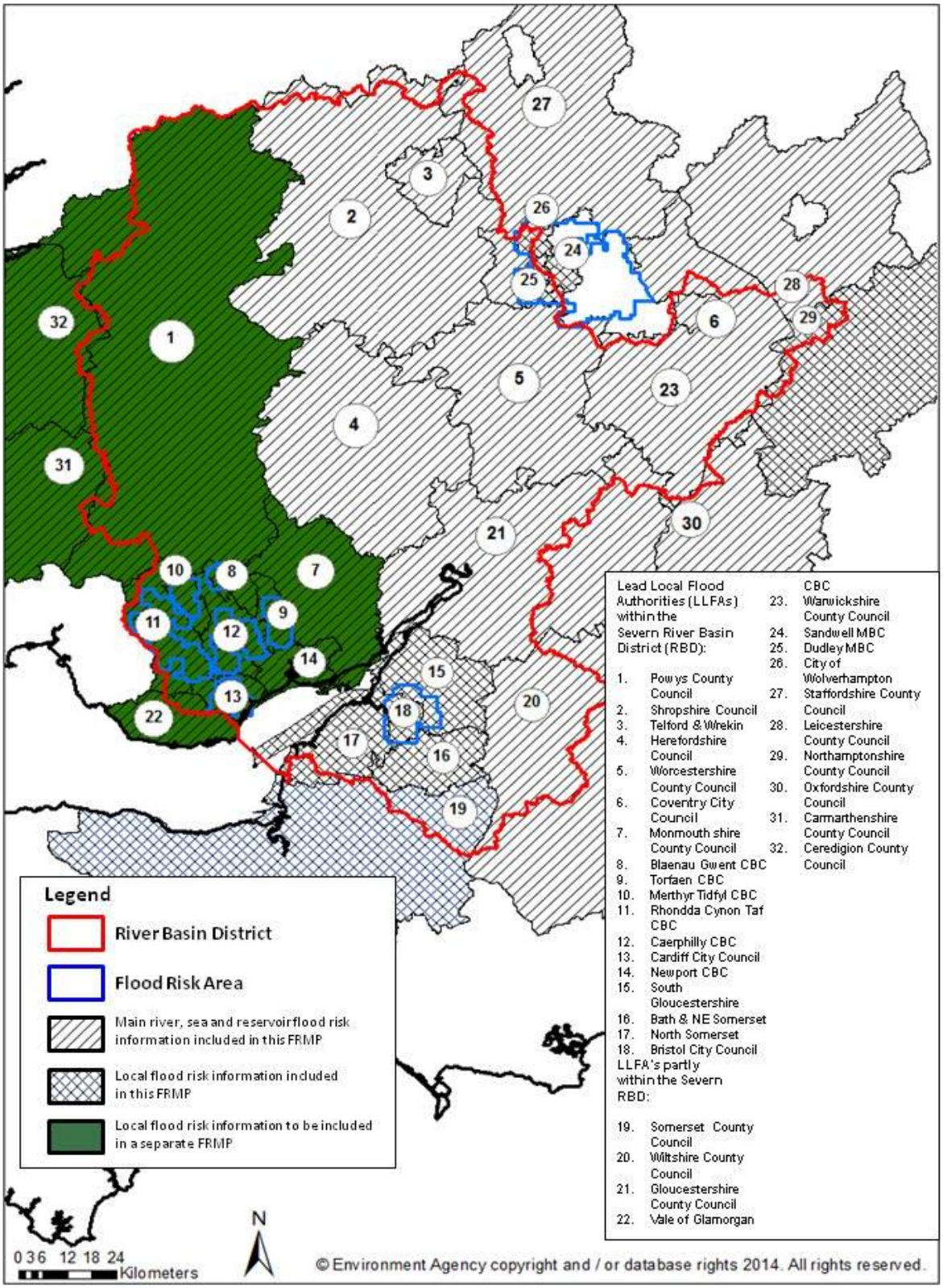
Table 2.3: LLFAs and Flood Risk Areas in separate FRMPs

Flood Risk Area and Voluntary Information	Lead Local Flood Authorities
South Wales Flood Risk Areas	Blaenau Gwent County Borough Council (statutory) Cardiff City Council (statutory) Caerphilly County Borough Council (statutory) Rhondda Cynon Taff County Borough Council (statutory) Merthyr Tydfil County Borough Council (statutory) Torfaen County Borough Council (statutory)
Voluntary	Newport County Borough Council (voluntary) Monmouth County Council (voluntary) Powys County Council (voluntary) Vale of Glamorgan County Borough Council (voluntary)

Find out more about flood risk management:

- **Link to FRMP guidance in England**
- **National Flood and Coastal Erosion Risk Management Strategy for England**
- **National Flood and Coastal Erosion Risk Management Strategy for Wales**
- **Flood and Coastal Change**
- **Interactive flood maps**

Figure 2.2: Sources of flood risk information included in this FRMP



3. How has the plan been developed?

The approach to developing FRMPs

In 2013 the Government agreed that the preferred approach to developing FRMPs would be for the Environment Agency and Natural Resources Wales to work in partnership with other RMAs, in particular LLFAs, to pool information to develop an overall plan for managing all sources of flood risk and coastal erosion. In preparing this FRMP, RMAs have built on relevant information from existing work (see Figure 2.1 and Table 3.1). Of particular importance are the Local Flood Risk Management Strategies developed by all LLFAs. In drawing measures together, RMAs have revisited priorities and ensured that there is a shared understanding of the risks and how best they can be managed.

The Environment Agency and Natural Resources Wales are co-ordinating the development of this FRMP with the RBMP so that there is an integrated approach to overall water management for the benefit of people, the environment and the economy.

Table 3.1 shows the sources of FRMP information. These plans remain active. In England the future need for Catchment Flood Management Plans (CFMPs) as the strategic plan for river and estuary flooding is being reviewed in 2015 and 2016. As with all of the plans listed in Table 3.1, all relevant actions have been brought together in FRMPs. Irrespective of the review, the actions will be being taken forward by the FRMP. The CFMP long term policies have not been carried forward in England but relevant CFMP objectives have been brought into the FRMP.

Find out more:

- **Interactive flood maps**
- **River Basin District Maps**

Table 3.1: Sources of FRMP information according to flood risk

Flood risk	Existing plans and FRMP information
Flooding from main rivers	**Catchment Flood Management Plans (CFMPs):** Eastern Valleys, Wye and Usk, Severn Tidal Tributaries, River Severn, Bristol Avon, Taff & Ely, North & Mid Somerset **Fluvial Severn Flood Risk Management Strategy**
Flooding from the sea and along estuaries, coastal erosion	**Shoreline Management Plans (SMPs):** Anchor Head to Lavernock Point **Estuary Management Plans:** Severn Estuary Flood Risk Management Strategy
Flooding from reservoirs	**Reservoir Plans and Reservoir Flood Risk Maps:** Severn River Basin District
Flooding from surface water, groundwater and ordinary watercourses	**Local Flood Risk Management Strategies (LFRMSs):** Bristol City Council, North Somerset Council, Bath & North East Somerset, South Gloucestershire Council Surface Water Management Plans (SWMPs): Bristol City Council

Consultation and engagement

Consultation and engagement on this FRMP helped improve, inform and shape the plan. National public consultation took place between October 2014 and January 2015.

Blaenau Gwent County Borough Council, Cardiff City Council, Caerphilly County Borough Council, Rhondda Cynon Taff County Borough Council, Merthyr Tydfil County Borough Council and Torfaen County Borough Council also have a legal responsibility to consult on the FRMP they are producing and have done so separately.

Environment Agency consultation document 12i – https://www.gov.uk/government/consultations/update-to-the-draft-river-basin-management-plans

NRW consultation document – http://naturalresources.wales/media/674720/dfrmp-consultation-response-update.pdf

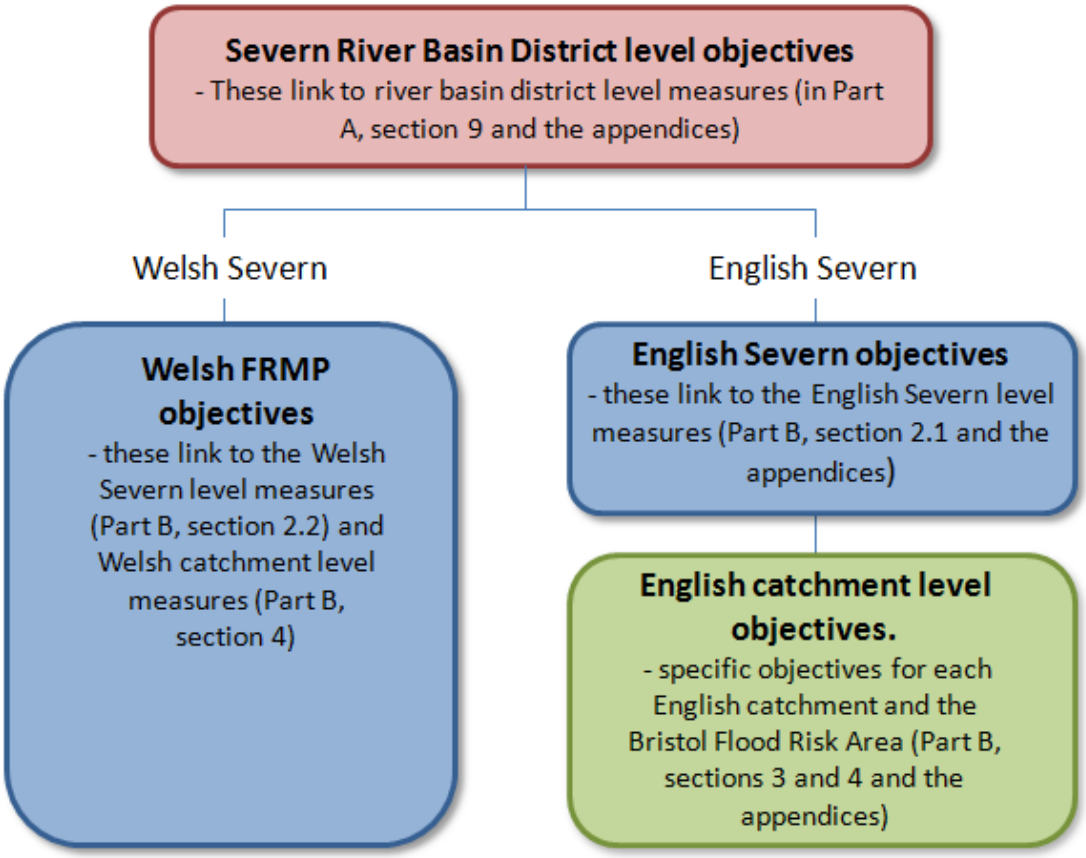
Objective setting

This plan covers areas in England where the Environment Agency is the responsible authority for flood risk management (with regard to main rivers, the sea and reservoirs) and areas in Wales where Natural Resources Wales is the responsible authority for flood risk management (with regard to main rivers, sea and reservoirs). Where the plan crosses the national boundary, agreements and arrangements are in place to enable both organisations to develop the plan jointly and ensure that impacts either side of the boundary are understood and agreed by each authority.

FRMPs contain objectives for managing flood risk. These objectives are a common set of goals agreed by risk management authorities and they state the main ways in which work is directed to make a difference and reduce flood risk. They cover people, the economy and the environment. The objectives are split into the 3 categories to help demonstrate the balance of objectives across the plans but the categories aren't assigned a weighting in the FRMP. Objectives are used to plan and prioritise investment programmes to target investment in the most at risk communities. Objectives are prioritised at an England-wide level and Wales-wide level. This takes into account the risk, but also considers other factors such as cost benefits, the level of investment to date and other aspects such as the potential for external funding opportunities.

The Severn FRMP contains an overarching set of objectives for the river basin district as a whole. Below this are separate sets of objectives for the Welsh part of the Severn and English part of the Severn. In Wales there are a set of objectives, listed in part B, that apply to all the catchments in Wales. These objectives ensure a consistency of approach in Wales and link to both the National FCERM Strategy and the measures as indicated in the tables at the catchment level. In England there is a set of objectives that relate to the whole of the English Severn and there are also separate English catchment objectives, which can differ from one area to the next and allow RMAs to focus on locally important improvements. All levels of objectives are linked. The English measures tables in the appendices show which category of objective relates to each measure.

Figure 3.1: Levels of objectives within the Severn flood risk management plan.



Management of flood and coastal erosion risk in England and Wales is driven by the National Strategies for Flood and Coastal Erosion Risk Management for England and Wales, respectively. These strategies provide the framework for flood and coastal erosion risk management work in the RBD. The overarching principles of the strategies were used to determine objectives for the RBD that consider people, the environment and economic activity.

The Severn RBD FRMP catchment objectives are based on those set in the Catchment Flood Management Plans (CFMPs) and the Shoreline Management Plans (SMP2s) previously developed for the whole of England and Wales in partnership with other RMAs, and Local Flood Risk Management Strategies prepared by contributing LLFAs to meet the requirements of the Flood & Water Management Act 2010.

Where objectives are specific to only England or Wales, they are captured in the England or Wales only sections.

How each authority delivers against their FRMP objectives differs in England and Wales.

Wales

In order to deliver measures to meet the FRMP objectives, Natural Resources Wales takes a risk based community approach to prioritise where to best direct investment. This is informed by the strategic framework provided by CFMPs and SMPs. The strategic framework set by these plans enable Natural Resources Wales to make short term decisions to manage present day risk whilst also considering the longer term prediction of risk (for further information on CFMPs and SMPs please refer to Annex 3). The risk based community approach of present day risk is done through the Natural Resources Wales Communities at Risk Register. This is a tool that considers a number of factors to give an indication of where the most vulnerable communities at risk of flooding from main rivers and the sea are located across Wales. This is then used to plan and prioritise the Natural Resources Wales investment programme to target investment in the most at risk

communities. Prioritisation is then done at a Wales-wide level and takes into account the risk calculation from the Communities at Risk Register but also considers other factors such as the Benefit: Cost appraisal, level of investment to date and other aspects such as the potential for external funding opportunities. There is also a facet of Natural Resources Wales work which is reactive to severe weather events, where severe damage may have occurred, leading to the need for emergency works.

All major flood alleviation schemes in Wales undergo appraisal work to assess options and to understand the costs and benefits of progressing work. This is done in accordance with Treasury guidance.

England

Measures to meet the objectives include actions taken forward from the SMP2 (except in the small number of locations where these now differ following development of more up to date strategies), incomplete actions from the CFMP where still relevant, from existing flood risk management strategies and the 6 year capital investment plan. Over time the aim is to also include actions from more local flood risk management strategies produced by LLFAs for their areas. This first plan includes a number of ongoing, agreed and newly proposed actions at the community level. Over time, the Environment Agency shall be considering further community level actions within the RDB. The aspiration is to add these in future cycles of the plan.

Funding to RMAs to manage flood risk from watercourses, surface run-off and groundwater is mainly provided by Defra as flood and coastal erosion risk management grant in aid (FCRM GiA). Highways authorities and water authorities can apply for GiA funding for projects to reduce flood risk which wouldn't ordinarily be within their remit. Regional Flood and Coastal Committees can also raise local levy funding for local priority projects in partnership with others.

Government promotes nationally consistent approaches to assessing and managing flood and coastal erosion risk and RMAs prioritise public investment in flood and coastal risk management works according to Defra policy and Environment Agency guidance.

The Environment Agency has a role in allocating FCRM GiA and local levy funding to RMAs. Risk Management Authorities bid for the funding through medium term planning and projects are selected on the basis of the outcomes delivered, costs and benefits. Taking a risk-based management approach, resources are targeted to ensure that public money is spent on the works that provide the greatest benefits to society, and that this money is spent efficiently and effectively.

Under Defra's partnership funding approach, government funding towards schemes is based on the numbers of households protected, the damages being prevented and other benefits that would be delivered. For schemes to proceed where they are not fully funded by government either the costs would need to be reduced or the remainder of the funding provided through local contributions. The approach helps achieve the best value for public money and encourages others to contribute where it is in their interests to do so.

Strategic Environmental Assessment and Habitats Regulations

A Strategic Environmental Assessment (SEA) was undertaken to consider the significant environmental effects of the FRMP. Natural England, Historic England, Natural Resources Wales, Cadw and the Marine Management Organisation were consulted on the scope of the proposed assessment in December 2013, and the environmental report sets out the results of the SEA. The report describes the environmental effects that are significant within the RBD and identifies measures to mitigate any adverse effects. Opportunities to improve the environment are also considered in order to deliver greater environmental benefits where possible. The SEA identified the potential environmental effects of flood risk management measures in the FRMP. The focus was on the combined effects of the programme of protection measures across a catchment or flood risk area, rather than individual measures at specific locations.

A similar approach has been used for the RBMP and FRMP which allows us to compare the environmental effects directly and consider the interaction between the two plans. Indicators are

also set out that will be used to monitor the effect of the plan on significant environmental receptors, taking advantage of existing monitoring that is already carried out by the Environment Agency, Natural Resources Wales and others.

A Habitats Regulations assessment has been carried out on the FRMP to consider whether the plan affects designated sites (Special Areas of Conservation, Special Protection Areas and Ramsar sites). The assessment concluded that the plan is not likely to have a significant effect on European Designated Sites.

For information on the Severn FRMP contribution to broader benefits and links with the Severn River Basin Management Plan see Section 8.

How FRMPs have been co-ordinated with river basin management planning

The Environment Agency and Natural Resources Wales lead on the development of FRMPs and RBMPs. The aims are to co-ordinate work effectively, and support others to do the same, so that more can be done for the environment when flooding is managed. Information on how consultation has shaped the plans was published jointly with RBMPs. The FRMP measures of the plans are linked to RBMP and Water Framework Directive objectives, so that the Environment Agency and Natural Resources Wales know where flood risk projects contribute to environment outcomes. How the FRMP contributes to wider benefits is covered in Section 8 of this plan.

Co-ordinating with the RBMP:

- **Severn RBMP**

4. How to manage risk

Involving communities leads to more effective flood and coastal erosion risk management. RMAs will continue to work with communities and other stakeholders to manage risk by:

- assessing the sources of flood risk and drawing conclusions about the risks;
- setting out what RMAs are trying to achieve and establishing risk management objectives;
- determining the best approach to achieving the objectives by identifying the right measures and prioritising them.

The conclusions, objectives and proposed measures are set out within this FRMP. During the 6 year planning cycle set out in the Flood Risk Regulations (2009) RMAs will work with partners and interested parties to:

- seek to secure the necessary funding, including from partners;
- implement the measures, with clarity on what each organisation is accountable for;
- monitor and review how the plan works.

RMAs will monitor, and report annually, on progress in implementing the measures set out in the FRMP. RMAs will continue to work in partnership, ensuring that they can maintain a forward look of prioritised proposals for managing flood risk. The next review of the FRMP under the Flood Risk Regulations will be completed by 2021.

National flood and coastal erosion risk management strategy for Wales

The Welsh Government National Flood and Coastal Erosion Risk Management Strategy provides the framework for flood and coastal erosion risk management in Wales. The framework is centred around four key objectives and the measures to meet those objectives.

- Reducing the consequences for individuals, communities, businesses and the environment from flooding and coastal erosion;
- Raising awareness of and engaging people in the response to flood and coastal erosion risk;
- Providing an effective and sustained response to flood and coastal erosion events;
- Prioritising investment in the most at risk communities.

Natural Resources Wales plans and implements flood risk management work for which Natural Resources Wales are responsible within the framework set by the National Flood and Coastal Erosion Risk Management Strategy.

In order to deliver the measures from the National FCERM Strategy, Natural Resources Wales takes a risk based community approach to prioritise where to best direct investment. This is informed by the strategic framework provided by Catchment Flood Management Plans and Shoreline Management Plans. The strategic framework set by these plans enable us to make short term decisions to manage present day risk whilst also considering the longer term projection of risk.

National flood and coastal erosion risk management strategy for England

The national flood and coastal erosion risk management strategy for England (2011) provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion risk in England. The overall aim of the strategy is to ensure the risk of flooding and coastal erosion is

properly managed by using the full range of options in a co-ordinated way. It encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to:

- ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risk;
- manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment;
- ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood forecasts, warnings and advice;
- help communities to recover more quickly and effectively after incidents.

The strategy recognises that difficult decisions have to be taken on where activities can and can't be carried out at both national and local levels. As such, six guiding principles have been identified to help guide these decisions and the processes by which they are taken. These guiding principles are:

1. Community focus and partnership working
2. A catchment and coastal "cell" based approach
3. Sustainability
4. Proportionate, risk-based approaches
5. Multiple benefits
6. Beneficiaries should be encouraged to invest in risk management.

In support of the guiding principles for delivering multiple benefits the national strategy advocates:

- Flood risk management solutions should enhance the environment;
- FCRM should avoid damaging the environment, including the historic environment;
- FCRM should wherever possible seek to work with natural processes;
- FCRM should always seek to provide environmental benefit as required by the Habitats, Birds and Water Framework Directives.

This FRMP has been developed to meet the legal requirements of the Flood Risk Regulations. In doing so, the national flood and coastal erosion risk management strategy for England has also been taken into account, in particular its guiding principles.

Measures for managing risk

There are different approaches to managing flood and coastal erosion risk – these are known as measures and are described below:

The text below sets out how measures are displayed in this document.

Preventing: by avoiding putting people or the environment at risk of flooding, for example, one way of preventing risks arising would be by not building homes in areas that can be flooded.

Preparing: by taking actions that prepare people for flooding, for example, by improving awareness of flood risk, or by providing warning and forecasting for floods so that people can take precautions to safeguard their valuables.

Protecting: by protecting people from the risk of flooding. For example, by the maintenance or refurbishment of existing defences, building new defences or incorporating property resilience measures such as using waterproof boards over doors and airbricks to reduce the damaged caused by flood water.

Recovery and review: by learning from when flooding happens and how to recover from it, for example, by improving the availability of recovery services such as providing temporary accommodation, after flooding has occurred. There will be a disproportionately low amount of actions in this category as recovery and review can only occur in the aftermath of floods.

Flood and coastal erosion risk management may require a combination of the measures outlined above. FRMPs bring together measures from existing sources, particularly CFMPs, SMPs, local flood risk management strategies and the 6 year investment plan. The development and completion of these measures is often dependent on partnerships and the provision of funding.

Working with communities

The risk management authorities should work in partnership with communities to understand the community perspective of flooding and coastal erosion. The aim is to help communities understand and actively prepare for the risks, and encourage them to have direct involvement in decision-making. Where there are Flood Action Groups or other community groups, these become a clear focus for the community to bring together all the relevant information its residents and businesses may have. Where no such group is in existence, all relevant RMAs should endeavour to engage with communities to impart information and understanding about local flood risk. Working together to share knowledge, all relevant RMAs can work with communities on managing local risk. This becomes an opportunity for the RMAs to explain what steps they propose to take, talk about the likelihood of funding for any construction works, explore any other funding sources and advise residents and businesses what they can do to help themselves. It also gives the community the opportunity to shape the proposals.

Box 1. Case Study Box

Kenilworth (Avon catchment)

After flooding in December 2012 the Environment Agency worked with affected residents in Kenilworth to establish the Kenilworth flood action group. The group of affected residents and partner organisations lead on raising awareness of the group amongst the community, reporting issues to the relevant authorities and increasing the resilience of the properties via developing a flood plan and investigating property level protection.

The Environment Agency was able to establish a flood warning service and worked with the group to ensure affected residents were registered for the service and understood what to do when they receive a warning.

The community took part in the Defra community engagement pathfinder project and gained funding to set up a CCTV camera so they can monitor the Finham Brook when they are away from home. This gives residents extra peace of mind alongside the warning service.

Flooding in Kenilworth, November 2012

Partnership working

Managing flood and coastal risks and particularly local flood risks requires many organisations to work together in partnership. The main RMAs in the Severn are the Environment Agency, Natural Resources Wales, lead local flood authorities, district councils, internal drainage districts (in Wales), internal drainage boards (in England), highways authorities and water and sewerage companies.

Partnership working allows organisations to pool expertise and resources to enable what they do to be as efficient and effective as possible. It encourages the sharing of knowledge, data and expertise and provides opportunities to manage cross boundary issues, ensure consistent approaches and develop and test innovative approaches to delivery.

Regional Flood and Coastal Committees (RFCCs) were first established in 2011 following the Flood and Water Management Act 2010, replacing the former Regional Flood Defence Committees. The English Severn RBD is covered by the English Severn and Wye RFCC. It covers an area of 11,500 sq km and some 2,520 km of designated Main River.

The RFCC plays a key role in local funding and approving programmes of work that protect communities from flooding. The RFCC supports the Environment Agency and Lead Local Flood Authorities in working with these communities and other partners to identify and bring in funding. The Environment Agency annually submits the 6 year investment strategy to the RFCC, which contains the funding bids for the Environment Agency and LLFAs for the next 6 years.

Flood risk partnership groups exist in the counties of Gloucestershire, Worcestershire, Herefordshire, Shropshire, Telford and Wrekin, Northamptonshire, North Somerset, Bristol City, South Gloucestershire, Bath and North East Somerset. In Wales there are flood risk groups that are based on the four Local Resilience Forum areas. These are attended by the local authorities and NRW.

5. Getting to know the Severn river basin district

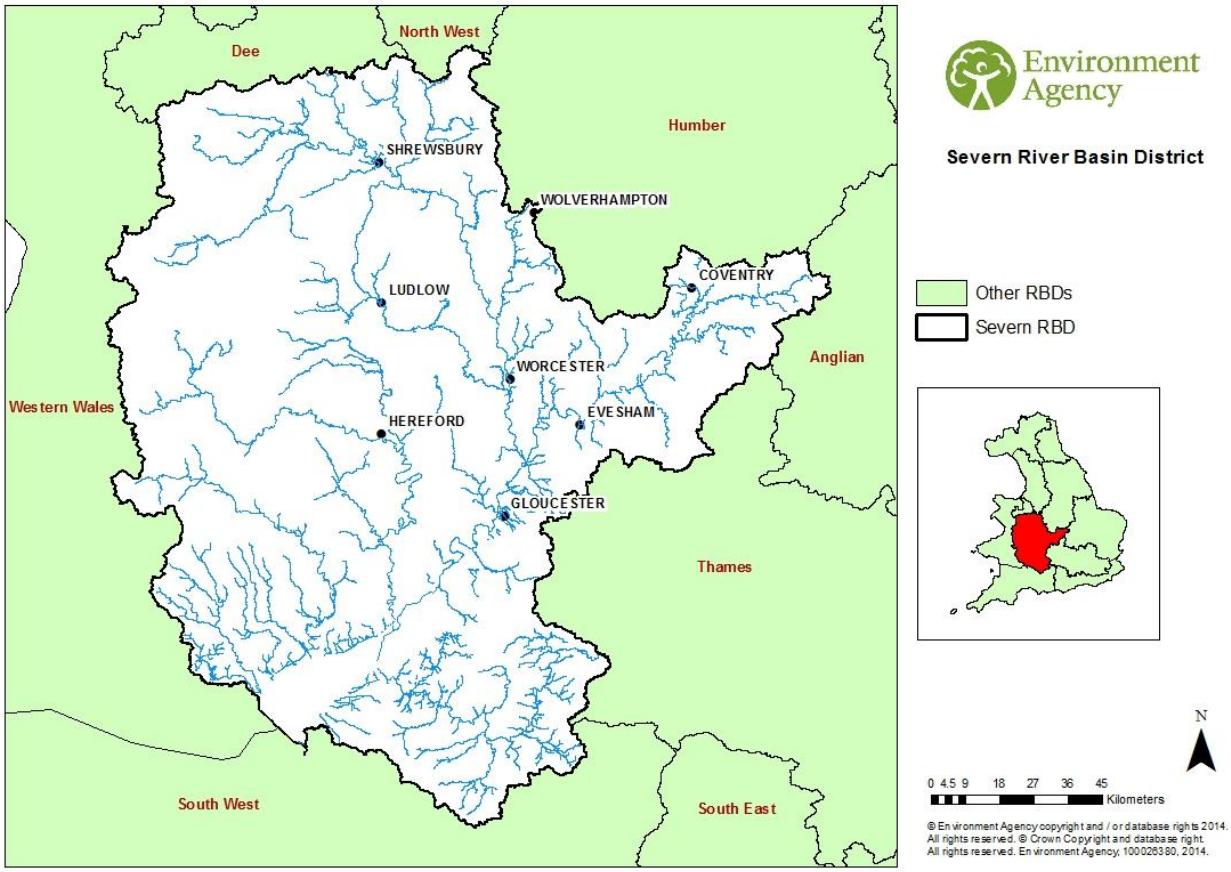
Introduction

The Severn River Basin District (RBD), shown in Figure 5.1, covers an area of just over 21,500 km^2. The River Severn is the UK's longest river, stretching 350km from its source to the mouth of the Bristol Channel. The RBD has a varied landscape from the uplands of Wales, down through valleys and rolling hills of central England, to the lowlands and the Severn Estuary. As well as the River Severn and its main tributaries, the Warwickshire Avon and the Teme, the district includes the rivers of South East Wales, including the Wye, Usk and Taff, and those of the South West, including the Bristol Avon, that drain directly into the Severn Estuary.

The area is home to more than 5.75 million people, and includes major urban centres such as Bristol, Cardiff, Coventry, Worcester, Shrewsbury and Gloucester. The water bodies of the Severn RBD are made up of 7,512 km of river, 76 lakes, and 36 canals, 40 areas of groundwater and 545 km^2 of estuary. The sheer size of the RBD gives rise to the huge variety of land uses, geology, topography and other descriptive factors. The catchment contains a diverse range of habitats associated with its upland areas, river valleys and floodplains, farmed landscapes and urban areas.

The river has a variety of flooding issues along its length and given the complicated nature and volume of tributaries there is a need to take a catchment-wide view to all changes within the RBD. Activities must seek to avoid passing risk on to others within the catchment without prior agreement.

Figure 5.1: Overview of the Severn RBD



Water

The main reason water is abstracted in the Severn RBD is to supply water for the general public. The headwaters of many of the rivers have been modified by dams to form reservoirs that ultimately supply drinking water. Water released from these reservoirs helps regulate river flow and can impact on river wildlife (such as the migration of fish) if there is insufficient flow variation. The Environment Agency and Natural Resources Wales work in partnership with water companies to regulate flow on the Severn and Wye. Agriculture and horticulture also rely heavily on abstractions. While the amount of water abstracted for agriculture is relatively low compared to other uses, it usually takes place when flows are naturally at their lowest.

Reducing abstraction is often difficult as an alternative source of water will usually need to be found. These options may be costly and can bring new environmental issues. Other solutions to tackle unsustainable abstraction are likely to include channel modifications to increase water depths and flow velocities at low flows, Water Level Management Plans or flow augmentation arrangements linked to abstraction.

Pressure on rivers and underground water stores is likely to grow due to climate change and increases in population. Actions to manage the demand for water and encourage people to use water more efficiently will be particularly important where there are acute pressures on water resources. This will involve working with water companies through Water Resource Management Plans and working with farmers and industry groups via initiatives such as on-farm reservoirs (although these may be expensive and require planning) and water audits to build resilience around water supplies. Installing water efficiency measures in the home is also an important area of activity.

Flood risk management systems and drainage

There is a wide variation in the characteristics of rivers and subsequently the nature of flooding throughout the district.

The majority of the district is of a rural nature with much of this comprising agricultural land use; hence it is considered that in most areas the biggest impact on the natural flood regime comes from the management of the land for these purposes.

The upland areas within the RBD that are dominated by the Welsh Mountains and Brecon Beacons have many watercourses which respond rapidly to high levels of rainfall as a result of the steep topography. Annual rainfall totals of up to 2500mm are experienced in these areas. Examples can be found within the south east valleys of Wales, such as the Rivers Taff, Rhymney, Esk and Ebbw and the upper reaches of the Rivers Usk, Wye and Severn in Wales. Similar conditions can also occur in other parts of the RBD where rainfall totals are similar to the national average of 700mm per annum but where the topography is steeper such as along the Cotswold escarpment, in the Forest of Dean and Mendip Hills.

Longer more sustained flooding is experienced over a significant area of the district in the middle to lower lengths of the larger watercourses such as the Rivers Wye, Severn, Warwickshire Avon and Bristol Avon. Here the topography is much flatter and the geology comprises mudstones and clays that have low permeability and thus can become easily saturated. It is in these areas where many of the medium to smaller sized communities at high flood risk can be found. In addition, the groundwater table in these areas is normally high, contributing further to the level of flood risk.

The Rivers Severn, Wye, Bristol Avon, Usk and most of the Southern Welsh watercourses enter the Bristol Channel/Severn Estuary resulting in a risk to these confluence areas from tidal flooding. This is most prevalent along the coastlines of Wales and North Somerset, extending up the River Severn as far as Gloucester. Areas adjacent to the coast are relatively flat with very little elevation. This means that tidal inundation can affect large areas with brackish water. Many of the areas adjacent to the coast are provided with a level of protection by defences.

There is a risk of surface water and sewer flooding in some urban locations. The rivers originating or running through such areas may also respond rapidly to rainfall due to water running off the increased area of impermeable surfaces.

Within the RBD there are many examples of flood defences which reduce the risk of flooding to major urban areas, local communities, essential infrastructure and agricultural land. These defences take the form of earth embankments, flood walls, outfall structures, barrage, attenuation areas, engineered channels and individual property level protection.

Climate change and adaptation

There is clear scientific evidence that global climate change is happening now. Over the past century sea level rise around England and Wales has been observed and more winter rain falling in intense wet spells. Climate changes can affect flood risk in several ways and the impacts will vary depending on local conditions and vulnerability. Risk management authorities should consider climate change within the development of all plans.

Wetter winters and more intense rainfall may increase river flooding and cause more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so there is a need for better preparation for extreme events. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could combine with very high tides, with the potential to affect places a long way inland.

Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s. UK Government's Flood Foresight (2014) re-endorses the findings of the 2008 foresight work, stating that in general terms climate change is likely to increase river flood risks by 2080 by between 2 and 4 times, and coastal flood risk by 4 to 10 times. Increases in the frequency of flooding would affect people's homes and wellbeing, especially for vulnerable groups.

According to UKCIP (UK Climate Impacts Programme), by the 2020s temperatures across the RBD could rise by up to 3°C under a low or high emissions scenario (50% probability level). Summer rainfall may decrease by up to 20% and winter rainfall may increase by up to 20% under either scenario. These extremes impact on water related issues such as decreased water availability and an increase in people and properties at risk from the effects of flooding. The increased frequency and intensity of rainfall events in combination with fast responding catchments will be the greatest threat to the upper areas where a relatively large number of small to medium sized communities are distributed over a wide area. The greatest threat to the lower catchment is from sea level rise which could increase flood risk significantly along the Severn Estuary and surrounding low-lying areas, and potentially change the character of a significant amount of agricultural land and valuable habitat.

Society and health

Over 5.75 million people live and work in small or medium sized towns and cities within the RBD. Over 33,000 are at high risk from flooding, with a further 63,000 at medium risk. There is a wide variety of community types within the area, from those in heavily urbanised areas to rural villages and farms. Health and poverty are inextricably linked and access to resources, including open space and the natural environment, is a key part of improving these factors. The nature of the Severn RBD being so large means that it is a microcosm of the wider issues facing the country as a whole. From a flooding perspective, communities within this basin district are vulnerable from a variety of issues and different flooding sources. Flooding can have impacts on the social welfare and health of the population, as was seen during and following the July 2007 floods. Many of the measures aimed at flood risk prevention, preparedness, protection and recovery and review seek to address potential impacts on the health, wellbeing and the safety of communities.

Land use

Much of the RBD is rural in character, with land managed for agriculture and forestry. This includes improved grassland for extensive beef and sheep farming, large dairy farms, and some arable and specialist horticulture such as orchards and fruit. The major woodland use types are coniferous and deciduous woodland distributed throughout the catchment, for example around Ironbridge Gorge, Breiddon Forest and the Wyre Forest, much of which is ancient woodland.

The way in which land is managed can significantly impact on natural resources including the water environment. A combination of incentive, advisory and regulatory measures help farmers and other land managers protect the environment. For instance, Cross Compliance and Nitrate Vulnerable Zone rules, agri-environment schemes (Countryside Stewardship, Tir Gofal), Catchment Sensitive Farming, and incentives are available for woodland management and planting. Such schemes can be beneficial for the water environment by helping to store water, manage water levels and improve water quality.

The catchment is also characterised by urban centres that are built along the Severn and its tributaries. These population centres vary from small to medium in the upper catchments to large urban and sub-urban areas in the lowland floodplains. In urban areas a key challenge is the non permeability of many surfaces resulting in poor infiltration rates and high surface water flows. The coastal areas around the Severn Estuary have a very particular challenge, with much of the land being reclaimed and heavily reliant on ancient systems of drainage ditches, and lying at or near sea level.

There is growing evidence that woodland measures can help to slow down or even reduce flood flows, particularly within smaller catchments. Strategic tree planting and woodland management can help reduce flood risk in a number of ways:

- Greater water use and interception by trees compared to other vegetation types helps to reduce run-off volumes;
- Woodland soils have greater capacity to absorb and store rainwater during flood events due to their more open structure and the presence of root systems; this also aids interception of overland flow from adjacent land;
- The ‘hydraulic roughness’ of trees and other woodland features can help to slow the flow of overland flood water;
- Soils under woodland are also generally better protected from erosion risk, thereby reducing delivery of sediment to watercourses and reducing pollutants in the water.

Therefore, ‘woodland measures’ for flood risk reduction include woodland creation – in the right place and to the right design – and the installation of woodland features such as large woody debris dams to both reconnect watercourses with already wooded riparian zones and floodplains and to slow down flood flows.

The 2011 the ‘Woodland for Water’ report detailed the evidence behind these conclusions. As a result ‘opportunity mapping’ was produced to help identify where targeted woodland measures could help to reduce flood risk. Priority locations fall into three categories:

- Floodplains – where hydraulic roughness from woodland cover slows the flow and encourages the deposition of sediment;
- Riparian zones – to intercept overland flow, protect river banks from erosion, and help slow the flow of water;
- Wider catchment planting – to protect sensitive soils from erosion, increase infiltration rates, and intercept sediment in run-off from adjacent land.

While opportunity maps can identify priority catchments where woodland creation and management can help reduce flood risk, it is important that woodland is located in the right part of the landscape and then designed and managed appropriately in order to maximise their contribution to reducing flood risk.

Flood and coastal risk management and agriculture

Land drainage for agricultural purposes was historically an important element of operational activity in flood and coastal erosion risk management. Today the prime driver for investment in water management for flooding and drainage is one of risk reduction to people and property, and for the improvement of the environment. Investment is prioritised according to government policy, the respective National Flood and Coastal Erosion Risk Management Strategies for England and Wales and HM Treasury Green Book on economic appraisal. Government policy gives the highest priority to lives and homes.

Economic activity

The key sectors of economic activity within the RBD relate to business, transport, health and industry. Agriculture is the dominant land use within the RBD and a significant contributor to the local economy. The catchment contains a mix of livestock (beef and sheep) and arable farms along with horticultural production. The post-industrial economy has seen clusters of small businesses flourish in the form of small industrial estates.

Recent decades have seen a major transformation in the economy and profile of the area. The traditional industrial base of the towns and cities have continued to decline, allowing significant areas of former industrial and dock land to be released for new housing and employment opportunities. Outside the major cities the catchment comprises a mixture of urban, semi-urban and rural communities. In these areas a growth corridor has emerged along the M5, M4, with secondary growth areas along the larger A-road network.

Recreation and tourism

The natural environment of the district is valued for its navigational and recreation uses and is an attraction for the people who live and work there, plus the many tourists who visit.

The whole catchment, including its rivers, reservoirs and canal network, is very popular with walkers, anglers, naturalists, canoeists and boat users.

Numerous nature reserves and country parks across the catchment also contribute to the local tourist economy. Much of the recreation and tourism in the catchment is focused around the landscape and outdoor pursuits. Activity holidays centred on hiking, cycling, mountain biking, horse riding, golf and water sports are popular and numerous.

The area provides a variety of recreational activities, for example, parts of the River Stour and its tributaries are located within the Cotswolds, which is popular with walkers and the Severn, Avon and Wye catchments, which are important for anglers and water sports. Major tourist centres include Stratford on Avon and Bath, in addition to the historic riverside towns of the River Severn such as Shrewsbury and Worcester as well as Ludlow on the River Teme, Monmouth in the Wye Valley and the Forest of Dean.

Infrastructure

Much of the Infrastructure in the RBD may be affected by flooding, as demonstrated in the 2007 floods, which affected many of the main roads, railways, power and water provision sites. Some of the infrastructure at risk includes the main London to South Wales railway line, power lines, the Severn Tunnel and associated structures and also the M4, M5, M48 M50 and M54 motorways. Several trunk road routes cross the catchment, mainly radiating out from Shrewsbury, Hereford, Worcester, Cardiff and Bristol linked by a network of A and B roads were also affected. Major transport routes, such as motorways and trunk roads can contribute significantly to increasing flood risk through accelerated run-off. Similarly extensive urban development has resulted in increased surface run-off and loss of permeable groundwater aquifers, thus also exacerbating flood risk.

Due to the nature of the Severn RBD it also houses some significant reservoirs that provide water resources to the Midlands and North West of England as well as providing other abstraction uses. These reservoirs lie in the upper reaches of the Severn, Taff and Usk. There is a barrage in Cardiff which may provide additional assistance with any tidal issues and help alleviate some flooding in the Cardiff area from fluvial issues.

Landscape

The sheer size of the RBD gives rise to the huge variety of land uses, geology, topography and settlement patterns that are reflected in its diversity of landscapes extending from the Welsh uplands, through the farmed lowlands as well as the area's river valleys and floodplains. Many of the district's landscapes are of recognised national importance and include the Brecon Beacons National Park in addition to Areas of Outstanding Natural Beauty (AONB) such as the Cotswolds, Malvern Hills, Shropshire Hills, Wye Valley and Mendip Hills. National Parks and AONBS are nationally protected areas with a statutory purpose that includes conserving and enhancing natural beauty, which also extends to wildlife, landscape features and cultural heritage.

National Character Area profiles produced by Natural England describe the character of the landscape across the England parts of the RBD, whilst landscape character assessments produced by local authorities provide a detailed understanding of local character and distinctiveness. Countywide historic landscape characterisation also provides a detailed understanding of the evolution of landscapes and their historic character.

Woodland, including ancient woodland and ancient trees, is an integral component of the district's landscape as well as providing wildlife habitat, natural resources, recreational opportunities and heritage interest. There is also increasing evidence to show that woodland can contribute to mitigating downstream flood risk and improve water quality. Landscape-scale mapping initiatives such as provided by the Midlands Woodlands for Water, has identified priority areas for woodland creation and the improved management of existing woodlands to reduce downstream flood risk and achieve the objectives of the Water Framework Directive.

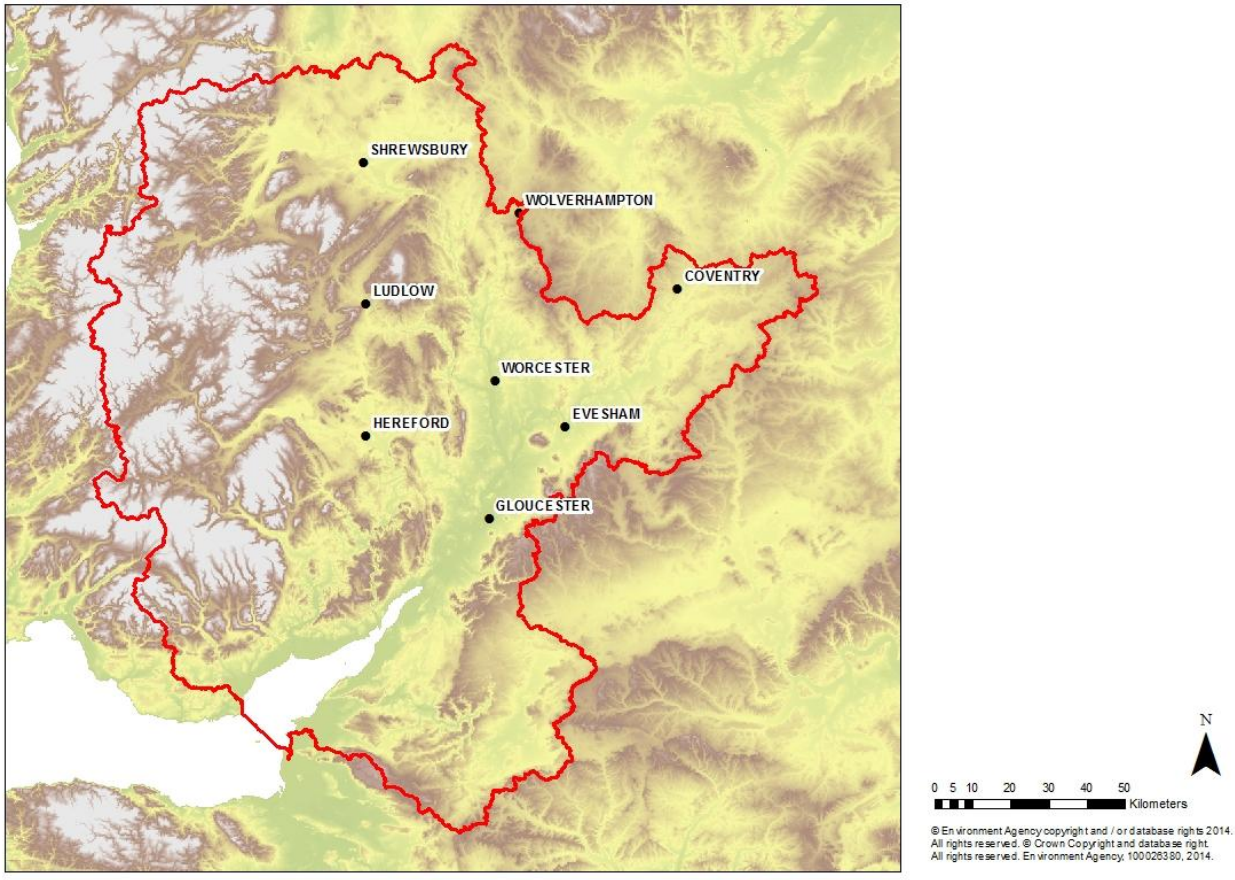


Figure 5.2: Topographic map of the Severn RBD

Biodiversity

The RBD includes many important habitat and wildlife areas of international, national and local importance.

The European Sites within the RBD encompass a wide diversity of habitat types including: freshwater rivers, lakes, canals and other wetlands, and estuarine, coastal and marine habitats. Other habitats include woodlands, grasslands and heathlands. Some European sites such as the Severn Estuary have more than one designation; Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar site. This reflects the importance of the estuarine and river system of the Severn which is one of the most diverse in the UK for fish species and a key migration route to and from spawning grounds in many tributaries for species, such as salmon, sea trout, sea and river lamprey, twaite and allis shad and eel. The estuary is also an important feeding and nursery ground for many fish species, particularly allis shad and twaite shad. The immense tidal range of the Severn Estuary results in extensive areas of intertidal habitats, comprising mudflats, sandflats, sandbanks, shingle and rocky platforms, together with adjacent areas of saltmarsh and lowland grazing marsh. These habitats and the food sources they support attract internationally important assemblages of overwintering and migratory birds, such as gadwall, dunlin, shelduck, redshank and greater white-fronted goose.

The area is ecologically rich and contains part of the West Midland Meres and Mosses, a series of lakes and peatland formed back in the Ice Age, which are internationally recognised as Ramsar sites for the importance of their unique natural habitat. Fourteen separate Ramsar sites exist within the Midland Meres and Mosses complex which include the 'Fenns, Whixall, Bettisfield, Wem and Cadney Mosses' complex near Wem – one of the largest blocks of lowland raised bog in England.

Some European sites are designated primarily due to the species they support, such as the populations of great crested newts at Granllyn in Wales and Fens Pools in Dudley, the fresh water pearl mussel of the River Clun and the aquatic plant species (floating water plantain) associated with the Montgomery Canal and Brown Moss. A number of sites within the RBD are designated for supporting important populations of bat species, including sites at Bath and Bradford-on-Avon, North Somerset and Mendip, Wye Valley and Forest of Dean, Usk, Mells Valley, and Tanat and Vyrnwy. Other sites are designated for supporting important invertebrate species. This includes the wet grassland sites of Aberbargoed and Blaen Cynan that support populations of marsh fritillary butterfly, and the rare invertebrate's species, such as the violet click beetle, associated with ancient tree habitats at Bredon Hill and Dixton Wood . A primary reason for the designation of the River Wye and Usk SACs is the range of fish species they support.

Many of the European sites within the RBD are designated in respect of their qualifying habitats, such as riverine habitats of the Wye and the lakes, ponds, mires and bogs of the West Midland Mosses. Other qualifying habitats subject to SAC designation include the woodlands of the Wye Valley and Avon Gorge, the Cardiff and Cotswolds beechwoods, the alluvial forests associated with Coed y Cerrig, and the oak woods of Sugar Loaf and Coedydd Llawr-y-Glyn. Other designated habitats represented in the RBD include the chalk grasslands of Salisbury Plain, the limestone grasslands of the Mendips, and the extensive Molinia meadows associated with Cwm Cadlan and Drostre Bank. Designated upland habitats and heathlands are also represented in the Brecon Beacons and Berwyn and South Clwyd Mountains together with the transitional dry heathland habitats of the Stiperstones and Hollies. Within the RBD sites designated for their wetland habitats range from the upland mires of Elenydd to the lowland raised bogs at Fenn's Whixall, Bettisfield, Wem and Cadney Mosses and Llangorse Lake, the largest lake in South Wales.

There are 450 SSSIs within the catchment, of which around 200 are designated for their water-interest, such as the River Teme throughout its entire length. Coniferous and deciduous woodland is scattered throughout the catchment, for example around Ironbridge Gorge, Breiddon Forest (Lake Vyrnwy) and the Wyre Forest, (much of which is ancient woodland). The River Teme, upper River Severn and River Vyrnwy provide particularly good aquatic habitat. Protected species such as otter, Atlantic salmon, marsh warbler, raft spider, club tailed dragonfly, caddisfly and white-clawed crayfish are known to exist in these areas. Around the Severn-Vyrnwy confluence and the Severn and Avon Vale there is a wide range of wetland habitats, for example wet woodland, reedbed and fen.

Other designated sites across the RBD include National Nature Reserves, such as the Wyre Forest and Sutton Park (Birmingham) in addition to local nature reserves and wildlife sites managed by local authorities, wildlife trusts and other organisations such as the Woodland Trust

and RSPB. Ancient woodland sites are distributed across the RBD. Ancient woodlands are complex ecological communities that have developed over centuries, and contain a high proportion of rare and threatened species, many of which are dependent on the particular conditions that this habitat affords.

The Environment Agency and Natural Resources Wales work closely with statutory and other agencies to ensure that opportunities are maximised to protect and enhance the designated sites, in accordance with the relevant river restoration, water level and nutrient management plans. The Environment Agency and Natural Resources Wales also work with partner organisations and landowners to deliver habitat creation and enhancement schemes on non-designated land that contribute towards meeting the England Biodiversity Strategy targets.

Historic Environment

The RBD has a wealth of designated and non-designated heritage assets, as associated with historic riverside towns such as Shrewsbury, Hereford, Worcester, Monmouth and Tewkesbury and the internationally recognised World Heritage Sites of Ironbridge Gorge, Blaenavon Industrial Landscape and the City of Bath. The heritage assets within the district make an important contribution to the character and distinctiveness of its landscapes and settlements as well as support the local tourism economy.

The catchment includes a wide variety of archaeological sites. These range from burial chambers of the prehistoric period to military installations dating from the Second World War. There are Roman towns, including Glevum (Gloucester) and Viriconium (Wroxeter) and Roman roads such as the Fosse Way and Watling Street. Numerous Anglo-Saxon earthworks and defensive works were built in the Montgomery Valley and other parts of the Welsh Marches region. Offa's Dyke is one key example.

Medieval towns were established for example at Shrewsbury and Worcester, where half-timbered buildings, city walls and medieval street patterns still exist. Important medieval features, with probable monastic origins also survive in a recognisable form. Expansion of coal mining and wider industrialisation of the area in the 18th century followed by the subsequent 20th century industrial decline has also left an impact on the historic character of many urban and rural areas within the district. The mining heritage of the district, for example, is also of recognised cultural and nature conservation interest, such as, Huglith Mine Site of Special Scientific Interest, (SSSI) and Snailbeach Lead Mine (Scheduled Monument) within the Seven Uplands catchment and the Blaenavon World Heritage Site in the South East Valleys.

Many heritage assets are also of historic landscape value such as features associated with the communications network, field patterns, hedgerows, ancient woodland, ancient trees and water management systems such as the network of water meadows along the River Lugg in Herefordshire. Indeed across the district there are many designated and non-designated heritage assets that are directly associated with the water environment, for example, dams, water mills and bridges. Lydney Harbour on the River Severn is a designated Scheduled Monument, whilst studies in Herefordshire are serving to increase the understanding of the significance of historic weirs and watermill landscapes to the water environment.

Extensive deposits of peat are of archaeological interest and include intertidal and submerged deposits in coastal areas as well as palaeo-environmental remains associated with former river channels and floodplains. Some examples of these are Goldcliff near Newport and in the coastal areas of Somerset and extending to Bristol and Gloucestershire. Important inland peat deposits include the Shropshire Meres and Mosses and upland areas in Wales. Across the district there is a particularly high number and wide range of landscapes of historic interest. Examples of these in Wales include the Gwent Levels, Merthyr Tydfil, The Rhondda, Lower and Middle Wye Valley, Elan Valley, Vale of Montgomery, Tanat Valley and Clywedog Valley.

Geology

The River Severn RDB exhibits a varied and interesting geological setting. The source is the mid Wales Cambrian mountains composed of the Cambrian, Ordovician and Silurian impermeable hard rock's of slate, shale and sandstone. The river flows rapidly down onto softer Permo-Triassic

mudstone and sandstone rocks of the Shropshire lowlands. The Severn then makes a deep cutting through the Carboniferous coal measures of the Ironbridge gorge, and on through the permeable Triassic sandstone hills. At Worcester the river flows out into the expansive Severn Vale and Estuary, composed primarily of poor draining Triassic and Jurassic mudstones, extensively overlain by fluvial terrace sand and gravel deposits.

The Teme catchment rises in the Welsh borderland and south Shropshire Hills, primarily situated in a sequence Silurian limestone and shale, or Devonian sandstone and mudstones, until its confluence with the Severn at Worcester.

The Warwickshire Avon catchment is dominated by Jurassic rocks, rising in the Northamptonshire and Cotswold limestone uplands, flowing out into the Vale of Evesham Lias mudstones, overlain by thick sequences of sand and gravel glacial drift deposits. The Cotswold limestone escarpment extends south to the Bristol Avon, there are also extensive Carboniferous limestone outcrops in the Bristol area.

The uplands of the South Wales catchments comprise Devonian Sandstone and shale sequences, with Carboniferous Limestone to the south of the Brecon Beacons. The steep topography resulting from these resistant rocks gives rise to rapid runoff.

Soil

The soils of the RBD are dominated by loam in the upper reaches and a more clay based soil as the Severn approaches the Severn Estuary. Around the Severn Estuary the soil becomes heavily clay dominated as a result of historic inundation. Soils in the mid to lower river basin are dominated by deep, well-drained and fertile Brown Soils, with scatterings of Surface Water Gleys and Groundwater Gleys. Brown soils occur in different forms from slowly permeable soils to less permeable loams and clayey soils. The subsurface layers are highly valued for agricultural purposes but the low permeability of the underlying geology means that during heavy rainfall the soil becomes quickly saturated. The reduced capacity of the soil will lead to increased surface run-off and an increase in the catchment response to rainfall. Increased surface runoff will also exacerbate rates of soil erosion with the potential to impact on soil fertility and yields. Across the RBD there are initiatives to provide help and support to farmers to enable them to manage their soils in a sustainable way.

6. Key flood risk issues in the Severn River Basin District

This section, including the maps and statistics illustrate the broad scale of flood risk across the RBD. You can see this information in more detail at the links below.

The plan should be used in conjunction with the Severn RBD River Basin Management Plan (RBMP). This has been produced to identify the state of, and pressures on, the water environment. It considers the technical and economic viability of beneficial actions, set objectives and coordinate/monitor delivery of agreed actions. In so doing it sets direction to maintain and improve the quality of all surface, ground water and coastal waters.

The FRMP should also be used to identify objectives and measures at all scales that complement the aims of the Water Framework Directive by providing environmental benefits as part of and in addition to any flood risk management benefits.

Find out more

- **Interactive flood maps for flooding from rivers, the sea, reservoirs and surface water**
- **Severn RBMP**
- **Current Ecological and Chemical Status of Water Bodies**
- **The Environment Agency maintenance programme for rivers and sea**

Flood risk issues within the river basin district

The Severn RBD covers approximately 21,500 km² with a total population of just over 5.66 million people. Approximately 100,000 people, just under 2% of the population, are at medium to high risk of flooding from rivers and the sea.

Other sources of flooding include from reservoirs where 260,000 people, 4.5% of the total population in the RBD, are at risk of flooding. Approximately 120,000 people, just over 2% of the total population within the RBD, are at medium to high risk of flooding from surface water sources. LLFAs are responsible for managing the risk of flooding from groundwater. Groundwater flooding is closely linked to geology and is less common in the Severn than in other locations, such as south east England where chalk is quite common. There is a risk of sewer flooding in some urban locations.

Tidal flood risk affects the whole Severn estuary. Wave action increases the flood and erosion risk south of the Severn Bridges. Near Gloucester, the greatest flood risk is caused by high fluvial flows.

There are over 100,000 properties currently at risk from the Severn Estuary in the 1% annual probability flood event. Also at risk of tidal flooding are 430 km^2 of agricultural land, sections of motorway, A-roads and other roads, mainline and local line railways and railway stations, strategic power lines to South East Wales and power stations and many sub-stations, telephone exchanges, schools and holiday caravans.

There are around 200 kilometres of existing flood defences along the Severn Estuary providing protection for many homes, businesses, agricultural land and infrastructure. All defences have a finite lifespan due to the wear and tear they suffer over time. The impacts of climate change and

sea level rise are likely to reduce the lifespan of defences, as well as the standard of protection they provide.

In some circumstances people could be at risk of flooding from a combination of sources and therefore may be included in more than one of the above categories.

Due to its size, RBD wide events are extremely rare, though large parts have been affected during individual incidents. More detail is given in the catchment summaries set out in Part B of the plan.

The most recent major events that have impacted on large areas of the RBD include those of 1947, 1968, 1998, 2000 and 2007. Other smaller more localised events, such as those experienced in 2014, though not resulting in significant numbers of property flooding, can be very disruptive to communities within the area affected. Historically, infrastructure and many of the transport links connecting communities have been built within floodplains. Road flooding causes access issues and travel disruption. Water can take many weeks to drain from the floodplain and this delays the recovery of the communities affected by flooding. Flooding events have been recorded throughout the RBD since the thirteenth century.

Table 6.1: Recent significant flood events in the Severn river basin district

Date	Source of Flooding	Impacts on Severn RBD
March 1947	Fluvial and Surface Water	Widespread damage and disruption across the Severn RBD, including Monmouth, Worcester, Bewdley, Gloucester and Shrewsbury. For many people the 1947 event is still the highest recorded event in living memory.
1960	Fluvial	Major floods in and around Gloucester and the River Wye. Hereford recorded its highest level.
December 1965	Fluvial	Major flooding on the River Frome following a rapid snow melt.
July 1968	Fluvial	Gauges on the River Avon recorded levels of 3.71m at Warwick and 4.15m at Evesham. According to reports of the flooding, Lydney town centre was under 4 feet of water during this period. This event prompted the introduction of flood warnings.
December 1979	Fluvial	Major flooding across the South Wales valleys. Thousands of properties affected including central Cardiff.
February 1990	Fluvial	Major floods in Gloucester and Worcester
Easter 1998	Fluvial	Two fatalities, approximately 1,050 properties and 1,400 caravans flooded in the RBD. Widespread flooding of highways and farmland particularly affected the Warwickshire Avon.
October 1998	Fluvial	This event was the largest of the preceding 30 years and impacted communities including Shrewsbury, Ironbridge, Bridgnorth, Bewdley, Worcester and Hereford.
Autumn 2000	Fluvial and Surface Water	Autumn 2000 was the wettest on record over England and Wales. Prolonged rainfall compounded run-off and high river levels. Communities affected by these floods included Tewkesbury, Upton-upon-Severn and Gloucester. This event was the largest on record for the Lower Severn catchment.
December 2000	Fluvial and Tidal	High tide combined with high river levels resulted in a flood peak in Gloucester of 4.61m and flooded 45 properties in the Gloucester and Tewkesbury areas. The lower Wye had repeated floods at Ross on Wye and Monmouth.
February 2002	Fluvial	Flooding during February 2002 affected a number of communities along the Severn including Shrewsbury,

Date	Source of Flooding	Impacts on Severn RBD
		Upton-upon-Severn and Kempsey.
February 2004	Fluvial	Lower magnitude incident than Autumn 2000 but caused flooding in areas of Bewdley and Shrewsbury.
Summer 2007	Fluvial and Surface Water	The period of May to July was the wettest since records began in 1766, with an average rainfall of 414.1mm across England and Wales. This was well over double the usual expected rainfall for that period. The resulting flooding was widespread, causing disruption and damage throughout the Severn catchment. In total over 14,000 properties were flooded from a combination of flooding from main river, ordinary watercourse and surface water. Major infrastructure such as road and rail networks were impacted. Mythe water treatment works in Tewkesbury flooded leaving 350,000 people in Gloucestershire without water for over a week. Hampton Bishop was evacuated.
February 2011	Fluvial	Significant flooding occurred along the River Vyrnwy resulting in the highest levels recorded since records began in many locations.
December 2012	Fluvial and Surface Water	Flooding at various locations across North Somerset affected over 50 properties.
December 2013	Fluvial	Localised flooding around Bath.
January/February 2014	Fluvial	Flooding across the Severn RDB including the length of the River Severn and Severn Estuary.

There is a wide variation in the characteristics of rivers and subsequently the nature of flooding throughout the district. Hence given the complex nature of flooding, there is a need to take a catchment-wide view of all changes within the basin district. Activities must seek to avoid passing risk on to others within the catchment without prior agreement.

Flood risk is influenced by a range of factors including climate change, changes in land use (particularly further urban development within the floodplain, but potentially also development elsewhere within the catchment), and changes in land management practices. A driver is the change in the factor affecting flood risk, not the factor itself as set out below:

- Urban development, both within the catchment and river corridor. An increase in urban areas can lead to increased surface water run-off and a more rapid rise in peak flows as the area of impermeable surface increases.

- As discussed in the Land Use section in Chapter 5, changes in land use management practices, supported by current agri-environmental initiatives, can lead to beneficial changes in surface water flows and field run off within the context of economically viable farm business.

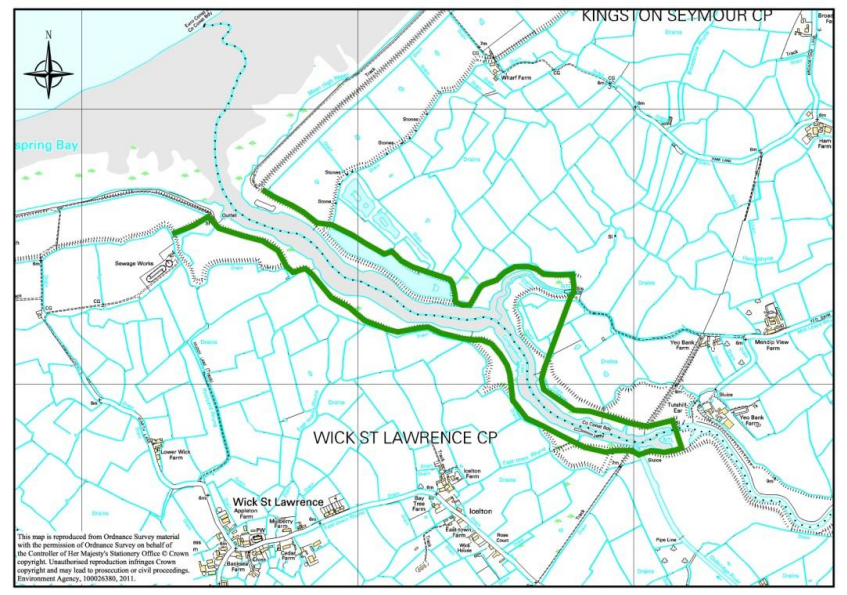
- Climate change. Milder wetter winters and increases in intensive rainfall events could increase flows in rivers on a more frequent basis and increase demands on the urban drainage networks. Sea level rise will increase tidal flood risk in the Severn Estuary.

Box 2. Case Study Box

Congresbury Yeo Tidal Banks (CYTB)

Background to the problem

Protection of a part of the low lying land against flooding alongside the Severn Estuary, south of Bristol in the Congresbury Yeo river estuary, is achieved by earth banks. As the Severn Estuary has the second highest tidal range in the world tidal flood risk is significant. The combination of settlement at the bank crest, rising sea level and the deteriorating condition of the existing tidal defences is leading to an increased likelihood of a breach (caused by overtopping) of the Congresbury Yeo tidal embankments. Breaching is possible for tidal events with a 2% annual chance. If left unchecked, these breaches will propagate, ultimately placing 39,741 properties at risk of flooding for extreme tidal events of 1% (1 in 100) AEP and above. Affected areas include properties in Worle and Weston-super-Mare. It would take less than 3 hours for flood water to reach Worle presenting a risk to life.



The solution to the problem

The scheme comprises the construction of 1328m of new set-back embankment and the raising of 2356m of existing bank. This will reduce flood risk to properties to 1.3% chance over the next 25 years and enable the creation of 7.57 ha of intertidal habitat.

This scheme provides a cost-effective opportunity to create new areas of intertidal habitat, addressing the overall decline in such habitat throughout the Severn Estuary. The project is to deliver new saltmarsh with landowner agreement. This provides environmental benefits which align with the Severn Estuary Flood Risk Management Strategy.

Land management and flooding

The Severn Uplands, Shropshire Middle Severn, Wye and Usk catchments all have large rural upland areas with moderate to high rainfall and relatively quick runoff rates. Appropriate changes to land management in these (and some other) areas include: afforestation, wet woodland, re-introducing river meanders, setting back some rural river defences and digging/creating ponds. These can reduce rates of surface water runoff. Where catchment areas are large it would take major change to achieve even a small reduction in flood flow. However, land management change can achieve a measurable flood risk benefit in upland areas, typically where catchment areas are less than 10km^2. Monitoring data is starting to provide the evidence of this, so further land use change for flood risk benefit can become more than just an aspiration. Such changes could make a difference to flash flooding too.

Box 3. Case Study Box

The Gloucestershire Frome Rural SuDS project

The Stroud Frome catchment encompasses 236Km^2, including the Frome, Slad, Nailsworth and Painswick valleys, draining the Cotswold escarpment into the Severn estuary in Gloucestershire. The Stroud Valleys have a long history of flooding and suffered extensive flooding during the summer of 2007. In 2009 the Environment Agency investigated a series of options for improving flood protection in Stroud and villages in the Stroud valleys. A flood storage scheme was not viable, but the local community enthusiastically supported the development of a pilot project to implement Rural Sustainable Drainage Systems (RSuDs)* in the Frome catchment.

Flood risk

- Stroud is the main centre of population in the catchment with many smaller villages and isolated houses scattered throughout the catchment.
- Flash flooding – the Slad valley has been designated as a rapid response catchment at risk of potentially destructive flash flooding.
- Land use change, from livestock to arable, on the upper escarpment has increased the rate of surface run-off, increasing erosion and flood risk in the valleys.
- The very steep valleys and extensive spring lines result in rapid surface run-off and river flows and provide limited floodplain storage potential.

Diffuse sediment pollution:

- Land use change on the upper escarpment and cattle poaching in the valleys has increased sediment in watercourses reducing water quality and increasing pollution.
- Phosphate levels in river water exceed WFD standards and rising levels of artificial chemicals (e.g. pesticides and industrial chemicals) in groundwater systems.

In 2014, the Environment Agency in partnership with Stroud District Council (SDC) established the Frome Rural SuDS project. SDC appointed a fulltime Project Officer funded through Local Levy from the English Severn and Wye RFCC, to promote the project aims and implement a series of demonstration projects. The aims of the project are:

"*To create a river catchment where water management is fully integrated into land management practices. Where public bodies, private companies and local communities work together to manage water within the landscape, creating valuable habitat for wildlife and people, and limiting flood risk downstream."*

The Gloucestershire Frome Rural SuDS project (continued)

In 2014/15, working with local community flood action groups and key landowners including the National Trust and Gloucestershire Wildlife Trust the project officer has implemented a range of projects including:

- Dillay / Slad Brook:
  20 in stream large woody debris structures to slow flows
  Stock fencing and spring fed cattle drinks to reduce erosion and sediment in stream.
- Sheepscombe Brook:
  16 in stream large woody debris structures to slow flows.
  4 track culverts and soakaways to reduce sediment and surface flows.
- Toadsmoor Valley:
  18 in stream large woody debris structures to slow flows.

Project funding during 2014/15 was £60k, comprising Stroud DC £5k, Gloucestershire CC £30k, Environment Agency £20k and National Trust//Glos Wildlife Trust £5k (In Kind).

*RSuDS is one of the titles under which projects of this type have been developed in recent years. The national R&D project has adopted the title Working with Natural Processes (WWNP) and Natural Flood Management (NFM) is also widely used

Dillay Brook: Large Woody Debris

Dillay Brook: LWD attenuating flows.

As part of flood and coastal risk management work and in partnership with other RMAs the Environment Agency and Natural Resources Wales monitor and adapt to future changes in the RBD by undertaking the following activities:

- strategic planning
- flood risk management investigations
- hydraulic and hydrological modelling
- flood forecasting and warning
- incident management planning
- engaging with local communities
- flood improvement works
- development planning and control
- maintenance work
- enforcement

Flood risk from rivers and the sea

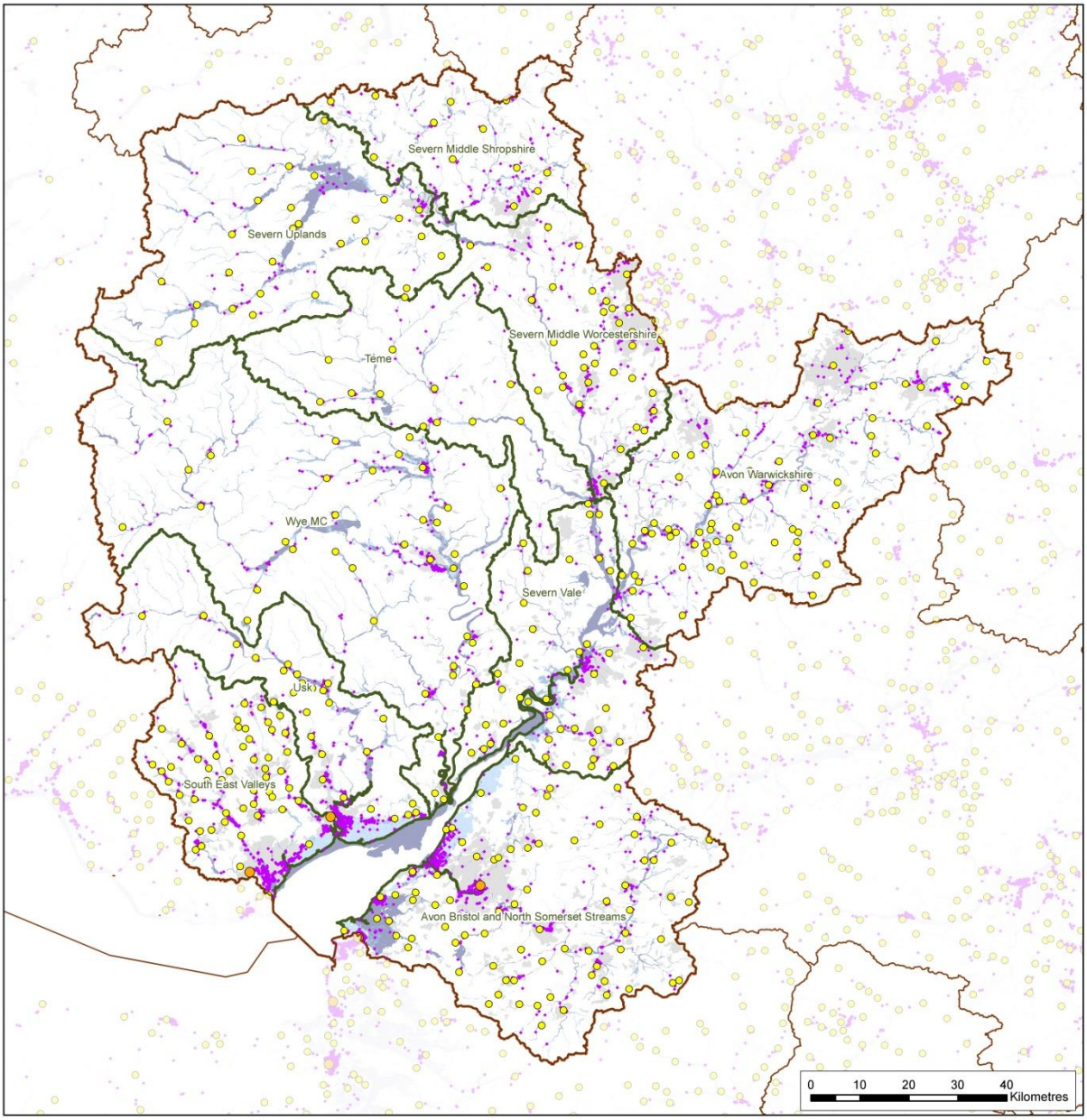
Table 6.2: Summary of flood risk to people, economic activity and the natural and historic environment across the Severn RBD.

River & Sea	Total in RBD	High risk	Medium risk	Low risk	Very low risk
Risk to people:					
Number of people in area:	5,664,400	32,600	62,100	240,650	33,050
Number of services:	12,760	450	290	540	150
Risk to economic activity:					
Number of non-residential properties:	765,450	13,550	13,750	34,550	6,300
Number of airports:	3	0	0	0	0
Length of roads (km):	4,090	90	90	180	40
Length of railway (km):	1,480	50	50	110	20
Agricultural land (ha):	1,157,450	47,400	17,000	26,800	9,250
Risk to the natural and historic environment:					
Number of EU designated bathing waters within 50m:	1	1	0	0	0
Number of EPR installations within 50m:	467	29	20	41	6
Area of SAC within area (ha):	82,050	15,500	400	150	200
Area of SPA within area (ha):	50,950	11,250	400	50	150
Area of RAMSAR site within area (ha):	19,450	10,800	250	50	200
Area of World Heritage Site within area (ha):	6,700	150	50	100	50
Area of SSSI within area (ha):	112,950	16,950	1,650	5,850	400
Area of parks and gardens within area (ha):	29,150	950	450	450	200
Area of Scheduled Ancient Monument within area (ha):	6,900	200	100	150	50
Number of listed buildings within area:	62,400	1,800	1,080	2,740	710
Number of Licensed water abstractions within the area:	4,360	1,530	180	120	60

Note:
SAC - Special Area of Conservation
SPA - Special Protection Area
SSSI - Site of Special Scientific Interest
Ramsar - wetland site of international importance
EPR installations - those registered under the Environmental Permitting Regulations

The following maps illustrate the broad scale of flood risk across the RBD from all sources. You can view them in more detail in the links set out at the end of this section.

Figure 6.1: Map of flooding from rivers and sea - risk to people



Rivers and Sea Flood Risk Map

Severn River Basin District

Risk to People

Flood Risk Source

Rivers and Sea
- High
- Medium
- Low
- Very Low

People at Risk
- 0 - 1000
- 1001 - 5000
- 5001 +

Reporting Boundaries
- River Basin District
- River Basin Districts (Neighbouring)
- Management Catchment

- Services at Risk
- Built-up Areas

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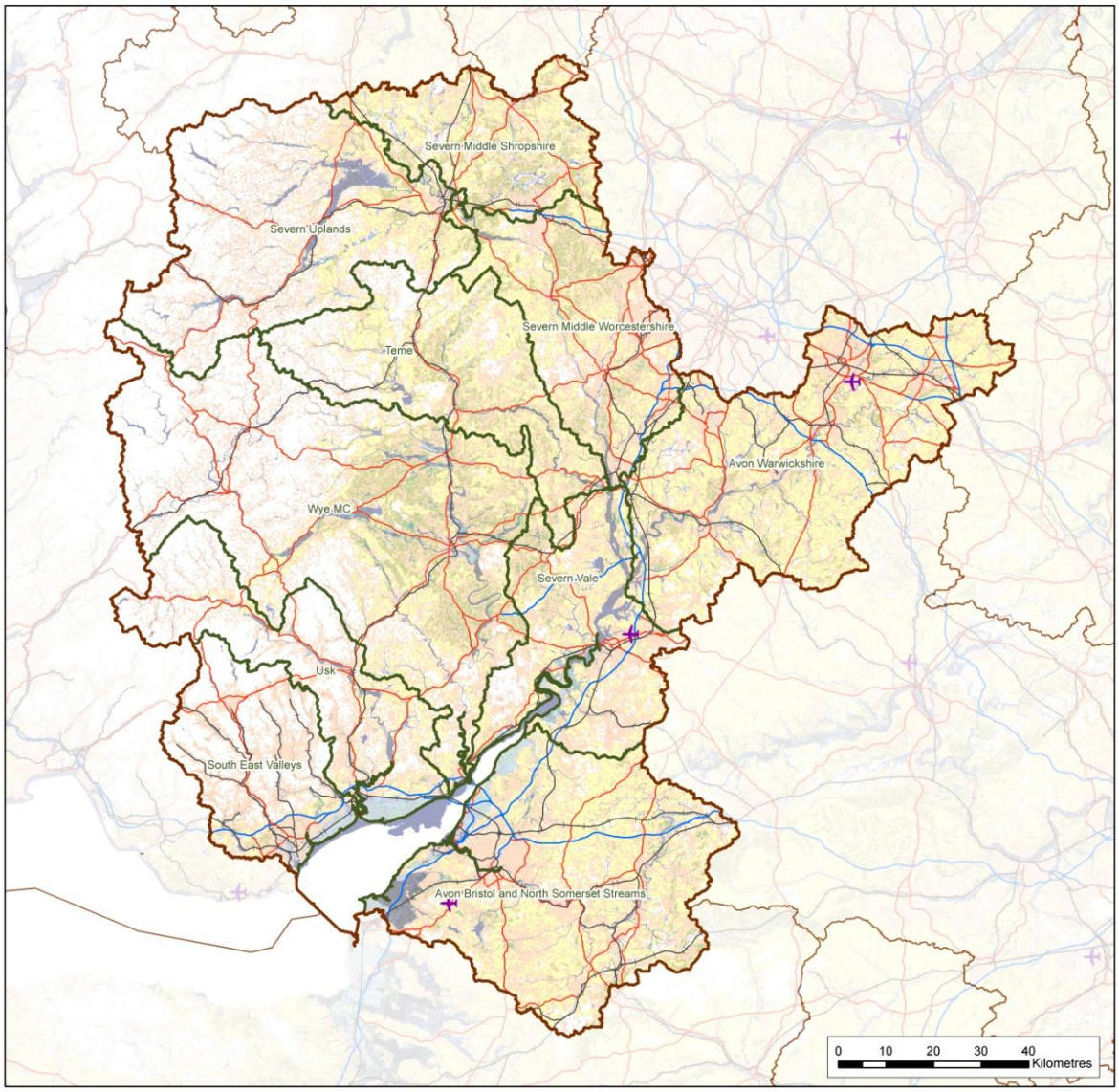
Figure 6.2: Map of flooding from rivers and sea – risk to economic activity



Rivers and Sea Flood Risk Map

Severn River Basin District

Risk to Economic Activity

Flood Risk Source

Rivers and Sea
- High
- Medium
- Low
- Very Low

Economic Activity
- Airports
- Main Line Railways
- Motorway
- Other Primary / Trunk Roads
- Non-residential Properties

Reporting Boundaries
- River Basin District
- River Basin Districts (Neighbouring)
- Management Catchment

Agricultural Land Classification
- Grade 1
- Grade 2
- Grade 3

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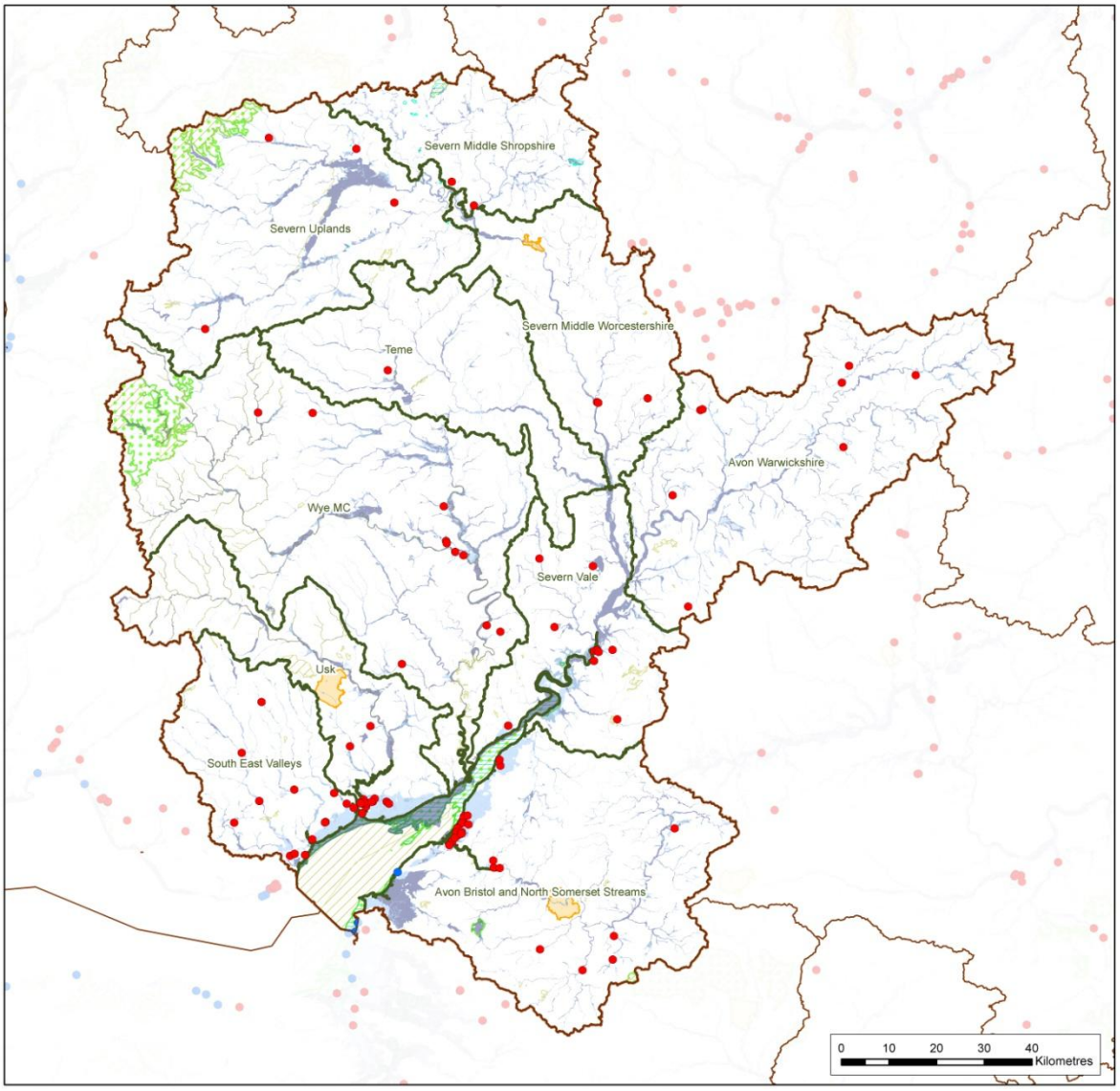
Figure 6.3: Map of flooding from rivers and sea – risk to natural and historic environment



Rivers and Sea Flood Risk Map

Severn River Basin District

Risk to the Natural and Historic Environment

Flood Risk Source

Rivers and Sea

- High
- Medium
- Low
- Very Low

Reporting Boundaries

- River Basin District
- River Basin Districts (Neighbouring)
- Management Catchment

Internationally Designated Sites

- Bathing waters that may be adversely affected by surface water run-off
- EPR (Environmental Permitting Regulations) Installations within 50m of Risk
- Special Areas of Conservation
- Special Protection Areas
- RAMSAR Sites
- World Heritage Sites

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Environment Agency

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Contact Us: Natural Resources Wales - Customer Care Centre, Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP. Telephone: 0300 065 3000 (Mon-Fri, 8am - 6pm). Email address: enquiries@naturalresourceswales.gov.uk

Reservoir flood risk

The Environment Agency and Natural Resources Wales regulate large raised reservoirs (with a capacity of 25,000 cubic metres and above) with regard to flood risk and provide guidance to reservoir 'undertakers' to help them manage their assets. Enforcement action may then be taken to seek improvements in some circumstances. The 'flood risk map for reservoirs' for the Severn RBD, which can be found on the gov.uk website, shows what is at risk, including people, economic activity and the environment.

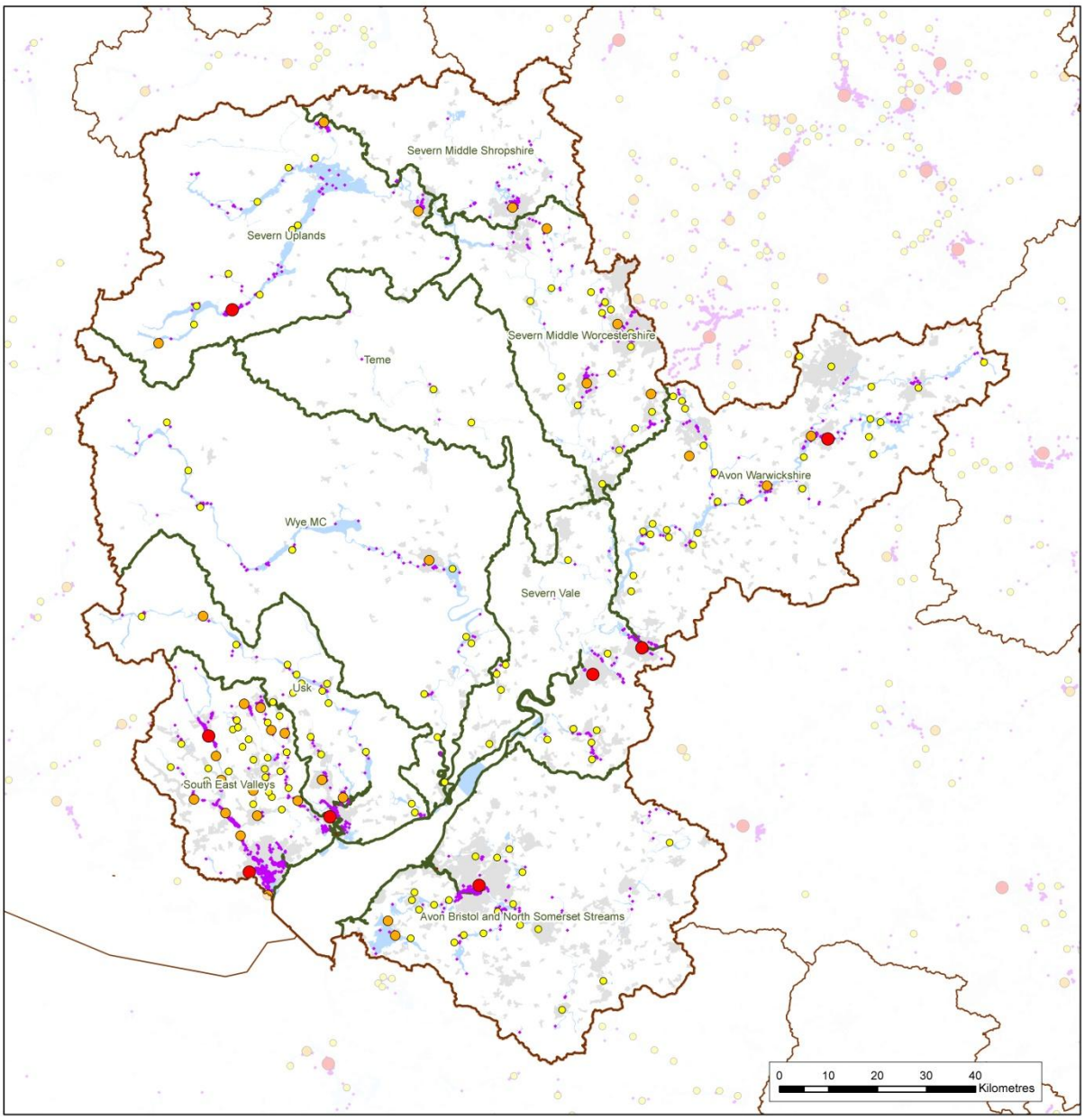
The statistics and maps below illustrate the extent of reservoir flood risk across the Severn RBD.

Table. 6.3. Summary flood risk from reservoirs to people, economic activity and the natural and historic environment across the Severn RBD.

Reservoirs	Total in RBD	Maximum extent of flooding
Risk to people:		
Number of people in area:	5,664,400	261,750
Number of services:	12,760	730
Risk to economic activity:		
Number of non-residential properties:	7,654,60	36,620
Number of airports:	3	0
Length of roads (km):	4,090	200
Length of railway (km):	1,480	100
Agricultural land (ha):	1,157,450	34,000
Risk to the natural and historic environment:		
Number of EU designated bathing waters within 50m:	2	0
Number of EPR installations within 50m:	467	23
Area of SAC within area (ha):	82,050	6,050
Area of SPA within area (ha):	50,950	3,950
Area of RAMSAR site within area (ha):	19,450	3,350
Area of World Heritage Site within area (ha):	6,700	100
Area of SSSI within area (ha):	112,950	8,100
Area of parks and gardens within area (ha):	29,150	1,400
Area of Scheduled Ancient Monument within area (ha):	6,900	300
Number of listed buildings within area:	62,400	3,360
Number of Licensed water abstractions within the area:	4,360	900

Note:
SAC - Special Area of Conservation
SPA - Special Protection Area
SSSI - Site of Special Scientific Interest
Ramsar - wetland site of international importance
EPR installations - those registered under the Environmental Permitting Regulations

Figure 6.4: Map of flooding from reservoirs – risk to people



Reservoirs Flood Risk Map

Severn River Basin District

Risk to People

Flood Risk Source

Reservoirs

Maximum extent of flooding

Reporting Boundaries

River Basin District

River Basin Districts (Neighbouring)

Management Catchment

People at Risk

0 - 1000

1001 - 5000

5001 +

Services at Risk

Built-up Areas

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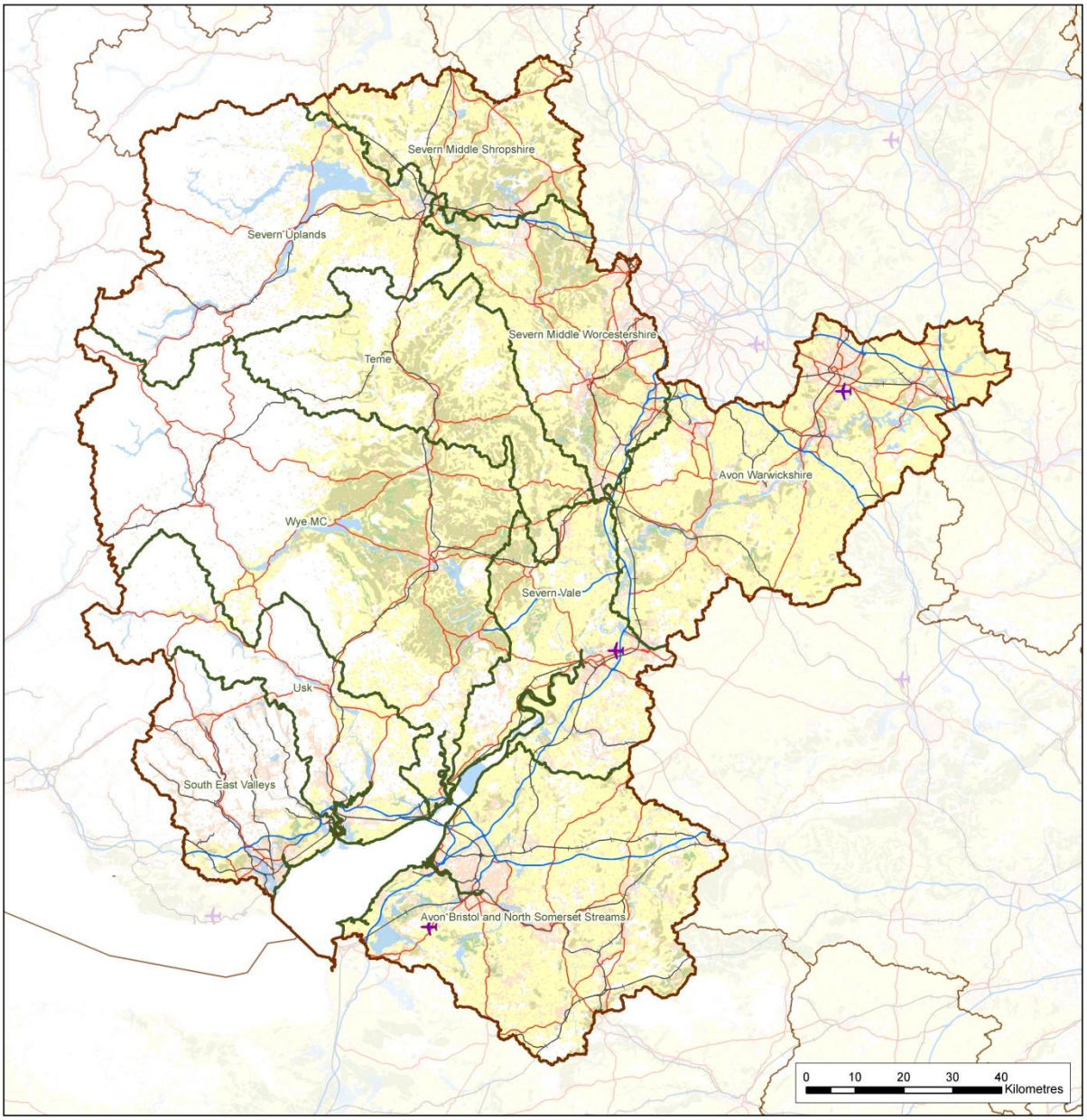
6.5: Map of flooding from reservoirs – risk to economic activity



Reservoirs Flood Risk Map

Severn River Basin District

Risk to Economic Activity

Flood Risk Source

Reservoirs

Maximum extent of flooding

Economic Activity

Airports

Main Line Railways

Motorway

Other Primary / Trunk Roads

Non-residential Properties

Reporting Boundaries

River Basin District

River Basin Districts (Neighbouring)

Management Catchment

Agricultural Land Classification

Grade 1

Grade 2

Grade 3

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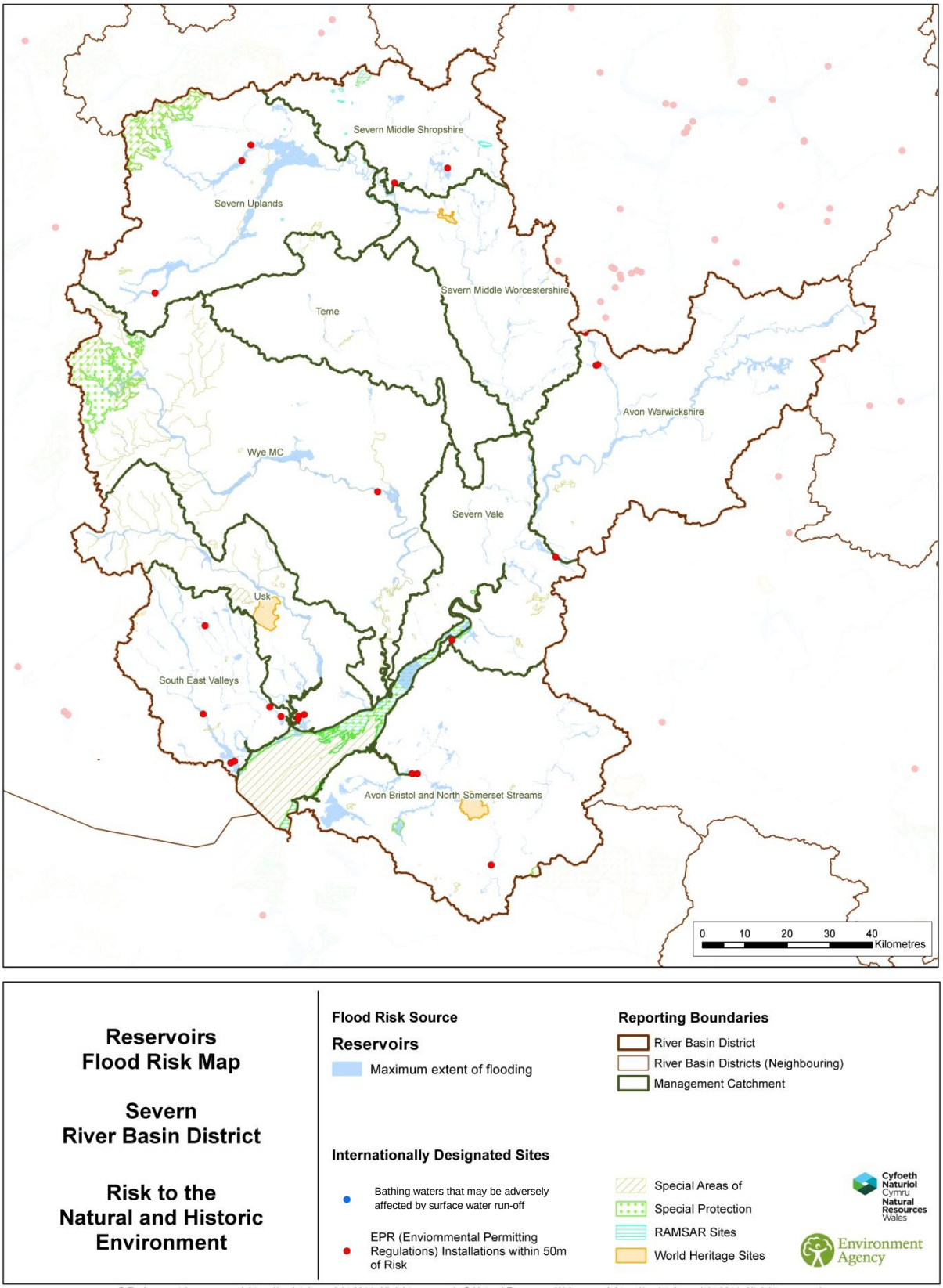
Figure 6.6: Map of flooding from reservoirs - risk to the natural and historic environment



Surface water flood risk

Lead Local Flood Authorities are responsible for managing the risk of flooding from surface water, defined as rainwater on the ground surface that hasn't entered a watercourse, drain or sewer. This type of flooding can begin to occur within minutes of intense rain, so it is almost impossible to forecast. Problems can quickly occur in several places, and although these might be over a small area, a local council's resources can quickly become stretched. It is good practice to plan for drains and watercourses becoming overwhelmed in a flood, such as by analysing the flow paths that floodwater may take. Once these are known, steps can be taken to ensure they are kept free from obstructions such as buildings and to consider whether roads and open space can be used to safely channel water away. Surface water flooding is a problem across the Severn catchment, whether due to run-off from fields and down roads in rural and semi-rural areas, or from roofs and paved surfaces in built-up areas, sometimes due to insufficient capacity of drains and sewers. The most notable surface water flooding in recent times includes Gloucestershire and Worcestershire in 2007, Caerphilly in 2009 and Rhiwbina in Cardiff 2009.

In England, from 15 April 2015, Lead Local Flood Authorities became a statutory consultee on planning applications in relation to surface water drainage arrangements for major development.

In Wales, the Flood and Water Management Act 2010 (Schedule 3), which has not been commenced, requires new developments to include SuDS features that comply with national standards. The Welsh Government proposes to publish interim national standards on an advisory basis until such time as it determines the most effective way of embedding SuDS principles in new developments in the longer term. These interim non statutory national standards and guidance are for the design, construction, operation and maintenance of SuDS serving new developments of more than one house in Wales. While these standards apply for new developments, the SuDS approach is increasingly being applied to existing developments to address sewerage capacity and local flood risk problems. The interim standards will therefore provide a useful framework for the delivery of such retrofit schemes.

To date in both England and Wales, most measures to limit run-off have been below ground, such as underground storage tanks or over-sized sewers. SuDS are usually above ground. They limit site run-off and can filter out some silt and contaminants. Common types of SuDS are ponds which fluctuate in level with rainfall, swales (wide grass ditches), soakaways and permeable pavements (block paving, sometimes with gravel beneath). The approach to be adopted requires infiltration to be considered first, then attenuation and discharge to a watercourse as the next option and only if these are impractical should attenuation with discharge to a sewer be considered. Retro-fitting of SuDS to existing buildings and land is also a way of reducing peak flows in drains/sewers and watercourses and so helping to reduce flooding and pollution.

The River Severn FRMP has 7 defined Flood Risk Areas. Only Bristol Flood Risk Area is consolidated into this FRMP. The LLFAs within Wales have opted to produce their first cycle FRMPs independently but in co-ordination with this FRMP. The maps and statistics on the following page therefore only cover surface water flood risk for Bristol.

Table. 6.4. Summary flood risk from surface water to people, economic activity and the natural and historic environment across the Bristol Flood Risk Area (BFRA)*

Surface Water	Total in BFRA	High risk	Medium risk	Low risk
Risk to people:				
Number of people in area:	570,600	38,400	14,900	15,200
Number of services:	611	35	11	13
Risk to economic activity:				
Number of non-residential properties:	32,400	2,600	2,200	300
Number of airports:	0	0	0	0
Length of roads (km):	110	<10	<10	10
Length of railway (km):	50	<10	<10	<10
Agricultural land (ha):	3,550	100	50	250
Risk to the natural and historic environment:				
Number of EU designated bathing waters within 50m:	0	0	0	0
Number of EPR installations within 50m:	7	3	0	1
Area of SAC within area (ha):	100	0	<50	<50
Area of SPA within area (ha):	0	0	0	0
Area of RAMSAR site within area (ha):	0	0	0	0
Area of World Heritage Site within area (ha):	2,900	0	0	0
Area of SSSI within area (ha):	250	<50	<50	<50
Area of parks and gardens within area (ha):	500	<50	<50	<50
Area of Scheduled Ancient Monument within area (ha):	<50	0	0	0
Number of listed buildings within area:	2,300	40	10	10
Number of Licensed water abstractions within the area:	20	<10	0	0

Note:
SAC - Special Area of Conservation
SPA - Special Protection Area
SSSI - Site of Special Scientific Interest
Ramsar - wetland site of international importance
EPR installations - those registered under the Environmental Permitting Regulations

*For the Bristol Flood Risk Area (BFRA), the property counting method uses Bristol City Council (BCC) parameter settings for the portion of the area within the BCC boundary (4m buffer, 0.25 proportion wetted perimeter) and national settings for the portion of the BFRA outside the BCC boundary (2m buffer, 0.5 proportion wetted perimeter). The different parameter settings ensure that the property counting method accords with the different flood modelling methodology used in each portion of the area.

Figure 6.7: Map of flooding from local sources – risk to people

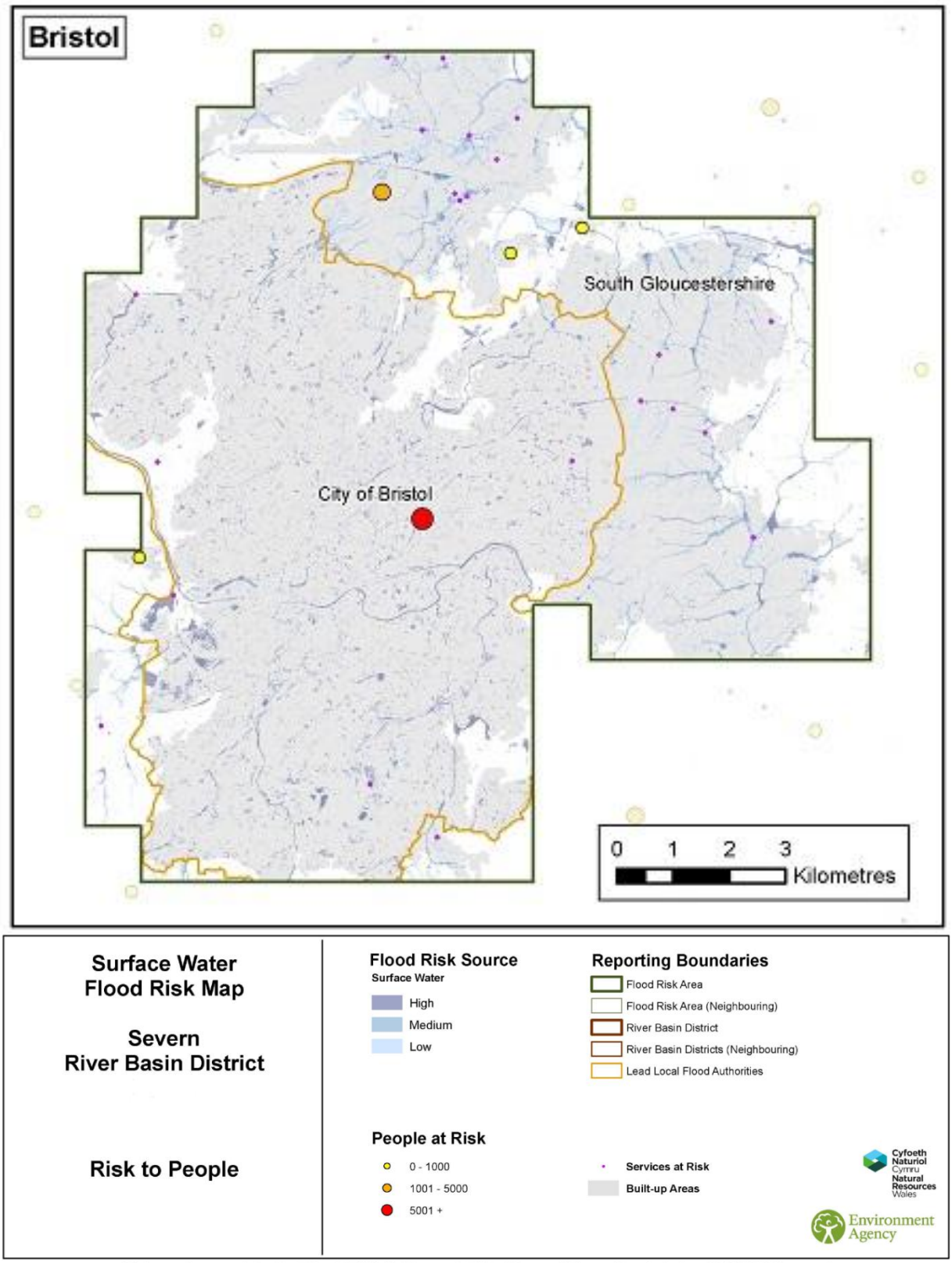
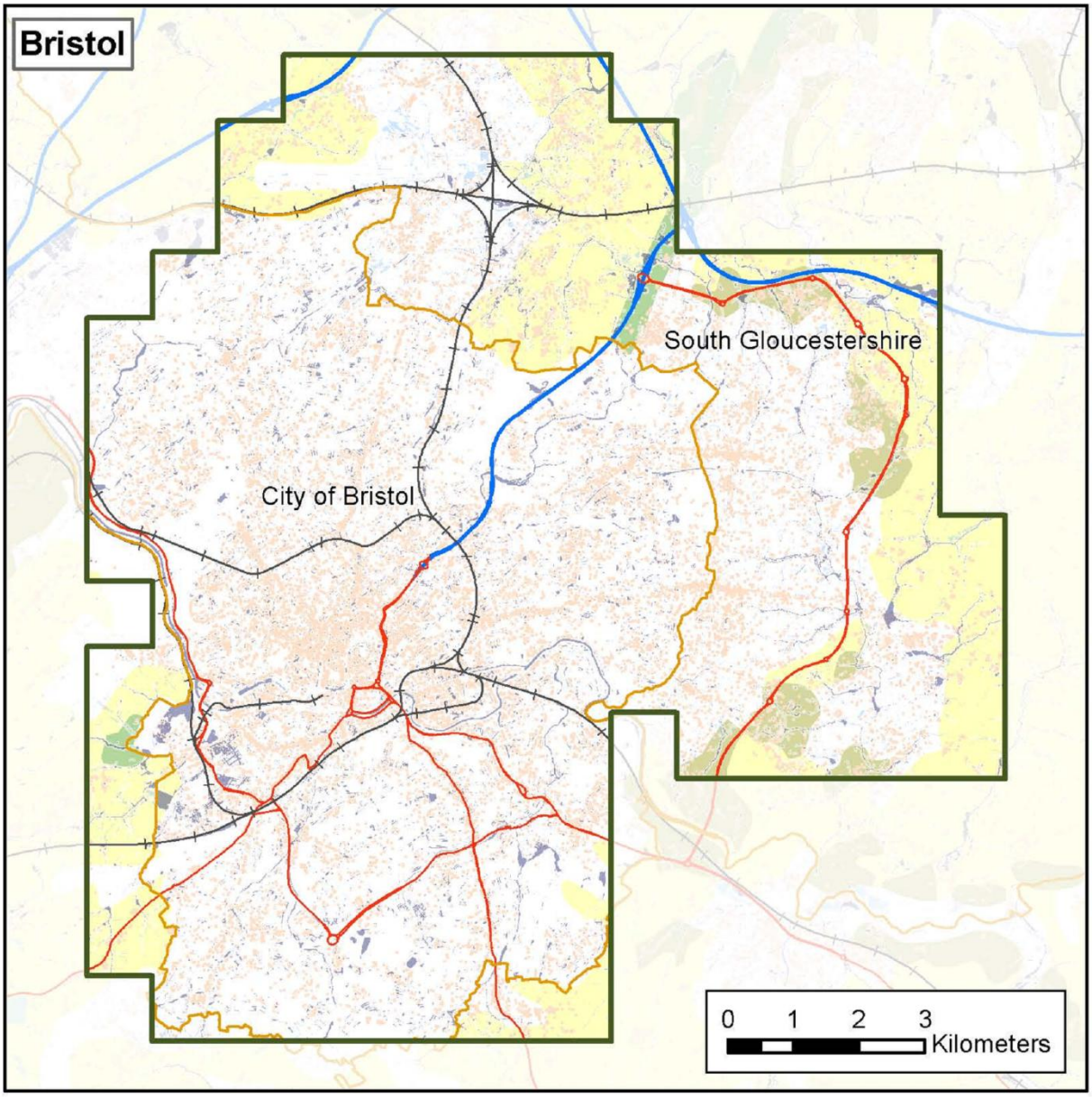


Figure 6.8: Map of flooding from local sources – risk to economic activity



Surface Water Flood Risk Map

Severn River Basin District

Risk to Economic Activity

Flood Risk Source

Surface Water

- High
- Medium
- Low

Economic Activity

- Airports
- Main Line Railways
- Motorway
- Other Primary / Trunk Roads
- Non-residential Properties

Reporting Boundaries

- Flood Risk Area
- Flood Risk Area (Neighbouring)
- River Basin District
- River Basin Districts (Neighbouring)
- Lead Local Flood Authorities

Agricultural Land Classification

- Grade 1
- Grade 2
- Grade 3

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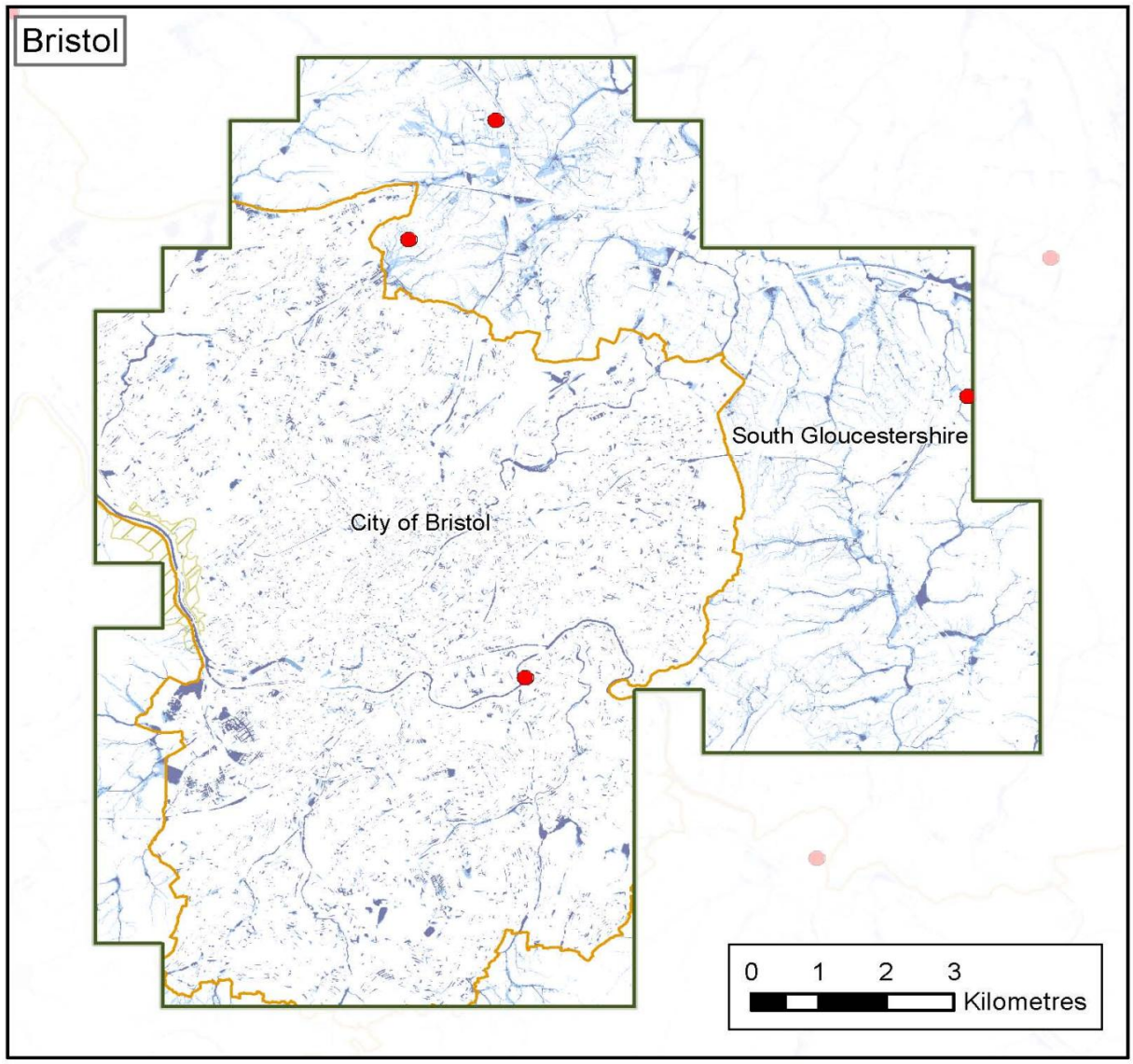
Figure 6.9: Map of flooding from local sources – risk to the natural and historic environment



Surface Water Flood Risk Map

Severn River Basin District

Risk to the Natural and Historic Environment

Flood Risk Source

Surface Water

- High
- Medium
- Low

Reporting Boundaries

- Flood Risk Area
- Flood Risk Area (Neighbouring)
- River Basin District
- River Basin Districts (Neighbouring)
- Lead Local Flood Authorities

Internationally Designated Sites

- Bathing waters that may be adversely affected by surface water run-off
- EPR (Environmental Permitting Regulations) Installations wihtin 50m of Risk
- Special Areas of Conservation
- Special Protection Areas
- RAMSAR Sites
- World Heritage Sites

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Contact Us: Natural Resources Wales - Customer Care Centre, Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP. Telephone: 0300 065 3000 (Mon-Fri, 8am - 6pm). Email address: enquiries@naturalresourceswales.gov.uk

Sewer flood risk

6 water and sewerage companies supply water across the Severn River Basin District and are responsible for sewers which take away wastewater and any surface water which drains into these sewers. Better outcomes can be gained by considering flood risk from sewers and other sources and then managing actions in an integrated manner with other organisations. However, this is not a mandatory requirement of Flood Risk Management Plans.

The FRMP promotes partnership working across all RMA's, including water companies, to encourage the identification of opportunities to deliver measures in support of flood protection, prevention and resilience, including land and catchment management initiatives. RMA's, including water companies are also encouraged to work together to deliver joined up advice and information about flooding (including sewer flooding) to support community engagement and awareness measures.

Groundwater flood risk

LLFAs are responsible for managing the risk of flooding from Groundwater. Groundwater is naturally stored in the ground below the water table level. When the water table rises and reaches ground level, water starts to emerge on the surface and flooding can happen. This may be because the ground slopes, or because of a break in the rock layers. Once on the surface this groundwater may flow or pond. It can also be caused by water moving through the superficial sediments near to rivers, where the sediments allow the movements of water more readily than less permeable sub-surface rocks.

The severity of groundwater flooding in the Severn catchment is largely unknown. However, in areas such as Birmingham, where industry has reduced and the volumes of water being abstracted from groundwater sources has fallen, the likelihood of groundwater flooding is increased as the groundwater sits at higher levels.

A study conducted by British Geological Society (BGS) showed a large quantity of superficial sediments near to the main channels of the River Severn and its tributaries and in its upland areas which may suggest that groundwater flooding could occur in these regions.

Coastal Erosion & Shoreline Management Plans

The Environment Agency has the coastal Strategic Overview in England and Natural Resources Wales has the coastal Strategic Oversight in Wales. These functions seek to join up coastal management activities to ensure flooding and erosion risk is managed effectively. Authorities are encouraged to work together in partnership to achieve effective management of coastal flooding and erosion risks.

Local authorities have operational powers relating to managing coastal erosion under the Coast Protection Act 1949 and the Flood and Water Management Act 2010. Local Authorities lead on coastal erosion risk management activities in collaboration with the Environment Agency in England and Natural Resources Wales in Wales.

Shoreline Management Plans (SMPs) are non-statutory, high level planning documents. They are large scale assessments of the risk associated with coastal processes, and a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. They set the strategic policy direction for how the coast should be managed over the next 100 years. SMPs identify the most sustainable approaches to managing coastal erosion and flooding risks in the short, medium and long term. During the development of SMPs a range of partners and the public were extensively consulted and involved in the decision making processes.

This Flood Risk Management Plan also draws some coastal erosion information for England only from the relevant SMPs. However, the full Shoreline Management Plan has not been included in this FRMP. The SMP measures included in this FRMP for England and Wales are those that are

most relevant for sea flooding and flood risk issues. You can access further information and the full SMPs for England and Wales here: https://www.gov.uk/government/publications/shoreline-management-plans-smps/shoreline-management-plans-smps.

In England, SMP content can be updated or changed using an established auditable process. These changes will be reflected in the FRMPs as they are updated on a six-yearly cycle. These changes may be prompted by changes in the evidence base guiding management decisions in SMPs, including evidence emerging from experience of the ongoing implementation of RBMPs. In this way, the Programme of Measures in RBMPs, the action plan and information in the FRMP, and the 'living' SMP documents should successfully inform and read-across to each other.

The Marine Management Organisation in England

The Marine and Coastal Access Act 2009 established the Marine Management Organisation (MMO) to produce marine plans, administer marine licensing and manage marine fisheries in English waters. It introduced marine planning in the UK through production of a marine policy statement and more detailed marine plans setting spatial policy at a more local level. Eleven marine plans covering English waters are anticipated by 2021.

Marine plans will inform and guide marine users and regulators across England, managing the sustainable development of marine industries such as wind farms and fishing, alongside the need to conserve and protect marine species and habitats. At its landward extent, a marine plan will apply up to mean high water, including estuaries and the tidal extent of rivers. All public bodies making authorisation or enforcement decisions capable of affecting the marine area must do so in accordance with the Marine Policy Statement (MPS) or marine plans (where they are in place) or state reasons for not doing so. Marine licensing, administered by the MMO is the main environmental and development control system below high water.

Further information can be found on the MMO web pages on GOV.UK
https://www.gov.uk/government/collections/marine-planning-in-england

Find out more:

- **Interactive flood maps for flooding from rivers, the sea, reservoirs and surface water**
- **Severn RBMP**
- **Current Ecological and Chemical Status of Water Bodies**

7. Sub-areas in the Severn RBD

Introduction

There are a number of sub-areas within the Severn River Basin District (RBD), as shown in Figure 7.1 and outlined below. These are:

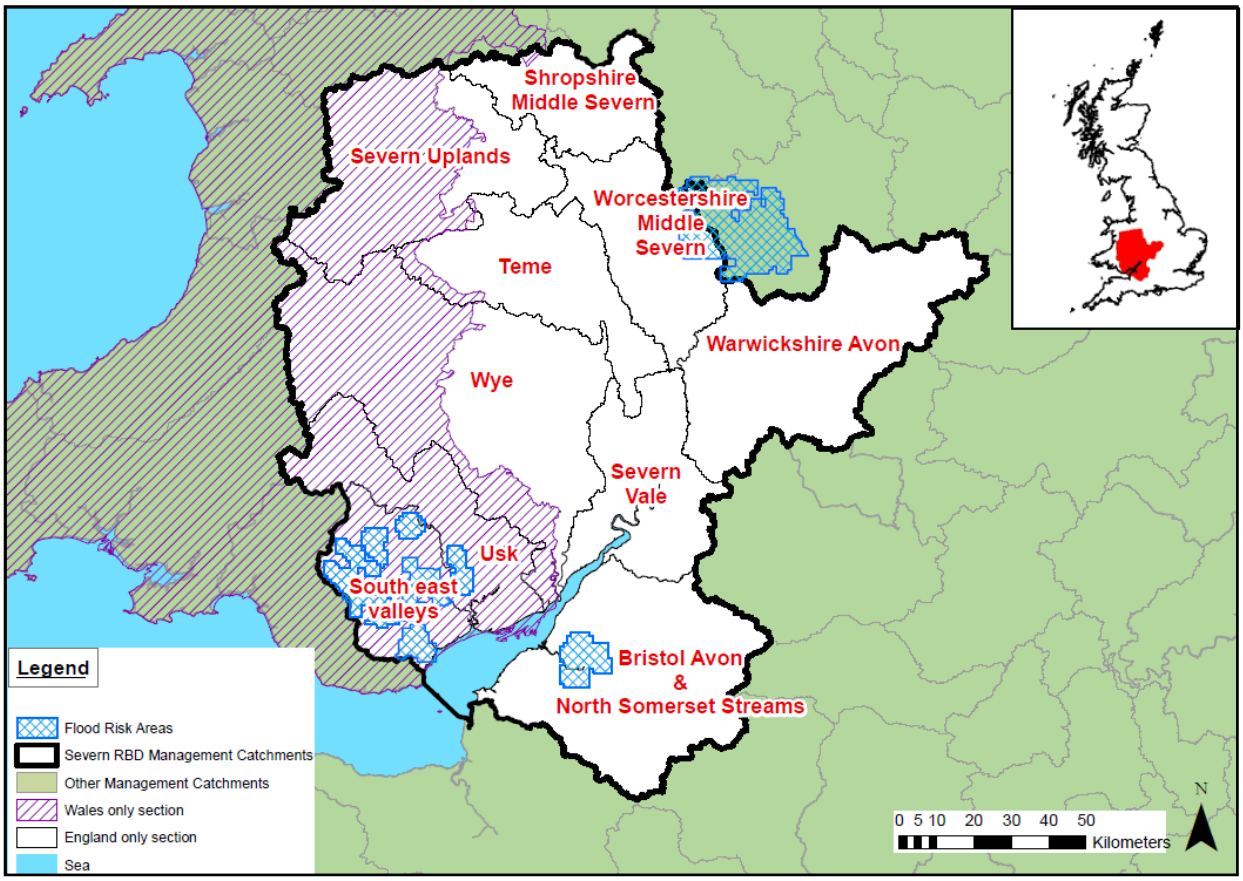
- English part of RBD
- Welsh part of RBD
- Catchments (which are set out according to WFD Management Catchments)

The measures that relate to Wales only are found in the Welsh Strategic Area. Due to the differences in the ways of working between Natural Resources Wales and the Environment Agency the measures tables for all Welsh catchments are reported at a community level, in Part B. NRW has a prioritised list of communities which requires the reader to understand the context of the community within its catchment. For this reason the Welsh measures appear in the relevant catchment detail and not in the Part C: Appendices. The Welsh measures are continually updated and the measures in this plan are indicative although correct at the time of publication. There are no Welsh related measures in the appendices, however the RBD-wide measures that affect Welsh Catchments are found in the appendices.

The measures that relate to the River Basin District, the English Strategic Area and English catchments are contained in the appendices.

Flood Risk Areas were identified in the Preliminary Flood Risk Assessment as areas that require flood risk management plans for local sources of flooding.

Figure 7.1: Severn RBD showing Catchments, Flood Risk Areas and Wales and England only sections



English / Welsh part of RBD: Where possible, this plan has been co-ordinated at RBD scale covering the whole of the Severn RBD. As the Severn RBD covers parts of both England and Wales, there may be elements of flood risk management work that are not applicable to the whole RBD and may just cover the Welsh section or the English section due to different administrations. This plan includes two large strategic areas:

- English Severn
- Welsh Severn

This will enable risk conclusions, objectives and measures to be developed for the English Severn as a strategic area and the Welsh Severn as a strategic area. The Teme, Severn Uplands and Wye catchments have areas in both strategic areas.

Catchments: These are areas where the Environment Agency and Natural Resources Wales focus engagement to enable a catchment based approach to water management. They are set out according to WFD management catchments. There are 10 catchments in the Severn RBD, as listed below:

- Severn Uplands (cross border)
- Shropshire Middle Severn (English strategic area)
- Worcestershire Middle Severn (English strategic area)
- Teme (cross border)
- Warwickshire Avon (English strategic area)
- Severn Vale (English strategic area)
- Wye (cross border)
- Usk (Welsh strategic area)
- South East Valleys (Welsh strategic area)
- Bristol Avon & North Somerset Streams (English strategic area)

The cross border catchments are split into Wales and England to reflect the difference in approach to measures. The English measures are listed in Annex 1 whereas the Welsh measures are incorporated in the catchment detail in Part B.

Flood Risk Areas: These are areas identified through Preliminary Flood Risk Assessments as areas of potentially significant local flood risk (for instance surface runoff, groundwater and ordinary watercourses), for which FRMPs need to be prepared.

The Bristol Flood Risk Area is included within this FRMP and is entirely within the Bristol Avon & North Somerset Streams catchment.

The West Midlands Flood Risk Area is included within the Humber FRMP. www.gov.uk/guidance/flood-risk-management-plans-what-they-are-and-whos-responsible-for-them

The Flood Risk Areas in Wales form separate individual FRMPs.

8. Conclusions, objectives and measures to manage risk for the Severn RBD

This plan sets out the type of measures proposed to manage the risk. In developing the proposed measures the RMAs contributing have:

- drawn conclusions from hazard and risk maps and other sources of information: this helps us all to understand the risks or opportunities the RMAs are aiming to manage;
- developed risk management objectives (related to people and society, the economy and the environment) that set out the outcomes RMAs are trying to achieve;
- identified the likely approach to managing risk using the following categories: preventing, preparing, protecting and recovering and review.

We have set out the following conclusions and objectives for the Severn RBD as a whole:

Conclusions

The Severn RBD covers an area of approximately 21,500 km² and water bodies are made up of over 7,500 km of river, 76 lakes, 36 canals, 40 areas of groundwater and 545 km² of estuary.

The large size of the RBD gives rise to a huge variety of land uses, geology, topography and other factors that have an influence on flood risk.

The large majority of the RBD, approximately 90%, is classified as rural, with over 55% of land being used for agricultural purposes.

Flooding from Rivers and the Sea

The percentage of the population at medium or high risk of flooding from rivers and the sea is relatively low, at less than 2%, for the majority of the catchment as most urban development has historically been located in areas of higher ground.

The percentage of non-residential properties at medium or high risk in the RBD is also relatively low at just under 4%.

In specific locations, mostly in the vicinity of urban areas where rapid post war expansion has taken place, these percentages may increase slightly.

Of the 12,000 km² of agricultural land within the catchment approximately 6% is at high to medium risk. This is mostly associated with the lower lying areas adjacent to the major watercourses such as the Rivers Severn, Wye, Warwickshire Avon and Severn Estuary, though a number of these areas are protected by agricultural defences that reduce the risk of flooding, and subsequent impact.

Flood risk is influenced by climate change, changes in land use and changes in land management practices.

Reservoir Flooding

In the Severn RBD there are a number of large raised reservoirs that hold at least 25,000m^3 of water above natural ground level. The hazard maps show the largest area that might flood if a reservoir were to fail. The chances of a reservoir failing and causing flooding are very low.

However the extent of flooding from a reservoir can be up to 50 miles from its source. This is because the local geography, such as valleys, can channel flood water long distances.

Many of these features are located in the upland areas of the RBD such as the Welsh Mountains, Brecon Beacons, Cotswold and Mendip Hills.

In the RBD there are approximately 260,000 people, as well as infrastructure and areas of environmental importance at risk of flooding from reservoirs.

The percentage of the population at risk of flooding from reservoirs is again low, at approximately 4.5%, whilst the percentage of non-residential properties at risk in the RBD is also low at just under 5%. Should failure occur, though, localised impacts could be severe. These low figures are due to the vast nature of the RBD and many of the main urban centres in the catchment being some distance downstream of the larger reservoirs such as Lyn Clywedog. This percentage however changes significantly in parts of the catchment such as the Welsh Valleys where there is significant urban development downstream of large reservoirs.

The impact on agricultural land within the catchment would be much greater with approximately 20% at risk.

Surface Water Flooding

Surface water flooding is usually the product of brief but intense storms.

This type of flooding occurs in rural areas when the ground is unable to absorb the high volume of water that falls on it in a short period of time. The water remains on the surface and flows along the easiest flow path towards a low spot in the landscape.

Within urban areas the non-permeability of many surfaces such as paved roads is often responsible for the ground not being able to absorb the water. Poorly maintained or inadequate drainage systems can then exacerbate the problem, leading to flow routes appearing and/or ponding of water to depths that can be a danger to life.

The percentage of the population at a medium to high risk of flooding from surface water is similar to that of fluvial flooding at approximately 2% whilst the percentage of non-residential properties at medium to high risk in the RBD is also low at just under 3%.

The impact on agricultural land within the catchment is again low with approximately 3% at medium to low risk.

Surface water flooding is a risk in some urban locations within the district. Within these more localised areas the percentage of people and properties at risk may be higher.

Sewer flooding

Sewer flooding occurs when blockages or extreme water volumes result in water backing up in the sewer system and overflowing into roads, gardens or homes. There has been significant investment in reducing sewer flooding by the water companies in recent years, e.g. £20million of improvements to sewer capacity in Leamington Spa, and continued investment from water companies and partnership working initiatives are aiming to reduce the risk further.

The pressures of climate change and increasing populations look likely to increase the risk of sewer flooding.

Groundwater flooding

Groundwater flooding is the emergence of groundwater at ground level, when water rises up from the underlying rocks, particularly following extended periods of sustained high rainfall. Groundwater flooding is closely linked to geology and is less common in the Severn than in other locations, such as south east England where chalk is quite common.

Groundwater flooding could be a problem in the Severn catchment due to the quantity of superficial sediment and reduction of industry around Birmingham, however, the lack of available data for the region makes it impossible to quantify the problem at this time or identify specific areas that are

likely to be at risk. Studies being undertaken by British Geological Society and UK Groundwater Society will help to highlight these areas of risk in the future.

Working with others

There is a continued need to work in partnership with others, where possible, to achieve flood risk management measures which will alleviate flooding from multiple sources, as well as providing wider environmental and other benefits to improve the natural, rural and built environment consistent with the principles of sustainable development. One example of this type of collaboration can be seen in the current review into how Clywedog and Vyrnwy reservoirs are used to provide water resources and ecological benefits in the Severn Catchment. The collaboration ensures that the study presents a balanced view of the effects on all aspects of the catchment and considers more than just the flood management issues.

Box 4. Case Study Box

The Clywedog and Vyrnwy Flood Benefits Review.

Natural Resources Wales (NRW) were directed by Welsh Government to carry out an independent assessment of the Operating Rules of Llyn Clywedog and Lake Vyrnwy. The Study was to look at the benefit and cost of increasing the storage, by reducing the operational water levels, within the reservoirs. The study reviewed the whole year, and considered the capacity to provide increased flood attenuation without jeopardising its primary statutory purpose of augmenting the water resources of the River Severn in England and in Vyrnwy's case direct public water supply. NRW also wanted to look at the cumulative effects of the Severn on the Vyrnwy and vice versa at the confluence.

The review was instigated in response to views that the timing and scale of water releases from both reservoirs may have adverse cumulative effects on the land downstream, particularly to the agricultural industry.

The review was carried out in partnership with the Environment Agency (EA) in England and took into account the requirements of water resources and the water companies' needs for abstraction particularly during dry/drought years, including the hydropower requirements of Severn Trent Water who own and operate Llyn Clywedog.

The main purposes of the review were:

- Extend a previous study which investigated the role of Clywedog in flood risk management to include the role of Vyrnwy;
- Ensure that the understanding of flood risk benefits is based on up to date data, information and flood risk and water resource models;
- Engage with stakeholders to understand their concerns about the current operation of the reservoirs;
- Identify whether there could be any additional flood benefits from changing the reservoir operation and management;
- Understand whether there would be any water resources impacts from a change in reservoir operation;
- Review the effects of combined reservoir releases and timings thereof on the Severn-Vyrnwy confluence area.

A key to producing this review was to ensure that all stakeholders had an opportunity to input their knowledge and to understand their views. The review process ensured that local knowledge from a liaison group made up of local political representatives, farmers, landowners and the public was input at the outset of the project. NRW also understood that any recommendations had to be credible and realistic to ensure that the partner organisations would be prepared to look into possibly implementing them in future.

The review is expected to deliver its findings in 2015.

Clywedog Dam

Objectives

The objectives that have been set are in line with the National Flood and Coastal Risk Management Strategies for Wales and England. These objectives set out the key factors that the measures should aim to tackle. They cover social, economic and environment factors.

Table 8.1: Objectives for the Severn river basin district

	Objective	Environmental	Economic	Social
1	Manage flood and coastal erosion risks, taking account of the needs of communities businesses and the environment and working with natural solutions wherever possible.	✓	✓	✓
2	Reduce the risk from flooding to people and households.		✓	✓
3	Develop and promote a better understanding of flood and coastal risk and use this to prioritise investment in risk management.	✓	✓	✓
4	Ensure that wherever possible investment in flood and coastal risk management provides environmental, social and economic benefits, protects and enhances the natural, built and historic environment and supports the achievement of WFD objectives.	✓	✓	✓
5	Target resources to reduce the risk of flooding to communities with the highest flood risk.		✓	✓
6	Set out a clear and consistent plan for flood risk management so that communities, businesses and other organisations can make informed decisions about the management of flood risk and associated opportunities for delivering environmental benefits.	✓	✓	✓
7	Raise awareness of and engage people, businesses and organisations on flood and coastal erosion risk to encourage them to take action to manage the risks they face.		✓	✓
8	Provide an effective and sustained response to flood and coastal erosion events.		✓	✓
9	Households and businesses at high risk of flooding can receive an appropriate flood warnings service.		✓	✓
10	Encourage emergency plans and responses to flood incidents to be effective and communities to respond effectively to flood forecasts, warnings and advice.			✓
11	In support of integrated catchment based water management, facilitate decision-making and action at the appropriate level (individual, community, or local council, river catchment, coastal cell or national), foster partnership working and ensure early engagement with stakeholders.	✓	✓	✓
12	Maintain Environment Agency and Natural Resources Wales flood and coastal risk management assets at or above required condition.		✓	✓
13	Reduce the risk of flooding from reservoirs to people, property, infrastructure and the environment.	✓	✓	✓

Measures across the Severn RBD as a whole

Many measures are specific to a catchment or smaller area. However, there are some important actions which apply across the whole Severn RBD. These are shown here and not repeated at each catchment level. Measures in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to RMA measures based on current

Government policy that gives the highest priority to the areas at highest risk. The funding for flooding is devolved so RMA measures are funded by DEFRA in England, in Wales they are funded by Welsh Government.

Preventing risk: There are 9 measures already in place to prevent flood risk at the River Basin District level (Measure codes M21/M23/M24, in Annex 1), including:

- work with others to avoid inappropriate development in the floodplain;
- ensure no increase in run-off from new developments through planning advice;
- increase awareness and encourage landowners to fulfil their riparian landowner responsibilities;
- promote flood resilience and flood proofing;
- ensure a robust, risk based, revenue maintenance programme exists that prioritises flood risk management works across each catchment.

Preparing for risk: There are 7 measures already in place to prepare for flood risk at the River Basin District level (Measure codes M41/M42/M43/M44 in Annex 1), including:

- provide advice and information to Local Resilience Forums and local communities to enable them to reduce the impact of flooding;
- maintain and improve the flood forecasting, flood warning and flood incident management service;
- raise awareness with key partners, land owners and land managers of their roles in flood risk management and explore opportunities for joint outcomes;
- provide a flood incident response service 24 hours a day, 7 days a week;
- Natural Resources Wales and Environment Agency work closely to consider the benefit or detriment to the whole river basin in all decision making and activity.

Protecting from risk: There are 7 measures already in place that protect from flood risk at the River Basin District level (Measure codes M32/M34/M35 in Annex 1):

- work with landowners, local and national government to encourage best farming practices to reduce rapid surface water run-off and soil erosion;
- work with Natural England and other partners and landowners to identify opportunities for floodplain restoration;
- secure funding and deliver emergency works where needed for assets;
- incorporate climate change allowances into flood risk management works;
- identify where working with natural processes can help improve resilience to climate change.

Recovery and review of risk: There is 1 measure in place to recover and review following flooding at the River Basin District level (Measure code M53 in Annex 1):

- improve and develop services based on lessons identified following flood events.

Flood Risk Management Plan contribution to broader benefits and links with the Severn River Basin Management Plan

Introduction

Through the development of this Severn FRMP, the aims and objectives of the National Flood and Coastal Erosion strategies for England and Wales have been considered. In order to take these strategies forward, this plan sets out a range of social, economic and environmental objectives that include wider benefits alongside the delivery of flood risk management outcomes – see the following sections. These have been informed by considering how the FRMP relates to other plans and wider policies and objectives. In particular, how the FRMP links to the River Basin Management Plans to contribute to a more integrated approach to water management planning, and also to the priorities of Natura 2000 sites that are the subject of recent Site Improvement Plans (Prioritised Improvement Plans in Wales). The following sections provide more details of this.

Other Plans and Partnerships

Table 8.2 sets out the key themes from a review of the main other plans and strategies that the Severn FRMP would be expected to influence. The purpose of the review is to take account of the objectives of these key documents in the assessment with a view to aligning and ensuring compliance of the plan with other policies and legislation. The plan review can also help to identify where other planning processes and organisations may be able to work with the flood risk management planning process. The following summary of the plan review is based on the Environmental Report for the Severn FRMP.

Table 8.2 Key influences from the plans review

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
Water and flood risk management	• Protection, improvement, sustainable management and use of the water environment in terms of quantity and quality – for the benefit of the human and natural environment. • Flood risk management measures could place pressure on water bodies and any measure to be implemented would have to be Water Framework Directive compliant. • The update to the Severn River Basin Management Plan has been prepared in parallel with the FRMP. In support of integrated planning, the SEA identifies where there is the potential for the two plans to deliver positive effects and areas where there may be potential conflicts and require early consideration to develop mutually beneficial solutions.	• National flood and coastal erosion risk management strategies for England and Wales • Water for people and the environment: Water resources strategy for England and Wales • Water white paper: Water for life • A Water Strategy for Wales • Severn RBMP (draft update) • Catchment flood management plans • Shoreline management plans • Fluvial River Severn Flood Risk Management Strategy • Severn Estuary Flood Risk Management Strategy • Surface water management plans • Water resource management plans • River Restoration

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
		Strategies • Nutrient management plans
Biodiversity	• Protection and enhancement of important habitats and species, both from a statutory basis (International and National conservation designations and protected species) and through policy. • Promotion of coherent ecological networks. • Promotion of working with natural processes and sustainable development/management. • Tackling the issue of non native invasive species • Flood risk management measures could place pressure on habitats and species, and work against natural processes.	• Natural environment white paper: The natural choice: Securing the value of nature • Biodiversity 2020: A strategy for England's wildlife and ecosystem services • Wales Biodiversity Framework • Environment Strategy for Wales • Coastal squeeze: Implications for flood management. The requirements of The European Birds and Habitats Directives. Defra policy guidance. • The invasive and non-native species framework strategy for Great Britain • Wales National Habitat Creation Programme • Green infrastructure strategies • Local biodiversity action plans
Landscape	• Protection of existing sensitive landscapes (such as National Parks and AONBs) • Promotion of actions to improve water quality and water quantity, protect and enhance habitats, and restore the wider landscape character • Flood risk management measures could place pressure on sensitive landscapes, and lead to changes in water quality, quantity and change in habitat type.	• All Landscapes Matter • AONB and National Park management plans [Mendip Hills, Cotswolds, Shropshire Hills, Malvern Hills, Wye Valley and Brecon Beacons] • Local landscape strategies
Climate	• Long term aims for reduction of carbon dioxide emissions including reference to binding targets, and wide-reaching policies across all sectors to deliver reductions. • Requirements to adapt to climate change and associated threats, the need for increased resilience to climate change. • Likely increase in flooding and	• Managing the environment in a changing climate • Climate Change Strategy for Wales • The national flood and coastal erosion risk management strategies for England and Wales

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
	coastal erosion due to climate change.	
Marine and Coastal	• Sustainable economic growth within the marine environment that balances benefits to society with the needs of local communities and protecting nature conservation. • Coastal flood risk management measures can enable growth • Coastal flood risk management measures would need to be in alignment with planning policies.	• UK Marine Policy Statement • Wales Fisheries Strategy • Welsh National Marine Plan (in preparation)
Cultural heritage	• Sustainable development in relation to historic assets through conservation and enhancement. • The historic environment could be affected by flood risk management measures e.g. through the construction of new flood risk management schemes, implementation of fish/eel passage on flood risk management assets, etc and as such any such measures would need to be appropriately assessed.	• The Government's Statement on the Historic Environment for England • Valuing the Welsh Historic Environment • Heritage at Risk Registers
Resource management	• Promotion of sustainable waste and resource management and the protection and enhancement of the environment.	• National Waste Strategy for Wales • Metal Mines Strategy for Wales • Minerals and Waste Plans
Planning	• Promotion of sustainable growth • Promotion of water-based recreation and tourist opportunities • Flood risk management measures can enable growth. • Flood risk management measures would need to be in alignment with planning policies. • Development activities could place pressure on the water bodies and would need to be appropriately management and assessed to ensure no detrimental effect to the water environment.	• National Planning Policy Framework • Planning Policy Wales • Local Development Plans/ Unitary Development Plans
Forestry and Farming	• Protection, management and enhancement of woods and forests to provide economic, social and environmental benefits e.g. managing flood risk in a sustainable way, and helping to reduce water pollution • Sustainable farming practices that deliver environmental benefits e.g.	• Government Forestry and Woodlands Policy • Woodland Strategy for Wales • Wales – A new Strategy for Farming

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
	biodiversity, landscape, cultural heritage, water quality	

Links with the Severn River Basin Management Plan

The main aims of the EU Water Framework Directive (WFD) are to return rivers and the water environment to a state as free from human influence as possible. Aspects of this include reversing some of the ways in which water bodies have been physically modified in the past, improving water quality and bio-diversity and improving the quality of bathing waters. To achieve this, work by the water companies, farmers and business is regulated by the Environment Agency and Natural Resources Wales, complemented by a programme of works by the Environment Agency, Natural Resources Wales and others to remove some structures from rivers.

The Severn FRMP promotes a range of benefits that will contribute to the RBMP through re-naturalisation, water quality improvements, bathing water improvements and natural flood management.

In the English section this is further detailed in Part B, section 2.1.

Severn opportunities for linked work

In delivering the programme of measures set out in the FRMP, the Environment Agency and Natural Resources Wales look for the potential in all measures to improve the local natural, built and historic environment, and so to achieve environmental benefits alongside economic and social gains. These include environmental improvements to meet obligations set out through the Water Framework Directive and Habitats and Birds Directives as well as other domestic commitments that link to flood and coastal erosion risk management. The Environment Agency and Natural Resources Wales also work to avoid, wherever possible, and minimise potential damage to habitats, including those protected by legislation, the ecological status of watercourses, heritage assets (designated and non-designated) and the character and appearance of the local landscape and townscape. The Environmental Report of the FRMP describes the likely environmental effects of the FRMP. It is also outlines high-level mitigation measures required to manage potential negative effects and highlights opportunities for delivering broader environmental benefits.

Early engagement with key partners and stakeholders and other relevant interests will help to identify potential opportunities for delivering broader environmental benefits. This may include the following:

- Central Government – including Environment Agency, Natural England, Natural Resources Wales, Historic England, Cadw, Sport England, Forestry Commission, Marine Management Organisation;
- Local Government and Regulators – including Local Authorities (planning and regeneration, conservation, archaeology, ecology, landscape, public rights of way), Internal Drainage Boards, AONB conservation boards and National Park authorities;
- Industry and Business – including Local Enterprise Partnerships, navigation and renewable energy interests;
- Non Government Organisations – including Local Wildlife Trusts, Catchment Partnerships, River Trusts, Local Wildlife Groups, Canals and River Trust, Woodland Trust;
- Water Industry – including water companies;
- Agriculture and Rural Land Management – including landowners, NFU;

- Recreation, Leisure and Amenity – including angling / fishing/ sport clubs/societies, local residents;
- Local communities – including parish and town councils and local community groups.

Further details of how the measures support environmental objectives in the FRMP for England are outlined in Part B, Section 2.1 and in the measures tables in Annex 1.

In parallel to flood risk management planning, the Environment Agency and Natural Resources Wales work with others to improve the quality of the water environment through River Basin Management Planning. The Environment Agency and Natural Resources Wales aims to co-ordinate effectively between the FRMP and River Basin Management Plan so that all organisations can do more for the environment.

Examples of projects that are delivering broader benefits are outlined below:

Puxton and Stourvale Marshes, Kidderminster Water Level Management Plan

Puxton SSSI and Stourvale SSSI lie on opposing floodplains of the River Stour in Kidderminster. Combined, they provide just under 23 hectares of floodplain wetland habitats including damp, marshy grassland, tall fen, with small patches of open water and carr woodland which support a diverse array of wetland and riparian plants, insects and birds. These sites are remnants of the once extensive marshland areas along the Stour Valley and they also provide a precious area of green space close to Kidderminster town centre.

The condition of both SSSIs has been recorded as ‘unfavourable’ in recent years, caused by a range of factors including woodland encroachment, lack of grazing, catchment-wide groundwater abstractions, urban development across adjacent land areas, construction of the Kidderminster Flood Alleviation Scheme and historic dredging of the River Stour.

To investigate all potential ways to bring these sites back into ‘recovering’ or ‘favourable’ condition strong partnerships have been developed between Natural England, Wyre Forest District Council, the Environment Agency and Severn Trent Water and many different options have been considered over the past three years. As a result, the partnership has now established detailed groundwater monitoring across both sites, arranged long term tenancy of SSSI areas not owned by Wyre Forest District Council which has then allowed land stewardship funding to support extensive tree removal works and restoration of grazing across both sites. The Environment Agency has installed site information boards and Wyre Forest District Council has engaged with the local communities about the ongoing works with positive results. Organisations are also working together to improve water management across both sites. Over the next few years the SSSIs will be monitored by Natural England for recovery and re-establishment of the vegetation and animal communities for which they were originally designated. Whilst 4 ha of Puxton SSSI has been assessed as ‘favourable’ since 2013, it is anticipated that the current works will significantly improve the condition of the rest of the site areas over the next 2-3 years.

Slow the Flow – Shropshire Rivers

The rivers of Shropshire have dramatically changed in character over the years through the influence of land management changes in the uplands and lower valleys. This has resulted in faster response rates to rain events, high flow velocities and increased flood risk to rural communities; reduced groundwater storage leading to lower summer flows; extensive loss of riparian habitat and natural gravel beds essential to many key species.

Using the principles of Woodlands for Water and Rural SuDS the aim is to work with key partners, local communities and landowners to identify opportunities to implement small scale land management projects, including woodland planting, that demonstrate the benefits of working with natural processes to restore sustainable river environments. The projects will contribute to reducing flood risk, improving water quality, reducing erosion/silt and enhancing riparian habitats and increasing groundwater storage to improve summer low flows.

Find out more:

- **Severn RBMP**
- **National Planning Policy Framework**

9. Implementing the plan

Implementation in Wales

FRMPs in Wales are produced every 6 years and summarise the risk of flooding from rivers, the sea and reservoirs. The plans draw relevant conclusions about the risk of flooding and set out and prioritise what needs to be done to manage the risk, now and in the future. Natural Resources Wales takes a risk based community approach to inform, plan and prioritise the investment programme to target investment in the most at risk communities. Funding is provided from Welsh Government Flood Defence Grant in Aid and is allocated in line with government policy and priorities.

Implementation in England

FRMPs are produced every 6 years and describe the sources, risks and measures to manage flooding within a river basin and catchment. Implementing the measures in the FRMP will be carried out by RMAs working with partners and communities. RMAs are invited to submit details of proposed flood and coastal erosion risk management work to the Environment Agency who administer funds on behalf of Defra. These proposals are combined with Environment Agency proposed schemes and local RFCC funded projects to form a programme of work. Funding is allocated in line with government policy and priorities.

The catchment based approach

The catchment based approach encourages local engagement and participation in decision-making. As the Environment Agency and Natural Resources Wales finalise and implement this plan they will seek to engage further with relevant catchment partnerships in order to deliver flood risk management outcomes and broader benefits.

Monitoring delivery of measures

During the planning and implementation cycle the Environment Agency and Natural Resources Wales will monitor progress in delivering the measures set out in the FRMP. Environment Agency will report progress annually to the relevant Regional Flood and Coastal Committees and the Environment Agency and Natural Resources Wales will review the FRMP every 6 years, as required by the Flood Risk Regulations.

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