Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

The draft flood risk management plan for the Severn River Basin District Environmental report

October 2014

This is a joint draft plan prepared by the Environment Agency, Natural Resources Wales and Lead Local Flood Authorities who protect and improve the environment and make it a better place for people and wildlife.

The Environment Agency

We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve

Natural Resources Wales

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future

We will work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution.

We will provide opportunities for them to learn, use and benefit from Wales' natural resources

We will work for Wales' economy and enable the sustainable use of natural resources to support jobs and enterprise. We will help businesses and developers to understand and consider environmental limits when they make important decisions.

We will work to maintain and improve the quality of the environment for everyone. We will work towards making the environment and natural resources more resilient to climate change and other pressures.

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Environment Agency
Horizon house, Deanery Road,
Bristol BS1 5AH
Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

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Email: enquiries@environment-agency.gov.uk.

Non technical summary

This is a summary of the environmental report for the draft Severn flood risk management plan. The environmental report presents the results of a strategic environmental assessment (SEA) carried out as part of the preparation of the flood risk management plans. The environmental report and this summary are required to be published with the draft plan, in order that people can understand and comment on how the environmental effects should be taken into account in the development of the final flood risk management plan. The final plans will be published in December 2015.

Flood risk management plans

Flood risk management plans (FRMPs) highlight the hazards and risks from rivers, the sea, surface water, groundwater and reservoirs and set out how risk management authorities, such as the Environment Agency, Natural Resources Wales and local authorities, will work together with communities to manage flood risk. They are required by the European Union Floods Directive and the Flood Risk Regulations 2009.

The Environment Agency and Natural Resources Wales are required to prepare flood risk management plans for all of England and Wales covering flooding from main rivers, the sea and reservoirs. Lead local flood authorities (county councils and unitary authorities) must prepare flood risk management plans for flood risk areas. There are ten flood risk areas in England and 8 in Wales where the risk of flooding from local sources is greatest, for instance from surface water, groundwater and ordinary watercourses. The flood risk management plans must be reviewed and reissued every six years to describe progress.

FRMPs are new plans, however risk management authorities[1] already plan for flooding and a large proportion of the draft FRMP is taken from existing plans that have already been consulted on and for which the effects have already been assessed. These are set out as **ongoing and agreed** flood risk management measures in the FRMP. The **proposed measures** of the draft FRMP build on existing plan measures in setting out the future management needs across catchment, shoreline and local sources of flood risk. At this scale they aim to set preliminary actions for the future investigation and development of flood risk management options and business cases.

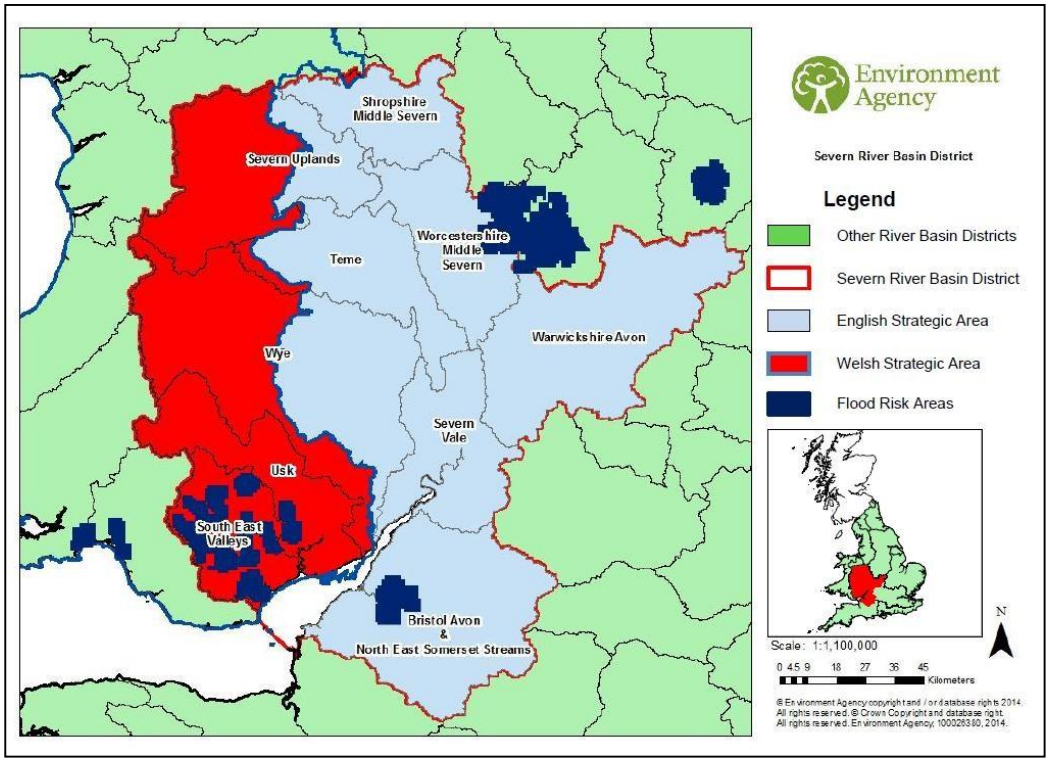
The draft plan is being consulted on for three months from autumn 2014.

The Severn River Basin District

The Severn River Basin District is predominantly rural with the majority of its people living in large cities such as Bristol, Coventry, Cardiff, and towns including Shrewsbury, Worcester, Hereford and Gloucester and Monmouth. Many of its landscapes are of recognised importance and popular destinations for recreation and tourism, such as the Brecon Beacons, Cotswolds and Malvern Hills. Numerous areas are also protected for their nature conservation value, ranging from the Severn Estuary to the Meres and Mosses in Shropshire. In addition to its historic riverside towns the district contains three World Heritage Sites, including the Ironbridge Gorge on the River Severn, as well as a wide range of historic buildings, structures and archaeological features that are associated with the area's rivers and canals.

Map of the Severn river basin district, catchments and flood risk areas

[1] Risk Management Authorities are Environment Agency, Natural Resources Wales, Lead Local Flood Authorities, district councils for areas for which there are no unitary authorities, internal drainage boards, water companies and highway authorities



Severn FRMP programme of measures

The Severn draft FRMP covers the 11 management catchments of the river basin district (this including the Severn Estuary) and 1 flood risk in England (Bristol) as well as 6 in Wales (Cardiff; Caephilly; Pontypool and Cwmbran; Ebbw Vale; Merthyr Tydfil; Rhondda, Cynon, Taff). The flood risk area measures focus on local sources of flooding, whilst the management catchment measures include statutory measures (covering flooding from main rivers, sea and reservoirs) with voluntary measures on other sources of flooding. The Severn Estuary is included within the management catchments covering the area and the West Midlands flood risk area is covered by the Humber draft FRMP. The English and Welsh parts of the 11 management catchments are separated into two – the English Strategic Area and Welsh Strategic Area.

The vast majority of the programme of measures within the Severn draft Flood Risk Management Plan (FRMP) is about ways of protecting communities from flooding, preparing for flooding, and ways to avoid or prevent flooding. The distribution of measures is variable across the River Basin District and its management catchments, this in part reflecting the wide variation in the characteristics of rivers and subsequently the nature of flooding throughout the district. Management catchments with particular concentrations of measures include the Seven Vale, Bristol Avon and North East Somerset Streams, South East Valleys and Warwickshire Avon. Protection measures comprise just over a third of the overall programme with most of these being ongoing or agreed measures and around a third being proposed measures.

Strategic environmental assessment

The SEA scoping process focussed the assessment on the statutory flood risk management measures that set the framework for development consent or make a decision about a particular option for managing flood risk. In the draft plan these are generally categorised as flood protection measures. The number of flood protection measures included in the assessment represents just over a third of all of the measures included in the draft plan.

Proposed measures set out future priorities for addressing flood risk across a catchment or flood risk area, rather than the details of individual flood protection options and solutions. For this SEA of the draft FRMP, we focussed on the combined effects of the programme of protection measures across a management catchment or flood risk area, rather than individual measures at specific locations.

The following is the summary of the likely effects of the plan as a result of the strategic environmental assessment. We have also identified mitigation required to manage the negative effects and opportunities to deliver greater environmental benefits.

Summary of main effects of the draft FRMP

SEA receptor	Summary of effects	Mitigation and opportunity
Water	Localised positive effect associated with improvements in water quality due to reduced surface water run-off in rural and urban areas and the input of sediments, nutrients and other pollutants Localised negative effect on water quality in the delivery of flood alleviation schemes involving built defences due to the reduced attenuation of surface water runoff and sediments as a result of habitat loss and by reducing the capacity of the local area to naturally store water and deposit sediments	Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir The localised negative effects on water quality in the delivery of flood alleviation schemes can be mitigated by minimising habitat loss and including habitat creation as well as by developing schemes that work with natural processes to reduce surface water run-off (such as Sustainable Drainage Systems) and sustain or improve the connection of watercourses with their natural floodplain enabling water storage, infiltration and the natural deposition of sediments
Population and human health	Localised positive effect on regulating river flows and surface water run-off from agricultural land and urban areas by improved attenuation, infiltration and storage of water this helping to reduce and slow flows downstream and reducing the risk of flooding for communities and infrastructure Localised negative effect on agricultural production as a result of land take for new or improved flood risk management assets, habitat creation and changes in the local flooding regime. Localised positive effect on recreation and tourism through improved water quality, fisheries, habitats and attractiveness of river corridors and reducing the risk of flooding of places and communities providing leisure and tourist destinations Localised negative effect on recreation and tourism in the delivery of flood alleviation schemes due to potential loss of recreational or amenity land, disruption to public rights of way and changes in water levels that could affect water-based activities	Opportunity in England to use the Midlands Woodlands for Water Project to identify priority areas for woodland planting and management in support of improved water storage Negative effects on agricultural production can be mitigated by avoiding high grade agricultural land and adapting farming practices as well as capitalising on opportunities such as high quality livestock grazing Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir All flood risk management schemes/works will need to comply with European regulations to allow fish and eel passage. Opportunities for flood risk management schemes/works to improve fish habitats, especially in areas with important local fisheries Negative effects on recreational and tourism facilities can be mitigated by involving relevant interests at an early stage at the project level to identify possible impacts and agree scheme specific mitigation. Opportunities for

SEA receptor	Summary of effects	Mitigation and opportunity

		schemes to improve public access, interpretation and footpath and cycling networks, and enhance recreational and amenity land Opportunity to engage local communities in the design of flood risk management schemes and to establish community based projects that promote the wildlife, heritage and recreational use of the water environment
Soil	Localised positive effect on soil in the longer term due to reduced rates of soil erosion and nutrient loss from reduced surface water run-off in rural areas	Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir
Biodiversity, flora and fauna	Localised positive effect on biodiversity, especially water dependent habitats and species, resulting from improvements in water quality, habitat creation (wetlands, wet woodlands) and more natural watercourses Significant negative effect on the integrity of the Severn Estuary (Special Area of Conservation, Special Protection Area, Ramsar site) in some locations associated with actions in existing plans for maintaining flood risk management assets in the area and the impact of this in the longer term on intertidal habitats Localised negative effect on biodiversity and designated sites of nature conservation interest in the delivery of flood alleviation schemes resulting from potential habitat loss and changes to the water environment	Negative effect on the integrity of the Severn Estuary (Special Area of Conservation, Special Protection Area, Ramsar site) will be addressed through the Habitats Regulations Assessments of existing plans and compensatory habitat schemes The mitigation approach for potential negative effects on habitats and species will involve early consultation with nature conservation interests to identify and assess at the project level any potential impacts (including designated sites of nature conservation interest and protected species) and agree scheme specific mitigation. All flood risk management schemes will need to comply with European regulations to allow fish and eel passage. Opportunities also for schemes to improve fish habitats, especially in areas with important local fisheries Early engagement with nature conservation interests will enable opportunities to be identified for improving habitat diversity and the condition and connectivity of sites, and for improving fish and eel passage and other habitats for protected species Opportunities for habitat creation, such as wetlands, to be included in the design of schemes, including Sustainable Drainage Systems, and for schemes to restore natural watercourses such as by deculverting
Cultural heritage	Localised negative effect on heritage assets subject to the location, type and design of flood risk management schemes Localised positive effects on heritage assets resulting from reduced risk of flooding in the local area associated with the implementation of flood risk	The mitigation approach at the project level for potential negative effects will include the identification of any heritage assets (including archaeology) and the early engagement of heritage interests to agree scheme specific mitigation Opportunity to engage local communities in
SEA receptor	**Summary of effects**	**Mitigation and opportunity**

	management schemes	the design of flood risk management schemes and to establish community based projects that promote the wildlife, heritage and recreational use of the water environment
Landscape	Localised negative effect on landscapes of recognised importance (Areas of Outstanding Natural Beauty, National Parks) subject to the location, type and design of flood risk management schemes Localised positive effect for urban and rural landscapes associated with the introduction of more naturalistic rivers and habitat creation	The mitigation approach to potential negative impacts will include early consultation at the project level with relevant landscape interests and the undertaking, where necessary, of landscape and visual impact assessments to inform scheme design and mitigation Opportunities to use green infrastructure strategies and landscape character studies to inform habitat creation and project designs
Material assets	Significant positive effect through reduced risk of flooding to infrastructure, services and property. Potential localised negative effect on the use of water for other purposes such as navigation and hydropower Potential localised negative effect on recreation and tourism due to potential loss of recreational or amenity land, disruption to public rights of way and changes in water levels that could affect water-based activities	The potential negative effect on other uses of water can be mitigated by involving all interests at an early stage at the project level to identify and assess any potential conflicts in use and develop scheme specific mitigation The potential negative effects on recreational and tourism facilities can be mitigated by involving relevant interests at an early stage at the project level to identify possible impacts and agree scheme specific mitigation. Opportunities for schemes to improve public access, interpretation and footpath and cycling networks, and enhance recreational and amenity land
Climatic factors	Little or no effects	
Air	No effects	

Overall, the Severn draft Flood Risk Management Plan is anticipated to have mainly positive effects on the water environment, including water quality, the natural flow of water and habitats. Potential negative effects are identified for cultural heritage, designated landscapes and designated sites of nature conservation interest.

The SEA also found that the draft FRMP aligns well with the objectives of other plans and programmes in the Severn river basin district, particularly those aimed at promoting sustainability and nature conservation. There is the potential for both alignment and conflict between flood risk management and the River Basin Management Plan (RBMP), which is a plan to improve the overall water environment. For this reason the FRMP has been developed in coordination with the RBMP. Furthermore, when measures are implemented the RBMP will be taken into account and compliance with the objectives of the Water Framework Directive will be checked.

The Environment Agency and Natural Resources Wales will monitor the effects the plan is having on the environment. The main mechanism will be through the flood risk management plan which will report on the outcomes and wider benefits to society from the measures implemented, but also through the river basin management plan which will report annually on the status of rivers, lakes, groundwater, estuary and coastal waters.

This consultation

This environmental report has been published with the draft Severn flood risk management plan and is available for consultation for a three month period. We are seeking your views and have set out some specific consultation questions below:

1. Do you agree with the conclusions of the environmental assessment? (yes / no) If not, please explain why.

2. Are there any further significant environmental effects of the draft plan which you think should be considered? (yes / no).
   If yes, please describe what they are.

   We have described potentially 'negative effects' of the draft plan on the environment which would need mitigation, as well as wider opportunities to achieve 'positive effects'.

3. Are there further mitigations or opportunities that should be considered for the plan? (yes / no)
   If yes, please give details.

How to respond

There are many ways to respond to this consultation, which runs from 10 October 2014 to 31 January 2015.

You can respond to the consultation online on the Environment Agency e-consultation web pages on the GOV.UK website

Natural Resources Wales also have this document available for consultation on their website and would prefer responses to be made by email at:
Flood.risk.management.plan@naturalresourceswales.gov.uk

Contents

1. Introduction

The environmental report sets out the findings of the strategic environmental assessment of the Severn draft flood risk management plan. The strategic environmental assessment is used to take account of the likely effects of the plan on the wider environment during its development. This section covers:

- draft flood risk management plans
- the SEA environmental report
- finding your way through this report

Draft flood risk management plans

The European Floods Directive sets out requirements to manage flood risk in order to reduce the consequence of flooding on human health, economic activity and the environment. For England and Wales, the Flood Risk Regulations 2009 implement the Directive and require planning and managing flood risk to be carried out on a six year cycle. This first cycle has involved:

1. Preparing a preliminary flood risk assessment report that details past floods and the possible consequences of future floods. This was completed in December 2011.
2. Identifying where the risk of flooding from local flood sources is significant. This was completed in December 2011.
3. Preparing flood hazard maps showing flood extent and velocity/depth and flood risk maps showing the consequences for flood risk areas. This was competed in December 2013.
4. Developing flood risk management plans (FRMPs). This consultation is one of the first set of draft flood risk management plans.

The Environment Agency and Natural Resources Wales must produce FRMPs for each **river basin district (RBD)** to cover flooding from main rivers, sea and reservoirs. There are 11 river basin districts across England and Wales, each divided into a series of **management catchments** based on the natural geography of rivers, lakes, groundwater and coastal waters.

Lead Local Flood Authorities[2] (LLFAs) must produce FRMPs for all **flood risk areas** to cover flooding from local sources, which includes surface water, ordinary watercourses and groundwater. There are 10 flood risk areas in England and 8 in Wales that span one or more local government boundaries.

Following consultation with LLFAs in 2012, the Environment Agency and Natural Resources Wales proposed the option of developing FRMPs through voluntary partnerships with others, in order to bring existing flood risk management planning together. In particular, drawing on information from catchment flood risk management plans (CFMPs), shoreline management plans (SMPs) and local flood risk management strategies. Also, the 11 FRMPs for river basin districts in England and Wales should be a consistent set of strategic plans for delivering (in England) the 'National flood and coastal erosion risk management strategy for England, 2011' and (in Wales) the 'Welsh Government's National Flood and Coastal Erosion Risk Management Strategy'.

The draft FRMP for the **Severn RBD** encompasses:

[2] **Lead local flood authorities (LLFAs),** county and unitary authorities, are the competent authorities for all local sources of flooding - for example, surface water, groundwater and ordinary watercourses, but also canals and flooding from lakes within their areas.

- **11 management catchments** across England and Wales, this including the Severn Estuary [measures related to the estuary are included in the relevant management catchments that together cover the area]. The draft FRMP sets out objectives and a programme of measures to manage flood risk for main rivers, the sea and reservoirs within each management catchment as a statutory requirement. Information on local sources of flooding within management catchments is also included in the Severn draft FRMP on a voluntary basis.
- **7 flood risk areas** – 1 in England (Bristol) and 6 in Wales (Cardiff; Caephilly; Pontypool and Cwmbran; Ebbw Vale; Merthyr Tydfil; Rhondda, Cynon, Taff). The plan sets out objectives and measures to manage local sources of flood risk within the Bristol flood risk area and these are included in the Severn FRMP as a statutory requirement. All the LLFAs in Wales that fall within the Severn River Basin District and have flood risk areas have made the commitment to produce separate FRMPs. The West Midlands Flood Risk Area, a small part of which falls in the Severn River Basin District, is covered by the Humber draft FRMP and its accompanying assessment.

Draft FRMP programme of measures

The draft FRMPs set out the following information for each management catchment and flood risk area based on the information provided by relevant partners:

- Flood risks and conclusions
- Objectives for flood risk management
- A programme of measures

The programme of measures is described under the following headings:

- **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.
- **Protecting:** by protecting people and assets from the risk of flooding, this could be achieved by taking physical interventions or by measures that work with natural processes. For example, the construction of new assets to manage flood risk and regulate water flow, and the creation of wetland areas to store water.
- **Recovery and review:** by learning from flood events and how to recover from it, for example, by improving the availability of recovery services such as providing temporary accommodation, after flooding has occurred.

In order to be clear on the source of the measures being drawn from existing plans as well as new work on future priorities, the measures were also identified as being either:

- **Ongoing** flood risk management measures which are already underway. These measures have already been consulted on and adopted in existing plans and are not specifically being consulted on in the draft FRMP.
- **Agreed** measures that are already planned with funding provisionally agreed. These measures are set out in plans that have been consulted on and adopted, such as measures drawn from catchment flood risk management. They are not being specifically consulted on in this draft FRMP.
- **Proposed** measures to be progressed from 2015 onwards that have not been consulted on previously. These are the measures that are specifically being consulted on in this draft FRMP.

Approach to the draft FRMP in Wales

Natural Resources Wales takes a risk based community approach to prioritise where best to direct investment. This is informed by the strategic framework provided by the National FCERM Strategy for Wales, Catchment Flood Management Plans (CFMPs) and draft second generation Shoreline Environmental report

Management Plans (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 projection of risk. The risk based community approach of present day risk assessment is done through Natural Resources Wale's 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 inform, plan and prioritise our investment programme to target investment in the most at risk communities.

In producing the FRMPs in Wales Natural Resources Wales took the top 100 Communities at Risk from the register and proposed measures to manage this risk in these communities, this being done within the framework of existing strategies and plans.

The Severn draft FRMP document is available for consultation from autumn 2014 for 3 months (http://ea.objective.co.uk/file/3092389).The responses will be taken into account in preparing a final FRMP by December 2015.

The SEA environmental report

The purpose of this report is to consider the environmental effects of the Severn draft FRMP at the scale of the river basin district. We have assessed the environmental effects of the draft FRMP programme of measures within management catchments and flood risk areas and summarised these for the river basin district.

The strategic environmental assessment has also been undertaken to fulfil the requirements of the 'Environmental assessment of plans and programmes regulations 2004' (known as the 'strategic environmental assessment regulations'). This requires plans within certain sectors (including the water sector) that provide a framework for future development to be subject to a strategic environmental assessment to ensure that the environment is considered from the outset. Table 1.1 sets out the requirements for an environmental report to meet these regulations and indicates where they are addressed within this report.

Table 1.1: How the requirements of the strategic environmental assessment regulations are addressed in this report.

SEA regulations requirement	How this has been addressed	Section
1. An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant plans and programmes.	Section 1 sets out the main objectives of flood risk management plans and an outline of the content of the plan can be found in section 4. Section 3 sets out the relevant key themes arising from a review of relevant plans and programmes. A full list of plans reviewed is provided in Annex A.	1, 3 and 4 Annex A
2. The relevant aspects of the current state and of the environment and the likely evolution thereof without implementation of the plan or programme.	An overview of the river basin district is provided in Section 3. Section 4 provides a description of the current state of the ecosystem services provided by the water environment and how these are likely to evolve in the absence of the plan.	3 and 4
3. The environmental characteristics of areas likely to be significantly affected.		
4. Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC	Existing environmental problems are presented as part of the baseline in Section 4.	3 and 4

SEA regulations requirement	How this has been addressed	Section

on the conservation of wild birds and the Habitats Directive.		
5. The environmental protection objectives, international, Community or which are relevant to	Environmental protection objectives are summarised as part of the review of plans and programmes in Section 3.	3
the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation.		
6. The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects.	The likely significant effects of the plan are described in Section 4 and summarised in Section 5.	4 and 5
7. The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme.	Mitigation measures and opportunities for additional environmental improvements are provided in Section 4 and summarised in Section 5.	4 and 5
8. An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information.	Section 2 sets out the alternatives considered.	2
9. A description of the measures envisaged concerning monitoring in accordance with regulation 17.	Proposals for monitoring are provided in Section 6 5.	
10. A non-technical summary of the information provided under paragraphs 1 to 9.	A non-technical summary is provided at the front of this document and is available as a separate document.	

Finding your way through this report

This report describes how the strategic environmental assessment process has been carried out to ensure the environment has been taken into account during the development of the draft flood risk management plan. The report comprises the following sections:

- **section 2: undertaking the assessment** describes how we have undertaken the assessment of environmental effects and the approach to the consideration of alternatives
- **section 3: environmental context for the plan** provides an overview of the environmental context for the plan in terms of both the physical environment and the planning and policy context
- **section 4: results of the assessment** sets out the environmental effects of the plan for the river basin district and for the flood risk areas
- **section 5: summary of results** sets out a summary of the assessment in section 4
- **section 6: monitoring the effects of the plan** sets out our initial proposals to monitor the significant effects of the plan
- **section 7: this consultation** provides further information on how you can comment on the plan and/or the environmental report and provides specific questions to help with your response.

2. Undertaking the assessment

This section sets out how we assessed the environmental effects of the draft plan and its consideration of alternatives. This section covers:

- scope and context of the assessment
- assessment method
- using ecosystem services for SEA
- alternatives considered
- Habitat Regulation Assessment

Scope and context of the assessment

The purpose of strategic environmental assessment (SEA) is to integrate environmental considerations into the preparation and adoption of plans that are likely to have significant effects on the environment[3]. The scope of the strategic environmental assessment was informed by the consultation with Natural England, English Heritage and the Marine Management Organisation as well as with Natural Resources Wales, Cadw, Scottish Environment Protection Agency, Historic Scotland and Scottish Natural Heritage in January 2014. We considered the comments made on the scoping letter and took them into account, as far as possible, during the environmental assessment.

Existing plans and proposed measures

The SEA took account of the environmental effects of ongoing and agreed flood risk management measures from existing plans that have previously been consulted on as well as newly proposed measures in the draft FRMP.

Ongoing and agreed flood risk management measures remain part of previously consulted on and adopted plans and were the subject of any relevant SEA or Habitats Regulations Assessments carried out on the plans. For this SEA of the draft FRMP, we scoped out any reassessment of these measures at the scale of existing plans, but have considered their combined effects with proposed measures at the scale of the FRMP. This provides an overview of the effects from current flood risk management activities of existing plans alongside those from newly proposed measures in the draft FRMP.

Proposed flood risk management measures are also considered in combination, as a package (or bundle) per catchment or flood risk area. Proposed measures set out future priorities for addressing flood risk across a catchment, rather than the specifics of individual flood protection options and solutions. For this SEA of the draft FRMP, we focussed on the combined effects of the bundle. But we also reviewed the types of proposed measures to check if they required more detailed assessment. This was based upon the nature of the measure and its likely environmental effects. For all proposed measures in the draft plan, we did not consider that any more detailed assessment was required, but note that when some types of flood risk management options are further developed and being appraised, more detailed assessment would be required.

Types of measures

The assessment focussed on the measures for flood protection that are likely to set a framework for future development. This is because flood risk management protection measures largely involve physical works, for example building new flood defences or creating flood storage areas, which could have significant environmental effects. Nevertheless, there are important health and

[3] Paragraph 4 of the preamble to Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (the Strategic Environmental Assessment Directive)

wellbeing benefits associated with measures for prevention, preparedness, recovery and review that we have also addressed.

Context and related plan review

We set out a context (or baseline) for the SEA for the river basin district by summarising the main components of the environment and other broad social and economic activities across the district. This was based on information taken from the draft update to the RBMPs. We further reviewed a range of plans that could contribute to flood risk management objectives or will be affected by them. See section 3 for the list of plans reviewed and how they relate to the main components given in the environmental context.

Assessment method

We carried out separate assessments of the following types of measures.

For measures in a management catchment covering flooding from main river, sea and reservoirs:

(a) In the English part of the Severn River Basin District, the environmental assessment followed a number of steps:

- Ongoing and agreed flood risk management measures from previously consulted on plans, were grouped and their combined effects on ecosystem services identified. This provided an overview of the interaction between current flood risk management activities and ecosystem services.
- Proposed flood risk management measures to be consulted on in the FRMP were grouped and an assessment made of the change to ecosystem services. We recommended mitigation to address any adverse effects and improvements that would realise additional benefits.
- Proposed flood risk management measures were reviewed to consider if they required detailed assessment. This was based upon the type of measure and its likely environmental effects and, for example, whether the measure was recommending further study or making decisions about a preferred flood risk management option.

(b) In the Welsh part of the Severn River Basin District, the approach to the environmental assessment involved the following:

- Ongoing and agreed flood risk management measures from previously consulted on plans (e.g. SMPs, CFMPs, Severn Estuary Flood Risk Management Strategy) were reviewed against the proposed measures to ensure consistency with the existing policies.
- Proposed flood risk management measures for communities at risk, which had been screened into the SEA, were assessed for their effects on the ecosystem services. We recommended mitigation to address any adverse effects and improvements that would realise additional benefits.

For measures in a flood risk area covering flooding from local sources:

(a) Measures covering the Bristol flood risk area, have been included the English part of the Severn FRMP.

(b) For Welsh flood risk areas, measures are being developed separately by relevant Lead Local Flood Authorities.

The effects of the bundle of measures were related to a range of environmental benefits (using ecosystem services). The full list of environmental benefits (ecosystem services) that were considered can be found in Annex C. We selected which ecosystem services would be most affected by the bundle of measures in order to focus our assessments on the main effects (see table 4.1).

We adjusted the ecosystem services approach in order to capture effects of flood risk management measures that were not well articulated in the approach, in particular material assets (infrastructure) and designated nature conservation sites. The consideration of material assets was added to ensure we addressed the protection benefits to the built environment and in particular infrastructure such as transport, energy and health facilities. 'Existence value' is the category under which we address the effects on designated nature conservation sites. This is additional to the effects on the wider provision of habitat.

There is further explanation of our use of ecosystem services below.

The effect of the flood risk management plan on each ecosystem service (and material assets) was recorded using a scaling of positive to negative effects. This was carried out for the existing plans and for the proposed measures and then as a cumulative summary. We then considered where these effects may be significant at the scale of whole plan, that is the river basin district, based on the following criteria:

- effects that are widespread across one or more catchments.
- local effects that are of a large enough scale to be considered significant for the river basin district. For example, this might apply to a major habitat creation project.
- effects that are likely to result in a demonstrable change in the health and/or social or economic well being of communities.

A summary table of the main effects of the draft plan is provided in table 5.1 of section 5. It is a cumulative result of the assessments described above (by ecosystem service) but set out under wider social, economic and environmental headings that are referred to in the SEA Directive. It highlights where we consider effects are significant at the strategic scale of the plan (the river basin district). It also summarises where mitigation is proposed to address any adverse effects together with improvements that would realise additional benefits.

For some effects, we have given a view of their likely timescales. Whilst for most effects this is long-term by the nature of the draft plan, we have also used short and medium term to mean the following:

- short term – within the current proposed plan cycle, 2015 to 2021
- medium term – within the cycle covered by the first update to the plan, 2021 to 2027
- long term – beyond 2027

Using ecosystems services for SEA

We used an ecosystems services approach in the assessment of the draft FRMP because this was used in the assessment of the draft updates to the river basin management plans (RBMPs) and because the Flood Directive[4] encourages coordination across both plans.

In England, the draft update to the RBMP sets out a programme of measures to improve the water environment and used an economic appraisal to identify the benefits that the changes to the water environment would bring to people based on ecosystem services. The appraisal assigned a monetary value to some of these benefits together with a cost of implementing the measures. This helped to identify which measures were worthwhile and to be included in the draft plan. The process was extended to meet SEA requirements so that it also captured information on the effects of proposed measures using the same range of benefits as the appraisal. Using the same assessment approach for both the RBMP and FRMP draft plans allows us to directly compare the environmental effects and consider the interaction between the two plans.

In Wales, the monetary costs and benefits were not considered at the assessment stage (in line with Welsh Government Guidance) and so the assessment for the FRMP and RBMP focussed on the positive and negative effects on ecosystem services. Natural Resources Wales adopts the

[4] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

ecosystem approach in all our natural resource management and planning and so utilising this approach in the Welsh parts of the RBMP and FRMP allows direct comparison and consideration of the interactions between these plans and with the emerging Natural Resource Plans.

Use of ecosystem services requires an understanding of the benefits provided to people by the wider natural environment. This is in accord with the objective of the SEA Directive which is to contribute to the preservation, protection and improvement in the quality of the environment, human health and the prudent and rational use of natural resources[5]. The Directive also refers to the Convention on Biological Diversity which requires parties to integrate, as far as possible, the sustainable use of biological diversity into plans and programmes.

Assessing the effects of a plan on the benefits (ecosystem services) provided by the environment has the advantage of not only understanding the environmental effects, but also indicating how these will be experienced by people. It also makes it possible to take account of the natural systems and processes that are part of the environment rather than just focusing on individual features (such as air quality, water and landscape).

There is an increasing level of support for the adoption of an ecosystems approach in decision making processes as well as in decision support tools such as strategic environmental assessment and environmental impact assessment. The Natural Environment White Paper[6] refers to the need to properly value the economic and social benefits of a healthy natural environment as well as its intrinsic value, and placing the value of nature at the heart of decision making. The Defra policy statement on 'The appraisal of flood and coastal erosion risk management' (2009)[7] states that 'where practical, environmental impacts should be assessed using an ecosystem services approach'. Further support for the approach can be found in the Scottish Strategic Environmental Assessment Review[7] and the International Finance Corporation's Performance Standards on Environmental and Social Sustainability[8]. Additional information on the ecosystems approach is provided in Fig 2.1.

[5] Paragraph 1 of the preamble to Directive 2001/42/EC

[6] HM Government (2011), The Natural Choice: Securing the value of nature, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228842/8082.pdf

[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69419/pb13278-erosion-manage-090619.pdf

[7] Scottish SEA Review: http://www.sepa.org.uk/planning/sea/scottish_sea_review.aspx

[8] International Finance Corporation's Performance Standards on Environmental and Social Sustainability: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_handbook_pps

Fig 2.1 The ecosystems approach

We have used the set of ecosystem service categories that were defined in the water appraisal process of the river basin management plans and based on Defra guidance. They aim to capture how a healthy natural environment provides a range of benefits to society that contributes to the health and wellbeing of people, mitigates extreme weather conditions and maintains the natural systems that our society relies on. For example:

- vegetation, soil and energetic rivers and streams all filter and purify water making it more suitable for drinking and irrigation,
- coastal saltmarsh provides protection from storms,
- floods are mitigated by floodplains providing storage for flood water and by woodland and moorland slowing down the runoff of rainfall into rivers and streams,
- vegetation also has an important role in reducing levels of soil erosion and contributing to more sustainable food production,
- woodland, moorland and wetlands are important stores of carbon, helping to mitigate the emissions of greenhouse gases.

The natural environment is also deeply embedded within the culture of society and is important to people in providing a sense of place, inspiration, spiritual renewal and knowledge about how natural systems operate. For example:

- the natural environment provides the basis for tourism and recreation,
- we designate environmental features, landscapes and habitats that are particularly rare or are valued,
- heritage is part of the landscape and indicates how society has engaged with the natural environment in the past.

The terminology for describing and reporting against ecosystem services can be quite technical, so we have tried to use more everyday terms where possible in this report.

Annex C gives further details of the specific set of ecosystem services used and how they relate to typical environmental components of SEAs.

Alternatives considered

Approach to developing the FRMP

The options for the strategic approach to developing the FRMPs for this first planning cycle (20152021) was considered through a consultation process in 2012. The three options for developing the flood risk management plans were:

- Option A. LLFAs prepare FRMPs for flood risk areas covering local sources of flood risk. The Environment Agency prepares FRMPs for main river, the sea and reservoirs.
- Option B. A consolidated FRMP is produced by the Environment Agency in partnership with others by bringing together information from existing, separate plans.
- Option C. A FRMP is developed in partnership through one integrated process covering all sources of flood risk.

The proposed way forward was published in June 2013, taking account of the feedback from the consultation. The preferred approach to FRMPs in this planning cycle is for the Environment Agency and Natural Resources Wales to prepare consolidated FRMPs in partnership with others by drawing existing information together, building on and supplementing the existing planning process (option B). This approach recognises that there are many plans already developed by various authorities that can be used to develop the FRMP in an efficient and effective way. The difference between the three options is largely related to the approach taken to developing the FRMP, rather than the content of the plan, and as such the three options are not expected to have significantly different environmental effects.

Ongoing and agreed measures from existing plans

As outlined in section 1, a large proportion of this flood risk management plan is directly drawn from plans that are covered by previous consultations and strategic environmental assessments (CFMPs, SMPs, local flood risk management strategies). These plans considered alternatives at the time and at their appropriate scale that do not require review within the FRMP and thus the FRMP SEA.

Proposed measures in the FRMP

The proposed measures of the FRMP for the river basin district aim to build on existing plan measures in setting out the future management needs across catchment, shoreline and local sources of flood risk. At this scale they tend to set preliminary actions for the future investigation and development of business case appraisals and options. Further planning processes and supporting environmental assessments will focus on alternatives at such programme and project level. So the focus of alternatives for this FRMP SEA is limited and has been where the environmental assessment has identified that significant adverse environmental effects are likely from proposed flood risk management measures. This is described in sections 4 and 5.

Habitats Regulations Assessment (HRA)

Amongst the areas that could be affected by the measures in the FRMP are those that are considered to be of international importance for nature conservation. These are designated under the terms of the 'Habitats Directive' (92/43/EEC)[9] or the 'Birds Directive' (2009/147/EC)[10]. These are implemented in England by the Habitats Regulations[12] and require an assessment be undertaken of the effects of the plan on these sites. This is known as a Habitats Regulations Assessment and the requirement applies to the following designations:

- Special Areas of Conservation (SAC) and candidate SACs (cSAC), Special Protection Areas (SPAs, classified under the Birds Directive), Sites of Community Importance (SCIs). and, as a matter of government policy:
- potential Special Protection Areas (pSPA),
- Ramsar sites (sites designated under the 1971 Ramsar Convention for their internationally important wetlands).

These are referred to collectively in this report as 'European sites'.

An HRA will be required to be prepared for each of the final FRMPs in discussion with Natural England, Natural Resources Wales and Scottish Natural Heritage. This will need to take into account how existing plans that have contributed to the FRMP have undergone their own HRA prior to their adoption and may have identified significant effects. In these cases mitigation and/or compensatory measures will have been proposed and approved as part of the adoption of the plans. However, it is not the intention of the final FRMP HRA to reopen consideration of the habitats regulations assessments or the statement of case made as part of the HRA for existing plans.

Effects on SPAs and SACs have also been considered as part of this SEA under the environmental benefit of 'existence value'. In these cases, we have reflected existing HRA findings in the results of the assessment of the overall plan and adopted a precautionary approach. For example where Shoreline Management Plans have cases of impacts on coastal SPAs and SACs that are unable to be mitigated and require compensation.

[9] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna

[10] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds [12] The Conservation of Habitats and Species Regulations (SI 490, 2010) implements the Habitats Directive and certain elements of the Birds Directive.

3. Environmental context for the plan

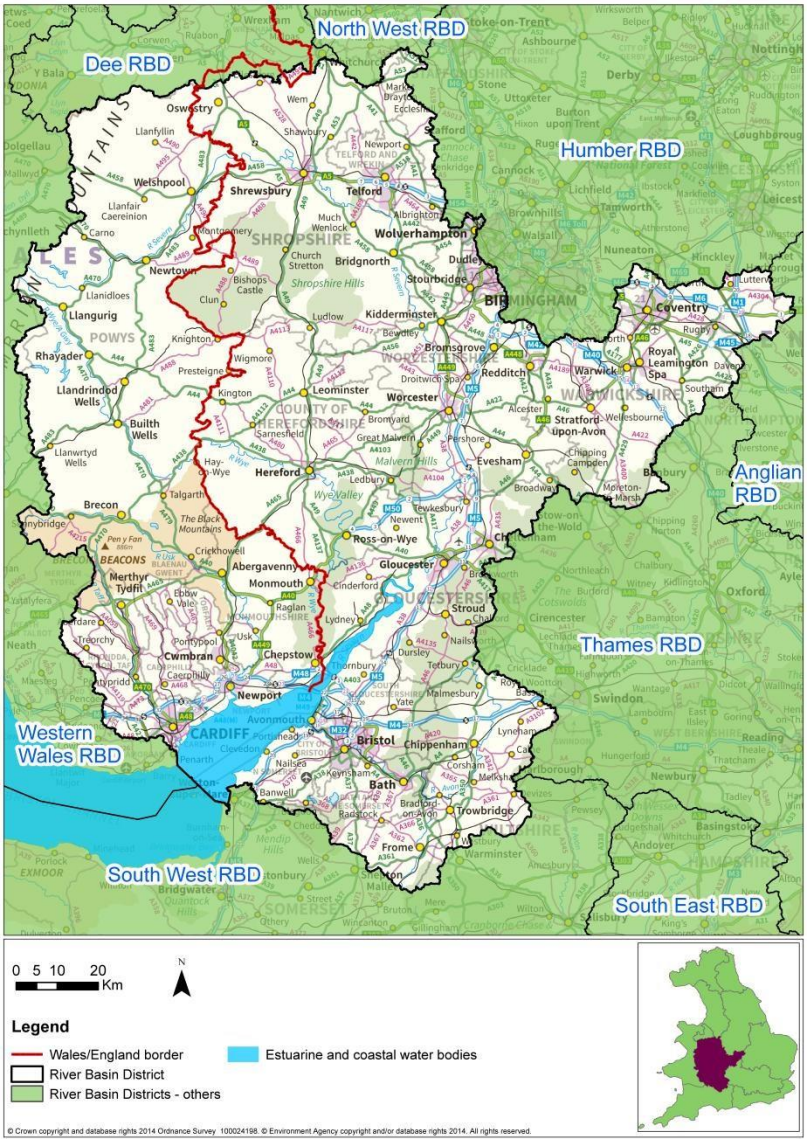
In this section we provide an overview of the environmental context for the Severn river basin district. This covers the physical context, in terms of existing environmental features and sensitivities and the policy and planning context. This section covers:

- The Severn river basin district
- the review of relevant plans and policies

The Severn river basin district

The Severn River Basin District covers an area of over 21,000 square miles extending from the uplands of Wales, down through valleys and rolling hills to the lowlands and the Severn Estuary. As well as the River Severn and its main tributaries, the Warwickshire Avon and the Teme, the river basin district includes the Bristol Avon and rivers of south east Wales including the Wye, Usk and Taff.

Map 3.1 The Severn River Basin District



Although predominantly rural in character, the river basin district has a population of over 5 million people with major urban centres including Bristol, Coventry, Cardiff, the South Wales Valleys and

parts of the West Midlands conurbation. Beyond the main population centres, the river basin district is relatively sparsely populated with less than 10% of the area urbanised.

Within the Severn River Basin District 80% of the land is in use for agriculture and forestry. The sector includes beef and sheep farming, large-scale dairy farms, coniferous forestry plantations and some arable and specialist horticulture. The local economy of the river basin district is dominated by the key sectors of business, transport, health, tourism and recreation together with important areas of manufacturing, such as at Avonmouth, and the minerals industry including sand and gravel extraction within the Severn Valley.

Important infrastructure includes the rail and motorway network linking the South West to the West Midlands, Wales and London (M5, M42, M54, M50, M4); commercial ports at Bristol, Cardiff, Newport and Sharpness; and the canal network such as the Kennet and Avon, Montgomery, Monmouthshire and Brecon, Gloucester and Sharpness canals and the River Severn Navigation. Growth and development pressures within the river basin district are particularly associated with the major towns and cities, but also increasingly the wider settlement network of market towns and villages. Other development pressures include wind energy and transport infrastructure.

The water bodies of the Severn River Basin District's 11 catchments comprise rivers, canals, lakes, estuarine and coastal waters, and groundwater bodies. Latest evidence indicates that nearly 70% of waters in the river basin district are at less than good status, according to the requirements of the Water Framework Directive. The most significant water management issues for the river basin district are pollution from rural areas (especially from agriculture) this affects 32% of waters; pollution from waste water, affecting 32% of water bodies; changes to the natural flow and level of water, affecting 19% of water bodies; and manmade alterations that affect nearly a quarter of the water bodies. Reflecting the rural character of the river basin district nearly 40% of the land area is covered by Nitrate Vulnerable Zones. Other 'protected areas' include Bathing Waters, Drinking Water protected areas (surface and groundwater) and Urban Waste Water Treatment Directive sensitive areas.

Across the Severn River Basin District there are many important habitats and wildlife areas of national and international importance, including the Severn Estuary which is a European Marine Site and a designated Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. Of the European protected sites in the river basin district three SPAs and 27 SACs are water dependent. Many Sites of Special Scientific Interest (SSSI) also have close links with the water environment.

The area also has many designated heritage assets (e.g. scheduled monuments, listed buildings, registered parks and gardens, conservation areas) as for example associated with the historic riverside towns of Shrewsbury, Hereford, Worcester and Tewkesbury and the internationally recognised World Heritage Sites of the Ironbridge Gorge, Blaenavon Industrial Landscape and the City of Bath. Designated landscapes include the Brecon Beacons National Park and a number of Areas of Outstanding Natural Beauty within or partly within the River Basin District (e.g. Mendip Hills, Cotswolds, Shropshire Hills, Malvern Hills, Wye Valley).

A more detailed baseline for those services scoped into the assessment is presented in Section 4. Follow this link to access a map depicting some of the important heritage, biodiversity and landscape designations in the Severn river basin district (https://ea.sharefile.com/d/sba8564a35a2472db).

The environmental baseline has been developed in close collaboration with the draft update river basin management plans. Should you wish to have more detail on the environmental context for each of the management catchments, please refer to the catchment summaries included in the draft Flood Risk Management Plan.

The review of relevant plans and policies within the Severn river basin district

The SEA regulations require that consideration is given to the relationship with other plans and programmes and environmental objectives set at an international, (European) community or

national level. Given the geographical scale of this plan, only policies, plans, strategies and legislation relevant to the river basin district as a whole have been considered as part of this review. Table 3.1 sets out the key themes arising from the policy review. 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 environmental 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. Annex A (Plans, policies and programmes reviewed for the SEA) references the plans that have been considered in the review.

Table 3.1 Key influences emerging from the plans, policies and programme 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 is being prepared in parallel the FRMP. The SEA for this will include a check on alignment with the FRMP.	• 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 risk management plans • Shoreline management plans • Fluvial river Severn FRMS • Severn Estuary FCERM Strategy • Surface water 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 • 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
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,	• All Landscapes Matter • AONB and National Park management plans [Mendip Hills, Cotswolds, Shropshire Hills, Malvern Hills, Wye Valley and Brecon Beacons]

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
	and lead to changes in water quality, quantity and change in habitat type.	

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 coastal erosion due to climate change.	• 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
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 Marine Spatial Plan
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. biodiversity, landscape, cultural heritage, water quality	• Government Forestry and Woodlands Policy • Woodland Strategy for Wales • Wales – A new Strategy for Farming

4. Results of the assessment

In this section we set out the environmental effects of the draft flood risk management plan for the river basin district and flood risk areas. Where

adverse effects occur for proposed measures we have suggested mitigation that will assist in avoiding or reducing them. This section covers:

- an overview of programme of measures
- an overview of the assessment
- the main effects in the RBD of measures covering flooding from main river, sea and reservoirs
- the main effects in flood risk areas of measures covering flooding from local sources

Overview of programme of measures

The draft Severn FRMP covers the 11 management catchments of the river basin district and 1 flood risk area in England (Bristol) and 6 in Wales (Cardiff; Caephilly; Pontypool and Cwmbran; Ebbw Vale; Merthyr Tydfil; Rhondda, Cynon, Taff). The flood risk area measures focus on local sources of flooding, whilst the management catchment measures include statutory measures (covering flooding from main rivers, sea and reservoirs) with voluntary measures on other sources of flooding.

The vast majority of the programme of measures within the Severn draft Flood Risk Management Plan (FRMP) is about ways of protecting communities from flooding, preparing for flooding, and ways to avoid or prevent flooding. The distribution of measures is variable across the River Basin District and its management catchments, this in part reflecting the wide variation in the characteristics of rivers and subsequently the nature of flooding throughout the district. Management catchments with particular concentrations of measures include the Seven Vale, Bristol Avon and North East Somerset Streams, South East Valleys and Warwickshire Avon. Protection measures comprise just over a third of the overall programme with most of these being ongoing or agreed measures and around a third being proposed measures.

A notable feature of the Severn FRMP is the inclusion of four protection measures that apply at the level of river basin district. These district wide measures include encouraging catchment sensitive farming as well as identifying opportunities for floodplain restoration and increasing storage in the upper catchments through detention basins/wetlands/attenuation. The district wide protection measures also include reviewing Asset System Management Plans and delivering emergency works where needed. The separate policy and legal mechanisms of England and Wales across the river basin district have required two strategic areas (one English and one Welsh) to be established that address common river basin measures appropriately either side of the border. In each of the strategic areas for Wales and England two area wide protection measures are identified. In England one of the area wide measures is investigating the benefits of planting wet woodlands to hold water back. Both strategic areas specify a measure for a maintenance programme to replace/refurbish flood risk management assets when needed to reduce flood risk.

The assessment results are presented as a cumulative view of effects across the river basin district from both agreed and ongoing measures drawn from existing plans and accompanying SEAs and proposed measures that are new proposals in the draft FRMP. Mitigation measures and opportunities to realise benefits have been identified for these newly proposed flood risk management measures.

Overview of the assessment

In reviewing the flood risk management measures, we noted the important health and well-being benefits of flood risk measures in general and in particular to:

- prevention measures (for example avoidance measures, land use planning and individual property protection)
- preparedness measures (for example flood forecasting, flood warning and public awareness) and

- recovery and review measures (for example clean-up work and supporting activities following a flood event)

The scoping process focussed the assessment on the statutory flood risk management measures that set the framework for development consent or make a decision about a particular option for managing flood risk. In the draft plan these are generally categorised as protection measures**. The number of protection measures included in the assessment represent just over a third of all the measures included in the draft plan. For those areas in England this included approximately 110 measures from existing plans and around 50 proposed measures. In Wales this included around 70 measures comprising a mixture of existing and proposed measures.**

It is important to recognise that there are a number of uncertainties in carrying out the assessment of the draft FRMP at the river basin district scale. The flood risk management measures that have been scoped into the assessment were considered together as one bundle for each management catchment. This means that detailed information on the location of an individual measure has not been considered, instead we have tried to identify the likely effects across the management catchment. Also, there are many flood risk management protection measures included in the draft plan that identify requirements for further study in a town or rural area to investigate the causes of flood risk and options for management. In these instances, there is no information on the nature and type of flood risk management option that will be delivered on the ground, for example raised defences or a storage solution. This has led to a number of the assessments being carried out on a precautionary basis using our experience of flood risk management activities.

The SEA and HRA requirements of the ongoing and agreed measures from existing plans in the draft FRMP will have been addressed as part of their consultation and adoption processes. In this SEA we have sought to reflect these existing SEA and HRA outcomes by summarising the incombination effects across the catchments of the river basin district. For each ecosystem service, we present the summary of the existing plans separately and as a basis for considering the further effects of the proposed measures in the draft FRMP.

Main effects in the RBD of measures covering flooding from main rivers, the sea and reservoirs

For the RBD, we considered the cumulative environmental effects from statutory FRMP measures covering flooding from rivers, the sea and reservoirs. The statutory measures included agreed and ongoing measures drawn from existing plans, such as catchment flood risk management plans and shoreline management plans, and proposed measures that are new to the FRMP. Measures were grouped together by management catchment to consider their effects within the management catchment. These results were combined to provide a summary of the overall effects of the draft FRMP.

Prevention, preparedness and recovery and review measures

Prevention, preparedness and recovery and review measures have considerable benefits to health and wellbeing. There is strong evidence that demonstrates the adverse health effects of flooding.

Deaths can occur, but more frequent and widespread are the psychological effects. In a study into the social impacts of flooding in Scotland[11], intangible impacts were considered to be more important than material losses. Intangible impacts included the stress of the flood itself, the anxiety of being out of one's home, the discomfort of living in temporary accommodation and the time and effort in dealing with insurers and builders. Longer lasting impacts included the fear of future flooding and the loss of sentimental/irreplaceable items. These effects were exacerbated when they affected low income families, the elderly or other vulnerable groups. The stress can result in physical or mental health problems and has also been shown to exacerbate pre-existing

[11] Werritty A, et al (2007), Exploring the social impacts of flood risk and flooding in Scotland, Scottish Executive Social Research, Edinburgh.

conditions. There are subsequent economic effects on the health care system and businesses whose employees are affected.

Prevention measures offer the opportunity to avoid these adverse social and health effects. Preparedness and recovery measures can provide mitigation to reduce the severity of the effects. For example, the provision of, or improvements to, flood warning enables people to move treasured belongings to a safe place, to deploy individual property protection, to turn off electricity and gas before vacating a property and allows public services to manage closures (such as roads or railways) to improve the safety of the public. These not only reduce the stress of the flooding event itself, but will aid the recovery process.

Protection measures

Table 4.1 sets out the ecosystem services and SEA factors that were identified as being the main ones affected by the protection measures in the draft plan and thus scoped in for assessment

Table 4.1 Ecosystem services scoped into the assessment

Ecosystem Service	Definition	Related SEA factors
Provision of fresh water	People obtain freshwater from rivers and groundwater and it is used, amongst other things, for drinking and irrigation. The provision of freshwater also supports a greater diversity of wildlife.	Water
The natural flow and storage of water (water regulation)	The timing and magnitude of run-off, flooding and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water-storage potential of the system such as the conversion of wetlands or the replacement of forests with farmland or farmland with urban areas.	Population and human health Water Material assets
Soil erosion and sediment in water (erosion regulation)	Vegetative cover plays an important role in soil retention and the prevention of landslides.	Biodiversity, flora and fauna Population and human health Soil
Cultural heritage	Society values the maintenance of both historically important landscapes ('cultural landscapes') and other features (buildings, archaeology, links to past uses of the land).	Cultural heritage Landscape
Recreation and tourism	The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement. Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries.	Population and human health Material assets
Designated nature conservation sites (existence value)	The value that society places on habitats and species regardless of the direct benefits they provide, indicated by national and international designations for nature conservation.	Biodiversity, flora and fauna

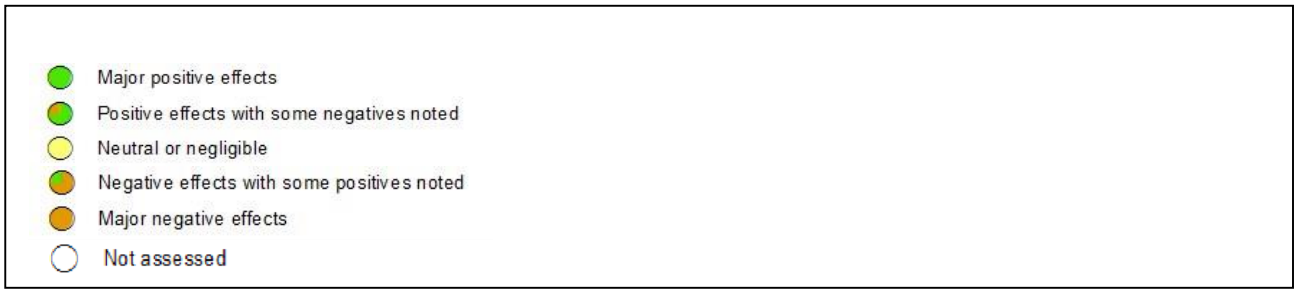
Provision of habitat	Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.	Biodiversity, flora and fauna
Infrastructure (material assets)	Infrastructure is vital to society. It includes housing and infrastructure relating to energy and transport networks, it also includes social infrastructure such as schools, hospitals and other public buildings. It contributes to the quality of life of the population and visitors to the river basin district.	Material assets

The findings of the assessment are set out below, and for each ecosystem service we have described:

- what the service is
- the current baseline
- the future baseline, which assumes that existing flood risk management plans would remain in effect in the absence of the FRMP
- the cumulative effects from the agreed, ongoing and proposed measures the significant effects of the plan

Catchment maps

Maps are presented for selected ecosystem services where they help in understanding the assessment results. There are separate maps for the effects from ongoing/agreed measures and for the effects from proposed measures. The maps depict the mix and scale of positive and negative effects to an ecosystem service (i.e. benefit) in each catchment. 'Neutral or negligible' denotes where the net effects of positive and negative effects are negligible. 'Not assessed' denotes where there were no scoped in measures or the nature of those that were scoped in would not have direct effects on the environmental benefit (ecosystem service).



Key to the scale of assessed effects on the catchment maps

Provision of fresh water

People obtain freshwater from rivers and groundwater and it is used, amongst other things, for drinking and irrigation. The provision of freshwater also supports a greater diversity of wildlife.

What is the current baseline in the River Basin District?

The main issues that affect the availability of water in the Severn River Basin District are water quality and levels of abstraction of ground and surface water resources for public supply, agriculture and industry.

Drinking water abstraction is particularly significant in the Severn River Basin District with the headwaters of many of the rivers modified to form reservoirs that supply drinking water to areas outside of the district, including Birmingham. In Wales this includes, for example, the Elan Valley, Clywedog and Vrynwy reservoirs and the head waters of the River Usk and in England Draycote Water reservoir (Warwickshire Avon catchment) and Trimpley and Chelmarsh reservoirs (Worcestershire Middle Severn catchment). The Severn River Basin District also has important sources of groundwater such as those found within the Shropshire and Worcestershire Middle Severn and Warwickshire Avon catchments.

Across the Severn River Basin District there are high levels of ground and surface water abstraction for public water supplies as well as for agricultural and industrial use. Abstraction can cause damage to the water environment through a reduction in water flow and less dilution of contaminants. In the district 19% of rivers already experience a lack of flow that affects their condition.

Diffuse pollution from agricultural run-off is a significant issue in the Severn River Basin District affecting over 30% of waters. Drinking water supplies are at risk from elevated levels of phosphate, pesticides (especially metaldehyde), sediments and nitrates. Another widespread issue across the Severn River Basin District is nutrients, especially phosphates, entering the water from sewage treatment works from both water company and privately owned. Within the district pollution from waste water affects 32% of water bodies. Elevated levels of nutrients result in algal blooms that can require costly treatment where affecting water bodies used for drinking water supplies and recreation.

Run-off from urban centres such as Coventry, Redditch, Telford, Bristol and Cardiff is a further risk to water quality. In some areas of the district pollution from abandoned mine workings is also a particular issue, such as in the South East Valleys, Severn Uplands, and Teme catchments.

In the absence of the plan, what is the future baseline?

In the absence of the plan the quality and availability of fresh water in the Severn River Basin District is likely to be under increasing pressure due to over abstraction and pollution from agricultural run-off and waste water. In the longer term, pressures on surface and groundwater supplies are likely to further increase due to population growth, urban expansion, economic development, intensive agricultural cropping and climate change. United Kingdom Climate Impacts Programme (UKCIP) predictions, for example, show that temperatures within the Severn River Basin District could rise between 1.2 and 4.4 ^{0}C by 2050. Although the predictions indicate that winter rainfall could increase by 2% to 27%, summer rainfall could decrease by over a third together with increased storm events. This will result in more pressure on water resources during the summer through increased abstraction. More intense rainfall events will also increase the risk of pollution from both point source (sewage treatment works and misconnections) and diffuse pollution as a result of increased surface water run-off and pressures on the capacity of the drainage/sewerage system.

In the absence of the FRMP, existing flood risk management plans and activities would continue. There is the potential for the provision of fresh water to be affected by flood risk management activities under these existing plans as outlined below.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both positive and negative effects on the provision of fresh water at a local scale. A minor positive effect is predicted in nearly all of the management catchments within the Severn River

Basin District. This is primarily the result of river basin district and catchment wide measures included in the FRMP. In particular, the district wide measures are supportive of encouraging changes in land management practices to reduce surface water run-off and soil erosion, such as through soil management plans, cropping techniques, soil compaction and riparian buffer strips. The district wide measures also seek to identify opportunities for floodplain restoration and improving water storage in the upper catchments by, for example, wetland and woodland habitat creation and detention basins. These measures for encouraging natural flood management and supporting catchment sensitive farming will have a positive effect on fresh water by reducing surface run-off and the input of sediments, nutrients and other pollutants to watercourses. Through improving the attenuation and infiltration of surface water run-off, they could also contribute to the replenishment of groundwater sources.

- Other measures that can have beneficial effects locally on the provision of fresh water include opportunities for reductions in the intensity of maintenance operations, such as in the Severn Uplands, Teme and Warwickshire Avon catchments. This can have a positive effect on water quality by reducing disturbance and facilitating in-channel and bank side habitat establishment that will further help to control surface water run-off and the retention of sediments. Measures that help to re-connect watercourses and their natural floodplain will also have beneficial effects on the provision of fresh water by improving the attenuation, storage and infiltration of water and allowing the natural deposition of sediments. These measures include, for example, the removal of existing raised defences in the Worcestershire and Shropshire Middle Severn catchments and managed realignment and associated habitat creation in the Severn Vale and Bristol Avon and North Somerset Streams catchments. The introduction of SuDs in urban and rural areas could also benefit water quality by helping to retain sediments, nutrients and pollutants, as for example in the Stroud and Frome valleys (Severn Vale catchment) and Warwickshire Avon catchment.
- Notwithstanding these positive changes, flood risk management measures for the implementation of flood alleviation schemes that could involve built defences as well as measures for improving the standard of protection of existing flood risk assets (such as in the Severn Vale and Bristol Avon and North Somerset Streams catchments) could have negative effects locally on fresh water. Such measures may sustain or increase the disconnection between a watercourse and its natural flood plain and prevent opportunities for improved storage, infiltration and the natural deposition of sediments. Measures may also result in the loss of habitat that could serve to reduce the attenuation of surface water run-off, sediments and other pollutants.

Proposed measures

- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both positive and negative effects on the provision of fresh water at a local scale. The proposed measures represent a relatively small proportion of the overall plan and for the majority of the management catchments in the river basin district. The proposed measures are also generally more targeted in their spatial extent and focus, in contrast to the river basin district and catchment wide ongoing/agreed measures that could benefit this service more generally at the local level. In Wales no change is predicted in this service in the Usk and South East Valleys catchments based on the assessment of both proposed and ongoing/agreed measures. Across the river basin district, all new flood risk management measures will need to address potential local effects and any required mitigation at the scheme level.

What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on the provision of fresh water across the catchments of the river basin district. There are likely to be both positive and negative effects at a local level from particular types of flood risk management measures. In particular, positive effects at the local level will be supported by the district wide measures for encouraging sustainable farming practices and improving storage in the upper catchments. Such

measures will help to tackle the issue of agricultural diffuse pollution across the rural parts of the district.

Improving the availability and quality of fresh water will benefit wildlife and water dependent habitats and species, fisheries and users such as anglers as well as positively contribute to recreation, tourism and the local landscape. Farmers may incur costs in the short-term due to the loss of agricultural land to habitat creation (such as riparian buffer strips, woodland) or costs associated with changes in land management practices. In the medium to long term, farmers and other abstractors and water companies operating with the river basin district may benefit from reduced maintenance and treatment costs as a result of improvements in water quality as well as benefitting from more sustainable and reliable supplies of water.

In general, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. The potential negative effects on water quality at the local level in the delivery of proposed flood alleviation schemes can be mitigated by minimising habitat loss and including habitat creation as an integral part of scheme design. Wider mitigation approaches might also involve developing schemes that work with natural processes to reduce surface water run-off (such as urban and rural SuDs) and sustain or improve the connection of watercourses with their natural floodplain enabling water storage, infiltration and the natural deposition of sediments. In support of the river basin district wide measure for encouraging catchment sensitive farming there is the opportunity for land management changes to be funded through grant schemes such as environmental stewardship and Glastir.

The natural flow and storage of water (Water regulation)

The timing and magnitude of run-off, flooding and groundwater recharge can be strongly influenced by changes in land cover, including, alterations that change the water-storage potential of the system such as the conversion of wetlands or the replacement of forests with farmland or farmland with urban areas.

What is the current baseline in the River Basin District?

As well as the River Severn and its main tributaries, the Warwickshire Avon and the Teme, the River Basin District includes the Bristol Avon and the rivers of south east Wales including the Wye, Usk and Taff. Over centuries human activity has altered the natural structure and flow of rivers for many different reasons. The main types of physical modification in the Severn River Basin District includes deepening, straightening and culverting channels for flood defence, drainage and navigation as well as building structures such as weirs, tidal sluices and flood banks. Reservoirs in the upper catchments such as Elan, Pontsticill, Usk and Clywedog provide largely drinking water but also some management of flood waters and low flow attenuation.

These alterations have significant benefits for people and the economy, but many have negative impacts on wildlife, for example, acting as barriers to fish migration and reducing the diversity and quality of habitats. Alterations can also disconnect rivers from their natural floodplain, thus reducing the capacity of areas to naturally retain and store flood water and filter sediments and pollutants.

Nearly a quarter of water bodies in the River Severn are failing to meet their WFD objectives due to physical modifications. In rural areas of the district drainage activities, such as desilting and weed cutting, have created deepened and straightened watercourses with uniform flow and limited vegetation cover resulting in increased rates of run-off and flood risk. High-rates of surface run-off from surrounding agricultural land with associated increases in sedimentation and flow rates further exacerbates flood risk. Existing in-channel structures can also create poor flow regimes and lead to increased rates of sedimentation affecting water flows and flood risk.

Within the Severn River Basin District approximately 100 000 people, just under 2% of the population are at medium to high risk of flooding from rivers and the sea. The majority of the district is of a rural nature with much of this comprising of 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.

In England there are seven Lead Local Flood Authorities with flood risk areas (comprising the Bristol Flood Risk Area) and in Wales six authorities have flood risk areas. The urban areas of the Severn River Basin District, including Coventry, Bristol, Gloucester, Cardiff, and the South Wales valleys, are characterised by heavily modified watercourses with residential and industrial development leading to the loss of the original floodplain. Surface water/sewer flooding is common in many of these larger urban areas, whilst also present in smaller conurbations throughout the catchment. Surface water run-off from urban areas and highways (such as M5 and M42 motorway network) is typically 'flashy', reacting quickly to rainfall events and increasing the risk of fluvial and surface water flooding. Additionally the steep sided nature of many of the South Wales valleys results in very flashy catchments. Areas at risk from coastal and tidal flooding include Cardiff and low lying areas throughout the Severn Estuary.

High rates of surface water run-off and poor attenuation and infiltration reduce the ability of ground water resources to replenish. This affects the condition of ground water bodies as well as their connected watercourses. Across the Severn River Basin District there are high levels of ground and surface water abstraction for public water supplies as well as for agricultural and industrial use. In the Severn River Basin District 19% of rivers already experience a lack of flow that affects their condition.

In the absence of the plan, what is the future baseline?

The ability of water to move naturally within the Severn River Basin District is likely to be under increasing pressure due to new development, agricultural intensification, deforestation and climate change. Urban expansion, for example, will lead to greater rates of surface water run-off and further reduce the capacity of natural floodplains to retain and store flood waters. Agricultural intensification and deforestation could also increase surface water run-off in rural and upland areas of the district. In the longer term the natural movement of water in the district is likely to be under further pressure as a result of predicted changes in climate change. UKCIP predictions show that by the 2050s within the Severn River Basin District winter rainfall could increase from between 2% to 27%. Although summer rainfall is predicted to potentially decrease by over a third, changes in weather patterns may lead to an increase in storm events. Sea levels are also expected to rise and there is likely to be an increase in tidal flood risk. These changes could reduce the availability of water particularly in the summer months, whilst also increasing the number of people and properties at risk from fluvial, tidal and surface water flooding.

In the absence of the FRMP, existing flood risk management plans and activities would continue. The natural flow of water will be affected by flood risk management activities under these existing plans as outlined below.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both positive and negative effects on the natural movement of water at a local scale. A positive change is predicted to occur in all the management catchments within the Severn River Basin District. This is primarily the result of river basin district and catchment wide measures in the FRMP. The effects are presented in the map below.
- In particular, river basin district wide measures set out in the FRMP are supportive of encouraging sustainable land management practices to reduce surface water run-off, such as through soil management plans, cropping techniques, soil compaction and riparian buffer strips. The district wide measures also seek to identify opportunities for floodplain restoration and improving water storage in the upper catchments by, for example, wetlands and woodland habitat creation and detention basins. The parts of the river basin within England, also have a catchment wide measure to investigate the benefits of planting wet woodlands to hold water back this stemming from the Midlands pilot project 'Woodlands for Water'. Particular catchments include similar measures for encouraging natural floodplain restoration as, for example in the Avon rural and Bristol Frome floodplains (Bristol Avon and North Somerset Streams catchment). These types of measures which encourage natural flood management

and improvements in land management will have a positive effect on the natural flow of water by improving the attenuation, storage and infiltration of surface water run-off. This in turn will help to reduce the magnitude of flows entering watercourses and slow their response times with consequent benefits in areas downstream with respect to the possible extent and severity of flooding. The introduction of SuDs in urban and rural areas has the potential to provide similar benefits for improving the attenuation, storage and infiltration of surface water run-off as, for example, in the Frome and Stroud valleys (Severn Vale catchment) and Warwickshire Avon catchment.

- Measures that may lead to reductions in the intensity of maintenance activities (including in the Severn Uplands, Teme, Severn Vale and Warwickshire Avon catchments) can provide positive benefits for the natural movement of water by facilitating more natural watercourses in terms of their channel morphology and habitats. The creation and re-establishment of habitats, for example, will help to further reduce surface water run-off from entering watercourses, whilst improving morphological diversity will help to slow water flows and the response times of watercourses to rainfall events. The possible removal of existing raised flood defences (such as in the Shropshire and Worcestershire Middle Severn catchments and Severn Vale catchment), and opportunities for managed realignment (such as in the Severn Vale and Bristol Avon and North Somerset Streams catchments) together with associated habitat creation are also likely to benefit the natural movement of water. Such measures will help to reconnect watercourses with their floodplain and support their capacity to store water and facilitate its infiltration. Initiatives for managed realignment associated with the Severn Estuary and the tidal extent of the River Severn, are also likely to improve the capacity of these areas to accommodate tidal waters and help to dissipate the erosive capacity of tidal waters as well as improve resilience to storm events.
- Notwithstanding these positive changes, the implementation of flood alleviation schemes and improving the standard of protection of existing flood risk assets can have negative effects on the natural flow of water depending on the type and design of the action/works. This applies particularly to catchments with greater numbers of potential schemes, such as the Severn Vale, Bristol Avon and North Somerset Streams, Warwickshire Avon and South EastValleys catchments. Measures that involve raising existing flood defences in the longer term in response to climate change will sustain or increase the disconnection between a watercourse and its natural floodplain preventing opportunities for improved storage and infiltration. Potential flood alleviation schemes in identified communities that employ hard engineering solutions and result in extensive physical modifications of the channel and banks could also adversely affect natural processes through the loss of habitats, reduced morphological diversity and exacerbating surface water run-off from surrounding areas. Such changes can serve to reduce the capacity of watercourses to naturally retain and store flood water and may increase the magnitude and response times of flows downstream that could increase the risk of flooding.

Proposed measures

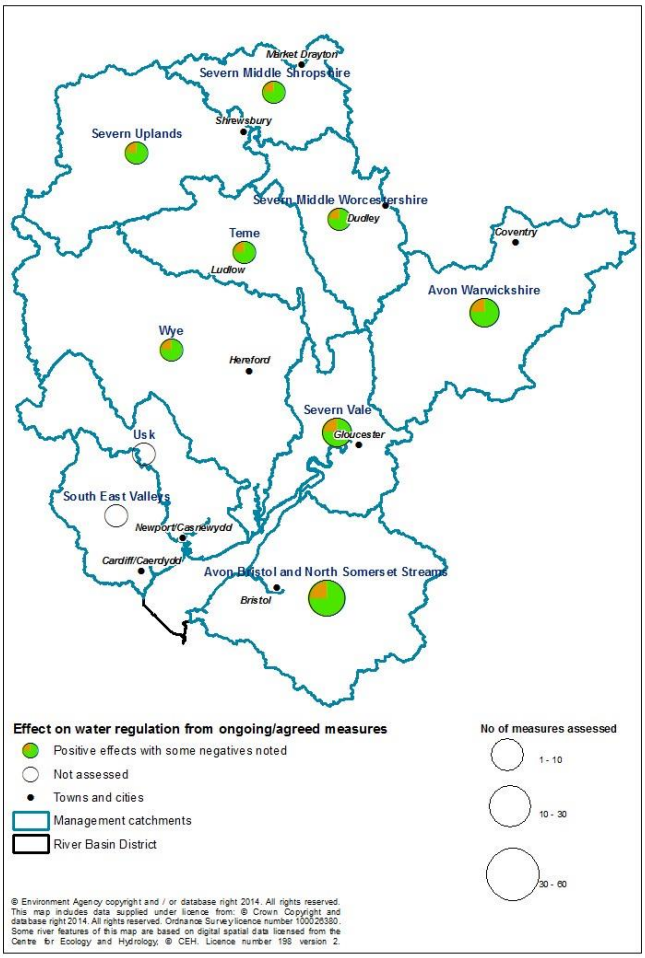
- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both positive and negative effects on freshwater services at a local scale. The proposed measures represent a relatively small proportion of the overall plan and for the majority of the management

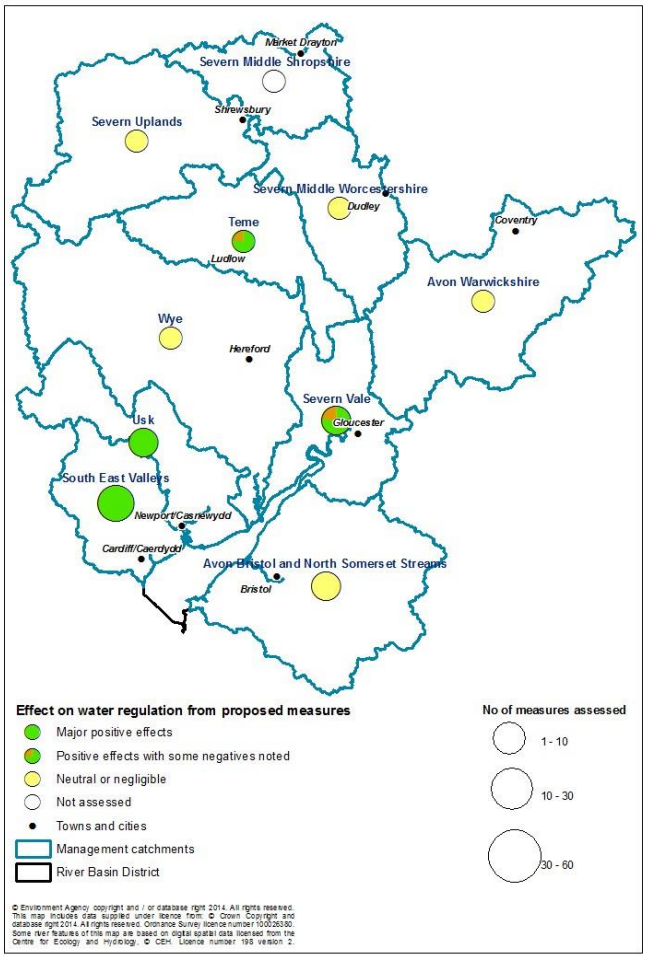
  catchments in the river basin district. The proposed measures are also generally more targeted in their spatial extent and focus, in contrast to the river basin district and catchment wide ongoing/agreed measures that could benefit natural movement of water more generally at the local level. In several catchments proposed measures are likely to complement these district wide measures, such as the ‘Slow the Flow’ initiative in the Teme catchment and the ‘Integrated Project in the Vale of Evesham’ in the Warwickshire Avon catchment. Proposed measures in catchments such as the Severn Vale, Bristol Avon and North Somerset Streams, Warwickshire Avon and South East Valleys include potential new flood alleviation schemes as

well as improvements to existing flood risk assets. These could have adverse impacts on the natural flow of water depending on the type and scale of the action/works.

Map 4.1: Maps showing effects on the natural flow and storage of water (water regulation) from (a) ongoing/agreed measures and (b) proposed measures

(Map Note - for the Welsh management catchments South East Valleys and Usk the number of measures assessed in the map of protected measures is a mixture of ongoing/agreed and proposed measures)





What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on the natural movement of water across the catchments of the river basin district. There are likely to be both positive and negative effects at a local level from particular types of flood risk management measures. In particular, positive effects on the natural movement of water at the local level will to be supported by the district wide measures for encouraging sustainable farming practices and improving storage in the upper catchments. These measures will help to reduce surface water run-off by improving the attenuation, storage and infiltration of run-off, which in turn will help to reduce the magnitude of flows entering watercourses and slow their response times with consequent benefits in areas downstream with respect to the possible extent and severity of flooding.

Those benefiting from changes in natural flow of water will include local communities, businesses as well as farmers and landowners through helping to reduce their vulnerability to flooding. In the short to medium term farmers and landowners may incur costs associated with the loss of productive land for habitat creation or changes in land management practices.

In general, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. In developing proposed flood alleviation schemes and options for improving the standard of protection of existing defences or their refurbishment/replacement consideration should be given to approaches that as far as possible utilise natural processes, such as the use of

SuDs, re-naturalising modified watercourses (such as deculverting), incorporating habitat creation and sustaining/improving the connection of watercourses with their natural floodplain. In England there is the opportunity to use the Midlands Woodlands for Water Project to identify priority areas for woodland planting and management in support of improved water storage in the upper catchments of the district. In support of the district wide measure for supporting catchment sensitive farming there is the opportunity for land management changes to be supported by grant schemes such as environmental stewardship and Glastir.

Soil erosion and sediment in water (Erosion regulation)

Vegetative cover plays an important role in soil retention and the prevention of landslides.

What is the current baseline in the River Basin District?

Rates of soil erosion are influenced by factors such as rainfall, slope, soil type, soil structure and the nature and extent of vegetation cover. Where vegetation is removed through cropping, grazing or deforestation for example, erosion rates generally increase. Agricultural practice is considered to be the main cause of soil erosion in England and Wales.

Three quarters of the land within the Severn River Basin District is managed for agriculture and forestry. Soil erosion and sedimentation is a widespread issue, the majority caused by high rates of surface water run-off from agricultural land (diffuse pollution). This is typically the result of various practices, such as limited riparian buffer zones, intensive cropping (such as associated with potatoes and maize), soil compaction, bank side damage caused by livestock poaching and heavy rainfall events. Altered flow regimes within water bodies caused by channel straightening and artificial bank and bed structures, also contribute to increased rates of erosion.

Within the Severn River Basin District, localised issues such as non-native invasive species such as Himalayan Balsam and Signal Crayfish can further intensify bank side erosion due to the lack of vegetation cover in winter and by undermining bank stability. Sedimentation can be exacerbated in watercourses with low flows as, for example, in areas experiencing high levels of abstraction such as the Worcestershire Middle Severn catchment.

In urban areas of the Severn River Basin District, erosion and sedimentation is also an issue and exacerbated by accelerated rates of surface water run-off, channel modifications leading to reduced flow diversity and the loss of riparian habitats such as bank side trees.

The erosion of former mine working areas and contaminated sediments is a particular issue in catchments such as the Severn Uplands and Shropshire Middle Severn. Upland peat areas, for example in the Usk catchment, are also at risk of erosion. In the South East Valleys and Usk catchments coastal erosion is a reported issue, mainly associated with the huge tidal range of the River Severn.

Soil erosion and sedimentation can impact on water quality with elevated levels of nutrients and pollutants also affecting wildlife and local fisheries. In smaller watercourses flood risk can also be increased due to sedimentation reducing their storage capacity. The abstraction of drinking water may also be hindered, especially on peaty soils, whilst high rates of surface water run-off can affect the replenishment of groundwater resources.

In the absence of the plan, what is the future baseline?

In the absence of the plan it is likely that erosion and sedimentation will continue and possibly become worse due to increased pressures associated with climate change, intensive agricultural production and increased development. In the longer term these changes are likely to lead to higher rates of surface water run-off and consequent increases in erosion, sedimentation and associated pollution from nutrients and other contaminants.

In the absence of the FRMP, existing flood risk management plans and activities would continue as outlined below.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both positive and negative effects on the control of soil and sediment erosion at a local scale. A minor positive effect is predicted to occur in almost all the management catchments within the Severn River Basin District. This is primarily the result of river basin district and catchment wide measures (ongoing/agreed) in the FRMP. The district wide measures are supportive of encouraging changes in land management practices to reduce surface water run-off and soil erosion, such as through soil management plans, cropping techniques, soil compaction and riparian buffer strips. The district wide measures also seek to identify opportunities for improving water storage in the upper catchments by, for example, wetland and woodland habitat creation and detention basins. These measures for encouraging natural flood management will also have positive effects of soil and sediment erosion control by improving the attenuation and infiltration of water, this serving to reduce surface water run-off and associated soil erosion.
- Other flood risk management measures that can have beneficial effects locally include opportunities for reductions in the intensity of maintenance operations, as for example in the Severn Uplands, Teme and Warwickshire Avon catchments. Such measures enable the restoration of more natural river channels and morphological diversity that can help reduce the erosive capacity of flows. The re-naturalisation of water courses, such as through deculverting, and improving their morphological diversity is also likely to help regulate flows and reduce their erosive capacity. Measures that help to reconnect watercourses with their natural floodplain, such as the removal of existing raised flood defences in the Worcestershire and Shropshire Middle Severn catchments and Severn Vale, can also reduce erosion by promoting more natural flows and by increasing the capacity of the river corridor to store water during periods of high flows this helping to dissipate its erosive energy downstream. The introduction of SuDs in urban and rural areas could also benefit erosion rates by improving water attenuation and reducing surface water run-off and associated soil/sediment erosion, as for example in the Stroud and Frome valleys (Severn Vale catchment) and Warwickshire Avon catchment.
- Flood risk management measures can also adversely affect natural soil and sediment erosion control. The implementation of flood alleviation schemes and improving the standard of protection of existing flood risk management assets, such as in the Severn Vale and Bristol Avon and North Somerset Streams catchments, could have negative effects locally on erosion depending on the type and design of actions. For example, works that lead to habitat loss could serve to exacerbate surface water run-off and soil erosion. Schemes involving the artificial modification of a channel or that alter flows as a result of the introduction of a storage area, can also potentially affect the hydromorphology of a watercourse and lead to changes in-channel erosion rates. Maintenance operations may also lead to the loss of morphological diversity within a channel that could serve to increase rates of in-channel and bank erosion.

Proposed measures

- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both positive and negative effects on the control of soil and sediment erosion at a local scale. The proposed measures represent a relatively small proportion of the overall plan and for the majority of the management catchments in the river basin district. The proposed measures are also generally more targeted in their spatial extent and focus, in contrast to the river basin district and catchment wide ongoing/agreed measures that could benefit the service more generally at the local level. In several catchments proposed measures are likely to complement the district wide measures, such as the ‘Slow the Flow’ initiative in the Teme catchment and the ‘Integrated Project in the Vale of Evesham’ in the Warwickshire Avon catchment. In Wales no change is predicted in the Usk and South East Valleys catchments based on the assessment of both proposed and ongoing/agreed measures. There is, however, a degree of uncertainty as to the potential effects of the measures locally, this dependent on the type and scale of the future works/action. Across the river basin district, all new flood risk management measures will need to address at the scheme level potential local effects and any required mitigation.

What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on the control of soils or sediment erosion across the catchments of the river basin district. There are likely to be both positive and negative effects at a local level from particular types of flood risk management measures. In particular, positive effects at the local level will to be supported by the district wide measures for encouraging sustainable farming practices and improving storage in the upper catchments these helping to reduce surface water run-off and soil erosion in the rural parts of the district.

The main beneficiaries of reduced rates of erosion will be farmers in terms of retained soil and nutrients and an improvement in the overall condition of the soil as well as a reduced cost associated with fertiliser inputs and watercourse maintenance. There may also be short term costs linked to the implementation of sustainable land management measures and taking land out of production to create riparian buffer strips. In some instances local communities may benefit from a reduced risk of flooding from smaller watercourses as a result of reduced soil erosion and sedimentation and improvements in the storage capacity of the watercourses. Reducing soil erosion and sedimentation will also benefit wildlife through improved water and habitat quality and increase the sustainability of fish populations. These changes will benefit users such as anglers and support recreation and tourism services in the River Basin District.

Potential negative effects locally on soil and sediment erosion control in the delivery of proposed flood alleviation schemes can be mitigated by minimising habitat loss and including habitat creation as well as by developing schemes that work with natural processes to reduce surface water runoff, such as urban and rural SuDs. In general, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. In support of the river basin district wide measure for encouraging catchment sensitive farming there is the opportunity for land management changes to be funded through grant schemes such as environmental stewardship and Glastir.

Cultural heritage

Society values the maintenance of both historically important landscapes (‘cultural landscapes’) and other features (buildings, archaeology, and links to past uses of the land).

What is the current baseline in the River Basin District?

The Severn River Basin District has a diverse range of designated heritage assets, for example, scheduled monuments, listed buildings, registered parks and gardens and conservation areas. These occur throughout the district and are typically are associated with the area’s historic riverside towns, including Shrewsbury, Hereford, Worcester, Tewkesbury, Monmouth and Stratford-upon-Avon. The district also includes the internationally recognised World Heritage Sites of the Ironbridge Gorge, Blaenavon Industrial Landscape and the City of Bath. Across the Severn River Basin 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.

Cultural heritage also includes historic landscape features such as the network of water meadows along the River Lugg in Herefordshire. Extensive deposits of peat are of archaeological interest and include intertidal and submerged deposits in coastal areas. 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. The mining heritage of the Severn River Basin District 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.

In the absence of the plan, what is the future baseline?

The future baseline for cultural heritage is dependent on the actions of a range of stakeholders (such as public, private and voluntary sectors) to conserve and enhance the historic environment, heritage features and their settings. In the longer term, as a result of climate change, heritage assets may be subject to an increased vulnerability to flooding due to the predicted increase in rainfall during the winter and the likelihood of more frequent and intense storm events. In addition to the damaging effects of flooding on the fabric of historic buildings, the increased severity and frequency of flooding events could potentially affect the viability of keeping a historic building in active use with implications for its future maintenance and condition.

In the absence of the FRMP, existing flood risk management plans and activities would continue. There is the potential for cultural heritage services within the Severn River Basin District to be affected directly and indirectly by flood risk management activities under existing plans as outlined below.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both negative and positive effects on cultural heritage at a local scale. A minor negative change to cultural heritage is predicted in all the management catchments within the Severn River Basin District. All the management catchments within (or partly within) Wales similarly predict a negative change to cultural heritage. This negative change is due to the potential impact of schemes/works on heritage assets in the areas identified as well as the possibility of disturbing previously unrecorded archaeological remains. A significant negative effect is predicted in the South East Valleys management catchment, which includes the Blaenavon Industrial Landscape World Heritage Site and other historic landscapes. Across the management catchments there is varying levels of uncertainty as to the location, type and or design of the measures and hence whether heritage assets could be affected by their implementation at the local level. Experience of delivering local strategies and projects for flood risk management, however, has demonstrated the potential for negative impacts on cultural heritage. The assessment therefore adopts a precautionary approach and indicates the potential for negative change at the local level, although opportunities for positive change are also recognised.
- The types of measures from existing plans that could lead to negative changes to cultural heritage include refurbishing and replacing existing flood defence assets, improving their standard of protection and the development of new schemes in areas with designated conservation areas and other valued historic townscapes and areas including World Heritage Sites and their setting. This includes, for example, Leominster in Herefordshire and towns and villages within the Cotswolds. Negative effects could result from the direct impacts of land take, development within the setting of a heritage asset and changes in the hydrological conditions of water-dependent archaeological and palaeo-environmental remains. Construction works, such as winning material from borrow pits, could also impact on archaeological features.
- River basin district wide measures for reducing surface water run-off and increasing water attenuation and storage in the upper parts of the management catchments (such as wetland habitat creation, detention basins, re-naturalisation of water courses) have the potential to affect archaeological and palaeo-environmental remains, water-dependent heritage assets (such as weirs) and historic landscape features (such as ridge and furrow, water meadows and historic hedgerow networks). The implementation of SuDs in rural areas and linked to new urban development could also affect historic landscape features and archaeology, whilst their use in existing urban areas could potentially affect the historic character of the townscape and the setting of heritage assets.
- Schemes associated with managed realignment, such as in the area of the Severn Estuary, and the removal of existing raised flood defences elsewhere in the River Basin District (such as

the Seven Uplands, Shropshire and Worcestershire Middle Severn catchment), could potentially affect heritage assets located within the natural floodplain of the watercourse. This may result from land take for the relocated defences as well as increasing the magnitude and frequency of inundations. Flood embankments may also be of historic interest in their own right and contribute to the historic character of the local landscape. Changes in the intensity of maintenance operations (such as in the Teme catchment) could negatively affect water dependent heritage assets, such as historic bridges and weirs. For example, there may be instances where existing operations have helped to maintain their condition by preventing their obstruction with debris or the control of vegetation growth that could serve to weaken their structure and fabric.

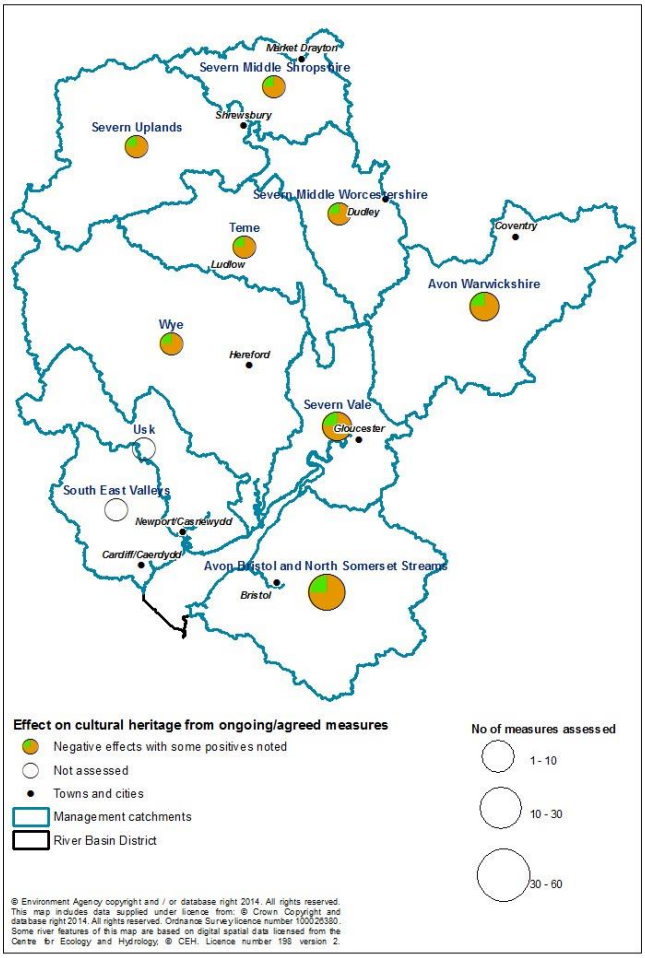
- There is, however, the potential for flood risk management measures to deliver benefits for cultural heritage services at the local level. Locally, the refurbishment/replacement of existing flood risk management assets may provide the opportunity to improve designs that reduce their visual impact on the setting of heritage assets or the surrounding historic townscape. More generally, improvements in natural flow of water in the upper catchments of the district and measures to reconnect rivers with their natural floodplain may help to reduce the magnitude and response times of flows downstream. This could benefit the historic riverside settlements in the district as well as key heritage assets such as the Ironbridge Gorge World Heritage Site (WHS) by reducing the severity and frequency of flooding. Maintaining the level of flood defence and the implementation of flood alleviation schemes in identified communities is also likely to benefit heritage in these areas by reducing their risk of flooding and helping to sustain their continued use and maintenance. Specific heritage assets may also benefit, for example, the National Trust is currently considering flood risk management options for Westbury Court Gardens (Severn Vale catchment).
- In urban areas of the Severn RBD, the introduction of SuDs will help to tackle surface water flooding that is also likely to benefit heritage assets. With careful planning and design the introduction of SuDs may also offer opportunities to enhance the character of historic townscapes.

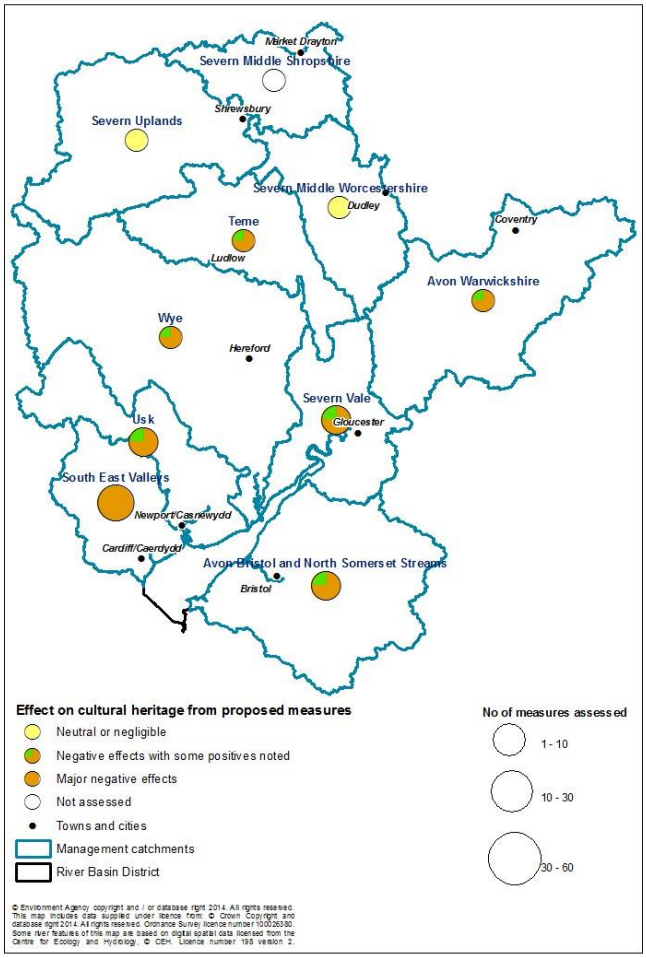
Proposed measures

- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both negative and positive effects on cultural heritage at a local scale. The proposed measures represent a relatively small proportion of the overall plan and for the majority of the management catchments in the river basin district. The proposed measures are also generally more targeted in their spatial extent and focus. Notwithstanding this, the measures still have the potential to adversely affect cultural heritage and as such a minor negative effect at the local level is retained on a precautionary basis. The assessment, for example, indicates a potential minor negative effect where the proposed measures include catchment wide initiatives (for example, Shropshire Slow the Flow, Vale of Evesham Integrated Project, Cotswold, Bristol Avon and Frome corridors) or where they indicate the potential for flood alleviation schemes in areas of established heritage interest (such as Warwick, Stratford-upon-Avon, Bristol, Bath, Monmouth, Chepstow). Across the river basin district, all new flood risk management measures will need to address at the scheme level potential local effects and any required mitigation.

Map 4.2: Maps showing effects on cultural heritage from (a) ongoing/agreed measures and (b) proposed measures

(Map Note - for the Welsh management catchments South East Valleys and Usk the number of measures assessed in the map of protected measures is a mixture of ongoing/agreed and proposed measures)





What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on cultural heritage services across the catchments of the river basin district. There are likely to be both negative and positive effects at a local level from particular types of flood risk management measures.

The assessment of potential negative effects on cultural heritage at the local level adopts a precautionary approach given the high degree of uncertainty across the majority of the river basin district as to the location, type and design of measures and the nature of cultural heritage features that could be affected. Heritage assets are likely to benefit indirectly from the implementation of flood alleviation schemes and increases in the standard of protection of existing defences and the reduced risk of flooding they will bring to the local area. These benefits, however, will be dependent on local circumstances and are considered unlikely to be significant across the river basin district.

Interests affected by the predicted changes include the owners of heritage assets and any associated businesses, residents, visitors and the local tourism economy and the heritage sector.

In general, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. To conserve and enhance the historic environment it will be important that individual schemes/works identify at the earliest opportunity any designated or non-designated heritage features, including the risk of unknown buried archaeology. Although the specific location and design of flood risk management measures is unknown at this stage, there is a significant potential for currently unrecorded archaeological sites to survive within existing rivers. Recent research[12] demonstrates that the lack of systematic study of archaeological sites within existing rivers has left weirs, sluices, bridge remains and other industrial features underrepresented in

[12] http://www.english-heritage.org.uk/publications/heritage-assets-in-inland-waters

existing records. These sites are also often omitted from Listing and Scheduling, despite many of them meeting the criterion for designation. The lack of records for sites of this type should not be taken as evidence of their absence, and the presence of a river corridor indicates an area where significant unrecorded monuments are likely to survive.

The early identification of designated and non-designated heritage assets is required to establish the potential for adverse effects as well as opportunities for providing benefits. This information can then be used to identify scheme options, inform detailed designs and establish an appropriate mitigation strategy. If potential adverse effects are identified, scheme specific mitigation will need to be developed. This should be done in consultation with the relevant organisations, such as English Heritage, Cadw, local authority archaeologists or the relevant Welsh Archaeological Trust and local authority conservation officers Relevant data sets to use in scheme development include the local Historic Environment Record, conservation area appraisals and Historic Landscape Characterisations of rural and urban areas. In the development of proposed schemes there may also be the opportunity to establish community based projects that promote improved understanding of and enjoyment of the heritage, wildlife and recreational use of the water environment.

Recreation and tourism

The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement. Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits.

What is the current baseline in the River Basin District?

Recreational and tourism opportunities within the Severn River Basin District are extremely varied. They range from angling and other water sports to walking and popular visitor destinations such as Stratford-upon-Avon and Bath, the Ironbridge Gorge and Blaenavon World Heritage Sites, the historic towns along the River Severn, the Brecon Beacons National Park and Forest of Dean and the Cotswolds, Malvern Hills and Wye Valley Areas of Outstanding Natural Beauty.

As well as the River Severn and its main tributaries, the Warwickshire Avon and the Teme, the Severn River Basin District includes the Bristol Avon and rivers of south east Wales including the Wye, Usk and Taff. The rivers and canal network, including the Kennet and Avon, Montgomery, Gloucester and Sharpness canals of the district provide a focus for water-based activities, such as boating, canoeing, kayaking and wild swimming as well as walking and cycling on long distance trails and footpaths, including the Severn Way, Avon Way and Taff Trail. Cardiff Bay and Bristol harbour also host a range of water sports, such as rowing, sailing, canoeing, power-boating and white water rafting. Designated bathing waters in the district include Clevedon, Weston Uphill, Weston Main Beach and Sandbay in the Avon Bristol and North Somerset Catchment.

Angling is a popular recreational activity within the Severn Estuary and Inner Bristol Channel as well as along many of the district's rivers, such as the Rivers Wye, Teme and Usk. Bird watching is another popular recreational activity that can contribute to the local tourism economy. The Severn Estuary is a major attraction for its internationally important over-wintering bird species and breeding waders. The Meres and Mosses in Shropshire illustrate how nature conservation and recreation and tourism activities can be mutually supportive. The lakes attract thousands of visitors each year for fishing, boating, sailing, waterskiing and wind surfing as well as offering visitor and educational centres.

In the absence of the plan, what is the future baseline?

The recreational and tourism opportunities of the Severn River Basin District are well established with internationally recognised visitor destinations and attractions. In the longer term, climate change may increase the vulnerability of particular recreational and tourism assets to flooding. As already covered in the assessment of cultural heritage, the predicted increase in rainfall and the intensity and frequency of storm events could result in more severe and frequent flood events affecting the district's historic riverside towns and other heritage assets. Many of these towns are important centres for recreation and tourism, attracting visitors within the area as well as nationally.

Prolonged and more frequent flooding could adversely affect the local tourism economy due to disruption, the costs of repair and a possible decline in visitor numbers due to negative images in the press.

In the absence of the Severn FRMP, existing flood risk management plans would remain in place. There is the potential for recreational and tourism services locally to be affected by flood risk management activities under existing plans as outlined below.

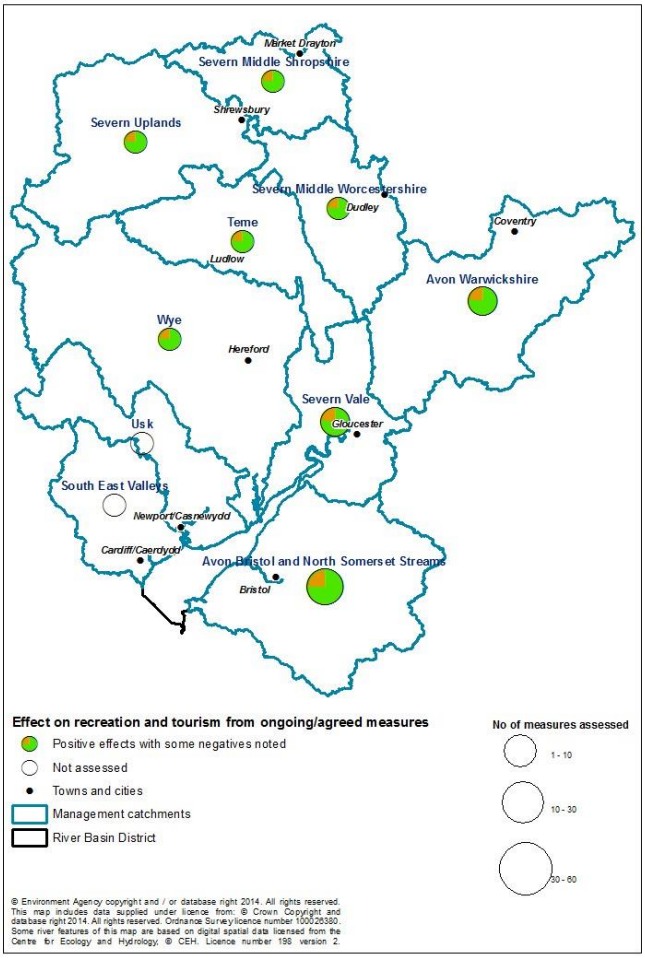
What is the effect of ongoing/agreed measures and proposed measures?

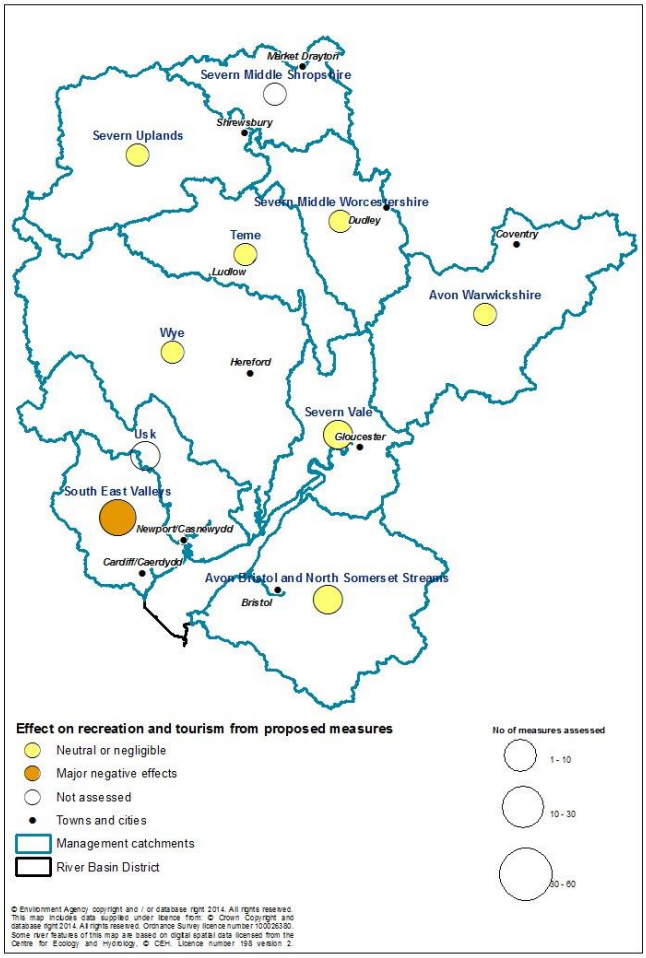
Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both positive and negative effects on recreation and tourism at a local level. A minor positive effect is predicted to occur in all the management catchments within England. This is principally due to the potential positive effects of river basin district and catchment wide measures in these areas associated with habitat creation, re-naturalising watercourses and changes in management practices. The creation of more natural and attractive river environments, for example, can encourage more water-based recreational activities and informal leisure pursuits such as walking and bird watching. Changes in the intensity of maintenance regimes, together with wider improvements in water quality as outlined under the assessment of freshwater services, is likely to improve fish habitats and local fisheries. In the Severn Estuary, opportunities for managed realignment and the creation of intertidal habitat will also further enhance the area's attraction for bird watching.
- More generally, as already outlined in the assessment of cultural heritage services, the local tourism economy may benefit from the reduced risk of flooding of the district's historic riverside towns and other heritage assets. This a consequence of a range of flood risk management measures, including the implementation of flood alleviation schemes, improvements to existing flood defence assets as well as wider district and catchment wide measures for reducing surface water run-off and regulating water flows. The refurbishment or replacement of existing flood defences will also provide the opportunity to improve fish and eel passage, benefitting local fisheries and angling.

Map 4.3: Maps showing effects on recreation and tourism from (a) ongoing/agreed measures and (b) proposed measures

(Map Note - for the Welsh management catchments South East Valleys and Usk the number of measures assessed in the map of protected measures is a mixture of ongoing/agreed and proposed measures)





- Flood risk management measures from existing plans may also adversely affect recreation and tourism at the local level. The implementation of flood alleviation schemes or improvements in the standard of protection of existing flood risk assets, for example, can serve to limit access to a watercourse or hinder its use for water-based activities, such as boating or canoeing. The development of flood alleviation schemes and maintenance activities can also result in the loss of habitat, including fish spawning areas with potential impacts on local fisheries and angling. The creation of SuDs and flood storage areas may affect recreational and amenity land through land-take or limiting their use at certain times of the year. There is also the potential for new flood alleviation schemes and those increasing the standard of protection of existing flood defence assets to impact visually on the surrounding landscape and townscape of places that are valued for their aesthetic qualities and cultural heritage interest, such as villages in the Cotswolds and other AONBs and the district's World Heritage Sites. Measures for managed realignment or the removal/non-maintenance of existing raised defences could affect the local Public Rights of Way network and its use, including long distance footpaths such as the Severn Way. Reductions in the intensity of maintenance operations could also have negative consequences for the aesthetic appeal and attractiveness of watercourses that become overgrown and making them unsuitable for water-based activities. The replacement or alteration of existing flood defence assets (such as tidal and river gates) may also lead to changes in water levels and flows that could potentially impact on the use of a watercourse for recreational activities such as boating or sailing.

Proposed measures

- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both positive and negative effects on recreation and tourism services at the local level. In the majority of catchments the proposed measures represent a relatively small proportion of the overall plan

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and are generally more targeted in their spatial extent and focus, in contrast to the river basin district and catchment wide ongoing/agreed measures that could benefit this service more generally at the local level. A negative change to recreational and tourism services, however, is predicted in the South East Valleys management catchment and parts of the Wye catchment in Wales. This is due to the potential impact of proposed schemes/structures that might be required in the identified communities and their effects on the current landscape, environment and its use for recreation and tourism. In the Wye management catchment, for example, Glasbury, Bulith Wells and Chepstow are all situated adjacent to the River Wye and Llanwrtyd Wells is on the River Irfon. As already outlined in the assessment of cultural services the South East Valleys management catchment includes the Blaenavon World Heritage Site and other valued landscapes that are particularly important recreational and tourism resources in this area. Across the river basin district, all new flood risk management measures will need to address at the scheme level potential local effects and any required mitigation.

What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on recreation and tourism across the catchments of the river basin district. There are likely to be both positive and negative effects at a local level from particular types of flood risk management measures. Positive effects are likely to be localised and serve to further enhance and support the existing recreational and tourism offer of the area. Potential negative impacts on recreation and tourism are also likely to localised and dependent on the detailed location, design and implementation of the measures.

Interests likely to be affected by the predicted effects on recreation and tourism services include local communities, visitors, anglers and fishing clubs, water sports users (such as sailing, boating, canoeing) and local businesses involved in tourism and recreation.

The adoption of appropriate mitigation measures at the project level will be important for those areas of the river basin district, such as in the South East Valleys, where the receiving environment is particularly sensitive. In the development of scheme options and their detailed design and implementation, consideration will need to be given at an early stage to potential negative effects on recreation and tourism services as well as potential opportunities for improvements. In general, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. Relevant interests should be engaged at an early stage, for example, local interest groups (such as fishing and boating clubs), national organisations such as Sport England, and formal and informal recreational users (such as sports clubs, local communities). Opportunities to enhance recreation and tourism services should also be considered as part of scheme development such as improvements to Public Rights of Way or cycle networks and providing better linkages to other amenities/attractions in the local area. There may also be opportunities to engage local communities in the design of flood risk management schemes and to establish community based projects that promote the wildlife, heritage and recreational use of the water environment.

Designated nature conservation sites (Existence values)

The value that society places on habitats and species regardless of the direct benefits they provide, indicated by national and international designations for nature conservation.

What is the current baseline in the River Basin District?

In the assessment, existence values has been defined to specifically consider the impacts of the draft FRMP on internationally designated Special Areas of Protection (SPAs) and Special Areas of Conservation (SACs) and Ramsar sites.

The Severn River Basin District has many important habitats and wildlife areas of national and international importance, including the Severn Estuary a European Marine Site and a designated Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. Of the European protected sites in the district three SPAs and 27 SACs are water dependent, such as the River Wye and its tributaries. In the north of the Severn RBD a notable example is the Meres and Mosses which form the largest and most ecologically diverse cluster of natural wetlands in lowland England, their importance recognised by their designation as Ramsar and SSSIs sites.

There is evidence that the condition of certain designated sites is being affected by water related issues, such as a reduction in water quality, changes in water levels, extensive drainage and inappropriate management. These changes affect habitats and species diversity throughout the river basin district. In the Severn Estuary, for example, priority habitats such as saltmarsh, intertidal mudflats and subtidal sandbanks are not in favourable conservation status. In the Meres and Mosses, it is estimated that 81% of recorded rare plants have become extinct across 13 key sites.

Other aspects of existence values are covered under the assessments of cultural heritage and aesthetic values (landscape or townscape character).

In the absence of the plan, what is the future baseline?

On balance designated sites within the Severn River Basin District are likely to remain the same. Some designated areas are likely to experience localised improvements due to existing initiatives, such as the Meres and Mosses of the Marches Nature Improvement Area. The condition of other designated sites, however, may continue to deteriorate as a result of urban development and agricultural intensification leading to further declines in water quality and hydrological conditions. In the longer term, climate change could further exacerbate these pressures. During the summer months rainfall is predicted to decrease and this could create pressure for increased abstraction with implications for the hydrological conditions of water dependent sites. The predicted increase in winter rainfall, as well as more intense storm events generally, could increase surface water run-off in rural and urban areas with negative consequences for water quality due to increased pollution from sediments, nutrients and other contaminants. Predicted sea level rise may also lead to the deterioration and loss of intertidal habitats within the area of the Severn Estuary. This results from 'coastal squeeze' and inability of these habitats to adapt to the changing conditions due to existing flood defences preventing their natural migration inland.

In the absence of the Severn FRMP, existing flood risk management plans would remain in place. There is the potential for designated sites locally to be affected by flood risk management activities under existing plans. These activities include: the implementation of planned flood alleviation schemes; the refurbishment and or improvement of existing flood defence assets; the creation of SuDs in rural areas and other measures for promoting natural flood management; habitat creation; watercourse maintenance; and initiatives for management realignment. These activities could have direct and indirect effects on designated sites depending on the location, type and scale of the action.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- Adverse effects to designated sites is predicted in five management catchments within the Severn River Basin District, for example the Teme, Severn Uplands,Warwickshire Avon and the Worcestershire and Shropshire Middle Severn catchments. Across these management catchments there is a varying level of uncertainty as to the location, type and or design of the measures and hence whether designated sites could be affected directly or indirectly by their implementation. The assessment therefore adopts a precautionary approach and indicates the potential for negative change, although opportunities for positive change are also recognised.
- Adverse effects are also predicted in a further five management catchments comprising the Severn Vale, Bristol Avon and North Somerset Streams, South East Valleys, Usk and Wye. This principally relates to the Severn Estuary in these catchments and ongoing/agreed

  measures drawn from and informed by existing plans, such as the Shoreline Management Plans and the emerging Severn Estuary Flood Risk Management Strategy. The Habitats Regulation Assessments (HRA) for these plans concluded that the policy options for continuing to maintain flood risk management assets in the area (hold the line policy option), are likely to adversely affect the integrity of the Severn Estuary SAC, SPA and Ramsar site at some locations. No alternative solutions are identified that entirely avoid adverse effects while protecting people and public safety. Consequently, the preferred policy options are being progressed through a statement of case, which considers the case for Imperative Reasons of Overriding Public Interest (IROPI) and compensatory habitat requirements (these based on the

assumption that sea level rises continues at the predicted rate). Priority habitat compensatory schemes (to meet the 1st epoch losses) have already been delivered near Stroat (including Plusterwine and Alvington) and for the Steart Peninsula (South West RBD). In the Severn Vale and particularly in the Bristol Avon and North Somerset Streams catchments, the draft FRMP includes a suite of ongoing/agreed measures focused on investigating the potential for removing existing flood defence assets in support of managed realignment, such as in the Axe Estuary (Somerset) and Minsterworth Ham and Slimbridge (Gloucestershire).

- More generally across the Severn River Basin District flood risk management activities (ongoing/agreed), have the potential to impact negatively on the conservation interest of designated sites as a result of potential direct impacts of land take as well as indirectly through changing the hydrological conditions of designated sites in the vicinity. For example, the creation of SuDs in urban and rural areas and the introduction of detention basins in the upper catchments of the district could potentially affect the hydrological conditions of designated sites by intercepting flows and changing the flow regime of local watercourses. In the Severn Vale and Bristol Avon and North Somerset catchments a number of measures (ongoing/agreed) relate to improving existing flood defence assets and or increasing their standard of protection.
- Measures that are likely to benefit water dependent designated sites across the Severn River Basin District include those that will improve water quality as well as enhance the connectivity of sites and the diversity of habitats in the wider landscape. These measures include, for example, habitat creation associated with district and catchment wide measures for improvements to land management practices, improving storage in the upper catchments (for example, wet woodland creation) and the establishment of more naturalised channels and diverse habitats resulting from changes in maintenance practices.

Proposed measures

- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The proposed measures represent a relatively small proportion of the overall plan and for the majority of the management catchments in the river basin district. The proposed measures are also generally more targeted in their spatial extent and focus. Notwithstanding this, the measures still have the potential to adversely affect designated sites and as such a minor negative effect at the local level is retained on a precautionary basis. In several instances, for example, works could be in close vicinity to the Severn Estuary SAC and SPA (such as in the area of Pill and Oldbury outfalls, Bristol Avon and North Somerset catchment) and will need to be carefully appraised as to any potential direct and indirect impacts. Across the river basin district, all new flood risk management measures will need to address at the scheme level potential local effects and any required mitigation.

What are the main effects and mitigation?

Overall, the Severn FRMP is predicted to have a significant negative effect on coastal designated sites as reflected by the conclusion of the Habitats Regulation Assessment carried out on the Shoreline Management Plans. This takes into account the importance of the Severn Estuary to the River Basin District; the conclusions of the HRAs of existing plans that identified the potential for significant impacts on the Severn Estuary SAC / SPA / Ramsar; and uncertainty as to the effectiveness of measures for compensatory habitat and the delivery of other opportunities for managed realignment and habitat creation in the area of the Severn Estuary. For the significant negative effects identified in relation to the Severn Estuary SAC / SPA / Ramsar compensation is being addressed through the HRA processes and Statement of Case for the Shoreline Management Plans and the emerging Severn Estuary Flood Risk Management Plan. Priority habitat compensatory schemes have already been delivered near Stroat (including Plusterwine and Alvington) and for the Steart Peninsula (South West RBD) As such this effect is expected to reduce over time as the Environment Agency continues to ensure that compensatory measures will be in place to offset predicted losses before they arise and to monitor actual sea level rise to inform later epoch requirements.

Elsewhere, mitigation will be identified and implemented in consultation with relevant organisations at the scheme level. In particular, early consultation with Natural England and Natural Resources

Wales will be required to identify and assess any potential implications for the nature conservation interest of designated sites. Early engagement with nature conservation interests will also enable the identification of possible opportunities for improving the condition and connectivity of designated sites as well as measures for enhancing habitats for protected species.

Provision of habitat

Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.

What is the current baseline in the River Basin District?

The Severn River Basin District has many habitats and wildlife areas of international, national and local importance. The district's network of rivers, canals and other watercourses and wetlands support a variety of water dependent habitats as well as terrestrial habitats associated with the adjacent riparian corridor. There is evidence, however, that the water dependent habitats are being affected by issues, such as a reduction in water quality, changes in water levels, extensive drainage and inappropriate management. These changes affect habitats and species diversity throughout the district.

Water courses throughout the Severn River Basin District, and especially in its urban areas, have been subject to varying degrees of physical modification over many years for flood defence, drainage and navigation purposes. Modifications such as the deepening, straightening and culverting of water courses has resulted in a loss of diversity of in-channel, marginal and bank-side habitats as well as the connectivity between watercourses and their natural floodplain and the wider landscape.

The Severn River Basin District contains a significant number of water bodies that support Salmon and Trout, including the Severn Estuary which is protected as a migratory route for Salmon, Sea Lamprey, Shad and Eels with protected spawning grounds in the Severn Uplands, Teme and Wye catchments. In the district, however, there are over 3,800 river obstructions that potentially stop fish from migrating freely with the result that approximately 11% of rivers have low numbers of fish.

Water bodies and wetlands in the Severn River Basin District also support numerous protected species (for example otter, water vole) and other Priority Species. Although not causing widespread problems, invasive non-native species present within the district include Japanese Knotweed, Himalayan Balsam, Giant Hogweed, American Mink, American Signal Crayfish (for example, in the River Isbourne, Worcestershire), Common Cord Grass (such as in the Severn Estuary) and Zebra Mussels (for example, in Cardiff Bay and the lower and middle Severn).

In the absence of the plan, what is the future baseline?

In the medium term the natural environment within the Severn River Basin District is likely to remain the same, with some areas experiencing localised improvements and others possible deterioration. In the longer term, however, climate change may have implications for the habitats and species in terms of their extent, distribution and condition across the river basin district.

In the absence of the Severn FRMP, existing flood risk management plans would remain in place. There is the potential for the natural environment to be affected by flood risk management activities under existing plans as outlined below.

What is the effect of ongoing/agreed measures and proposed measures?

Ongoing/agreed measures

- The flood risk management measures brought forward from existing plans are likely to have both positive and negative effects on habitat and green infrastructure at a local level. A minor positive change to habitat is predicted to occur in nearly all of the management catchments within the Severn River Basin District. This is principally due to the potential positive effects of river basin district and catchment wide measures that encourage habitat creation such as wet

woodlands, the re-naturalisation of watercourses and deliver improvements in water quality. In the South East Valleys Management Catchment a minor negative effect is predicted (based on existing and proposed measures. In this catchment localised negative effects in the short-term are considered likely due to the loss of habitats from the implementation of future schemes and the planned capital and maintenance programme.

- Measures that are likely to benefit habitat in the Severn River Basin District include district wide measures (ongoing/agreed) for sustainable land management practices and improving storage in the upper catchments (this including wetland creation) and in England initiatives associated with planting wet woodlands in support of natural water management as informed by the West Midlands pilot project 'Woodlands for Water'. Also beneficial will be the establishment of more naturalised channels and diverse habitats resulting from changes in maintenance practices, such as in the Severn Uplands, Teme, Severn Vale and Warwickshire Avon catchments. Habitat creation in association with opportunities for the removal of existing raised flood defences is likely to have a positive effect locally, as for example in the Shropshire and Worcestershire Middle Severn catchments. In the Severn Vale and Bristol Avon and North Somerset Streams catchments, schemes associated with managed realignment in the area of the Severn Estuary are likely to provide important opportunities for habitat creation, including wetlands, intertidal habitats and flood plain grazing marsh.
- Flood risk management measures from existing plans may also have negative impacts on habitats at the local level. The implementation of flood alleviation schemes and improvements in the standard of protection of existing flood risk assets can result in the loss of habitat through land-take as well as modifying the natural form and functioning of watercourses with consequent impacts on habitat diversity for fish and other protected species (such as water voles). The development of new schemes and the introduction of SuDs and flood storage basins can also lead to changes in the hydrological regime of water dependent habitats in the surrounding area. The implementation of measures, such as SuDs and flood storage basins, however, may also incorporate habitat creation and enhancement as an integral part of the scheme design. Maintenance activities, can negatively impact fish habitat by reducing the morphological diversity of the channel and increasing sedimentation. The refurbishment/replacement of existing flood defence assets will, however, provide the opportunity to improve fish and eel passage in order to comply with European Directives.

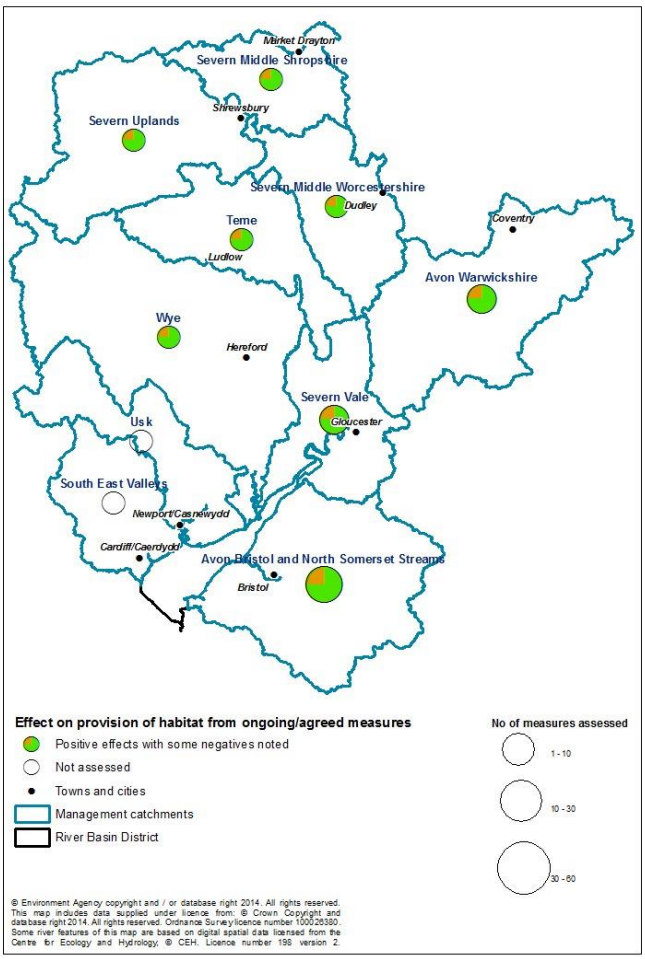
Proposed measures

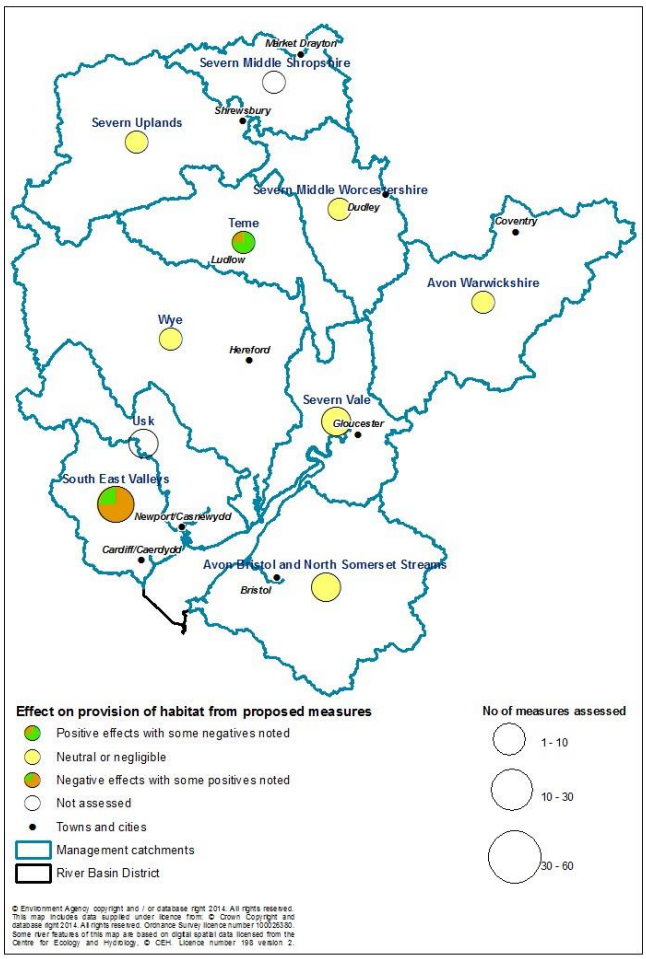
- The new flood risk management measures continue the ongoing programme of protection of communities at risk covered by existing plans. The main effects on the environment are broadly similar to these ongoing/agreed measures and are also expected to have both positive and negative effects on habitat and green infrastructure at the local level. In the majority of catchments the proposed measures represent a relatively small proportion of the overall plan and are generally more targeted in their spatial extent and focus, in contrast to the river basin district and catchment wide ongoing/agreed measures that could benefit habitats more

  generally at the local level. In several cases proposed catchment level projects will serve to complement the district level measures. In the Teme catchment, for example, the proposed 'Slow the Flow' project complements the catchment wide measures for promoting natural flood management processes including habitat creation opportunities. Similarly, the Vale of Evesham Integrated project in the Avon Warwickshire catchment will consider Water Framework
  Directive delivery, habitat and flood risk management issues across area. In the South East Valleys catchment, the assessment highlights the comparatively large number of proposed measures that could involve new schemes or actions that might have an adverse impact on habitats locally. Across the river basin district, all new flood risk management measures will need to address at the scheme level potential local effects and any required mitigation.

Map 4.4: Maps showing effects on the provision of habitat from (a) ongoing/agreed measures and (b) proposed measures

(Map Note - for the Welsh management catchments South East Valleys and Usk the number of measures assessed in the map of protected measures is a mixture of ongoing/agreed and proposed measures)





What are the main effects and mitigation?

Overall, the Severn FRMP is not expected to have significant effects on habitat across the catchments of the river basin district. There are likely to be both positive and negative effects at a local level from particular types of flood risk management measures. In particular, positive effects at the local level will to be supported by the district and catchment wide measures that encourage habitat creation such as wet woodlands, the re-naturalisation of watercourses and deliver improvements in water quality as, for example, through encouraging sustainable farming practices.

Mitigation for potential negative effects on habitats will be identified and implemented in consultation with relevant organisations at the scheme level. In the development of scheme options and their detailed design and implementation, consideration will need to be given at an early stage to potential negative impacts on habitats and protected species. This should be informed by appropriate and timely ecological surveys and appraisals, and the involvement of relevant interests such as Natural England, Natural Resources Wales, Local Wildlife Trusts, local authority ecologists and local wildlife groups. Early consideration should also be given to opportunities for improving the diversity, extent, condition and connectivity of water-dependent and priority habitats as well as improving fish and eel passage and habitat diversity. The development of schemes at the project level may also provide the opportunity to engage local communities in their design as well as to establish community based projects that promote the wildlife, heritage and recreational use of the local water environment.

Infrastructure for communities (Material assets)

Infrastructure is vital to society. It includes housing and infrastructure relating to energy and transport networks, it also includes social infrastructure such as schools, hospitals and other public buildings. It contributes to the quality of life of the population and visitors to the river basin district.

What is the current baseline in the River Basin District?

Throughout the Severn River Basin District there is a wide range of material assets associated with its cities and towns, transportation network, economy and energy infrastructure. Over 5.75 million people live and work in small or medium sized towns and cities within the Severn river basin district. Over 30,000 are at high risk from flooding, with a further 62,000 at medium risk. There is a wide variety of community types within the area, from those in heavily urbanised areas to rural farms. From a flooding perspective, communities within this basin district are vulnerable from a variety of issues and different flooding sources. For example, 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 district is also relatively low at just under 4%. 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 river basin district is also low at just under 3%. Surface Water/sewer flooding, however, is common in many of the larger urban areas; these include Cardiff and the South East Valleys of Wales, Bristol, the Black Country and Coventry as well as some smaller conurbations throughout the catchment. Within these more localised areas the percentage of people and properties at risk may be higher.

The rail and motorway network of the River Basin District links the South West to the West Midlands, Wales and London (including the M5, M42, M54, M50 and M4) with the primary road network (including to the west A5, A49 and to the east A429, A44) providing key links nationally as well as within the River Basin District. Major river crossings include the Severn Bridge and Second Severn Crossing, whilst in the many of the district's riverside towns bridges provide access to the central urban areas and to the surrounding areas. The Bristol Avon and North Somerset Streams catchment includes the commercial ports of the Royal Portbury Docks and Avonmouth that is also part of the Avonmouth Severnside Enterprise Area and a strategically important employment location.

Much of the Infrastructure in the river basin district 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 and M50 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.

Due to the nature of the Severn river basin district 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. **In the absence of the plan, what is the future baseline?**

Material assets can be at risk of flooding from different sources, such as fluvial, tidal and surface water depending on their location. Flood risk management measures in general, whether related to prevention, protection, preparedness, and recovery and review, are all likely to indirectly benefit material assets where they are in place in the local area. In the longer term, however, climate change may increase the vulnerability of material assets to flooding as a result of increased rainfall and more intense storm events as well as an increased risk of tidal flooding due to a rise in sea levels.

What are the main effects and mitigation?

Existing and proposed measures in the draft FRMP are likely to benefit material assets directly and indirectly through helping to reduce their risk of flooding. Measures, for example, that will serve to support the natural flow of water generally across the river basin district are also likely to benefit material assets in the district's urban and rural areas. More specifically, the draft FRMP includes a range of measures that seek to investigate and look to reduce flood risk for particular types or groups of material assets. This includes measures relating to the rail and road network, as for example in the Warwickshire Avon and Bristol Avon and North Somerset Streams catchments. There are also specific measures relating to the ports and employment areas at Royal Portbury Dock and Avonmouth, and more general measures that seek to minimise the impact of flooding on community services such as schools, hospitals, nursing/care/retirement homes, police stations, fire and ambulance stations, sewerage treatment works and electricity installations (Warwickshire Avon catchment). Such measures could involve maintaining and improving the standard of protection of existing flood risk management assets, the development of new flood risk management schemes as well as the use of SuDs and other measures linked to prevention (including planning policy, adapting properties) and preparedness (including emergency response planning).

More generally, protection measures relating to sustaining or improving the standard of protection of existing flood risk management assets can serve to directly benefit important infrastructure. An example of this is sustaining the standard of protection of sections of flood embankment in the area of the Severn Estuary and the benefit this has for reducing the flood risk of key transportation lines such as the A48 and mainline railway. Additionally, area wide measures across all parts of the river basin district in England and Wales for maintaining existing flood risk management assets through their refurbishment and or replacement will sustain or improve their standard of protection and help to reduce flood risk to local communities, property and infrastructure.

Overall, the full programme of measures in the draft FRMP will have a positive effect on material assets, benefiting property owners, employers, local communities and the users in the wider area that are dependent on the services the material assets provide.

It is considered that this effect is likely to be significant at the river basin district scale as measures to protect material assets will contribute to the regeneration and income generation, maintain key infrastructure and transport links, and contribute to economic growth as well as reducing the risk of flooding to people and property across the Severn river basin district.

Main effects in flood risk areas of measures covering flooding from local sources

As noted in section 1, LLFAs are responsible for ensuring that the flood risk area FRMP meets the requirements of the SEA regulations. We have applied the same approach to the assessment of flood risk area measures to the management catchment measures (as described at the start of section 4) so that they can be considered as part of the cumulative assessment. The majority of measures for the flood risk areas come from local flood risk management strategies that have, or will be, subject to consultation and environmental assessment.

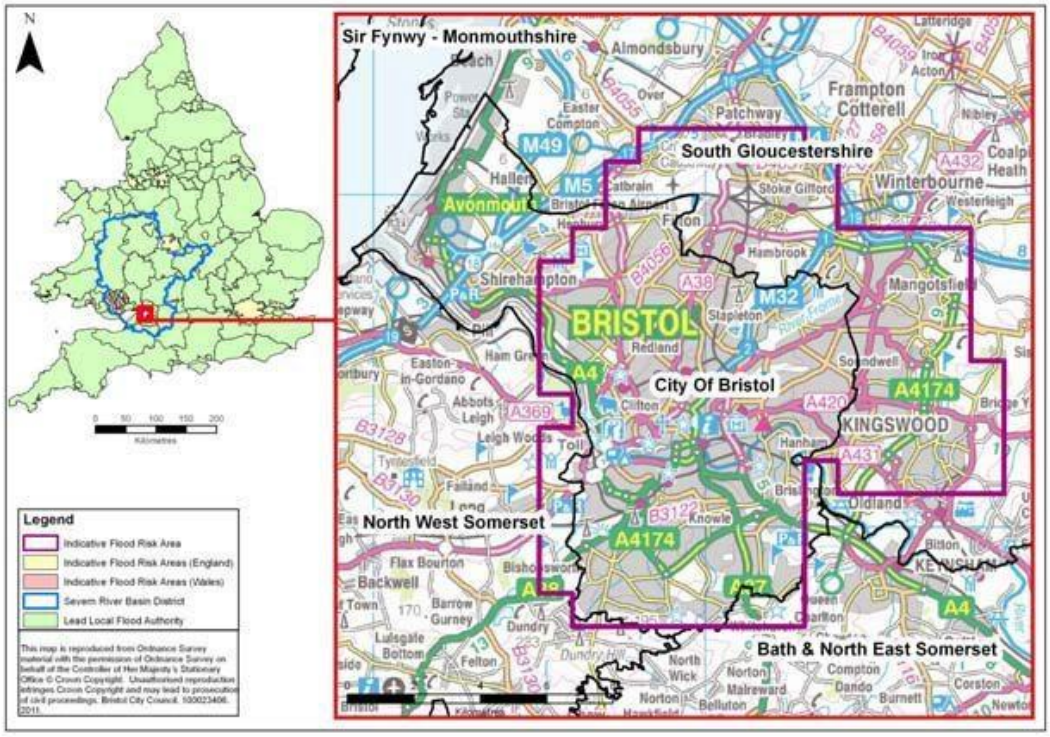
The Bristol Flood Risk Area is included within the draft Severn FRMP and is in entirely within the Bristol Avon and North Somerset Streams Management Catchment (Figure 4.5). The West Midlands Flood Risk Area is included within the draft Humber FRMP and its accompanying environmental report. The Flood Risk Areas in Wales form a separate FRMP.

The Bristol flood risk area

The Bristol Flood Risk Area extends beyond the Bristol City Council boundary and into three neighbouring Lead Local Flood Authority (LLFA) areas. The majority of Bristol City Council lies inside the Flood Risk Area, except for Avonmouth and its surrounding areas. A large proportion of

South Gloucestershire also lies inside the boundary of the Flood Risk Area. However, only small sections of North Somerset and Bath and North East Somerset lie inside the Flood Risk Area.

Figure 4.5: Bristol Flood Risk Area and the Severn River Basin District



In Bristol City Council there are no measures proposed to manage risk from 2015 and beyond. This is because these measures have been taken from the Bristol City Council Local Flood Risk Management Strategies, which have all been consulted on and previously agreed. South Gloucestershire Council is presently preparing its Local Flood Risk Management Strategy. It is anticipated that this will be completed and approved by the end of 2014. The draft FRMP includes the proposed measures to manage flood risk across the South Gloucestershire part of the Bristol Flood Risk Area.

The majority of measures for the Bristol Flood Risk Area relate to prevention, preparedness and protection. Within this overall programme, less than a quarter of the measures relate to protection and across these there is an equal split of measures that are ongoing/agreed and proposed. A large proportion of the proposed measures relate to establishing the policy and implementation framework for Sustainable Drainage Systems (SuDs). Additionally there are proposed measures to agree strategic options for improving flood storage capacity in River Frome and River Avon catchments.

Measures for the Bristol Flood Risk Area were assessed as having potentially positive or negative effects on the following ecosystem services. Appropriate mitigation will be delivered through the respective LLFAs local flood risk management strategies.

The natural flow and storage of water (Water regulation)

There is potential for negative and positive effects on natural flow of water in the Flood Risk Area depending on the location, type and design of the identified measures. A large proportion of measures (ongoing/agreed and proposed) are linked to establishing the policy and mechanisms for delivering SuDs and testing pilots such as in north Bristol. The introduction of SuDs are likely to benefit the natural movement of water by helping to attenuate and store urban surface water runoff and facilitate its infiltration and help to reduce flows entering watercourses within the area. Catchment management measures along the River Frome and Avon corridors for improving natural flood management are also likely to benefit this service through helping to reduce surface water run-off by improving its attenuation, storage and infiltration. There is uncertainty as to the likely practical implementation of SuDs across the flood risk area in relation to new development as well as in the existing urban area. Similarly, there is uncertainty as to the type of action/works that

will be adopted to tackle flood risk in identified communities (such as Long Aston Brook). Overall, it is concluded that positive effect on the natural flow of water is likely to be localised and not significant at the scale of the flood risk area.

Cultural heritage

A negative effect on cultural heritage is predicted for the Bristol Flood Risk Area on a precautionary basis due to uncertainty as to the location and or type of interventions (ongoing/agreed and proposed) and their potential affect on heritage assets in the area. This includes potential schemes/works in Bristol (such as Long Aston Brook) and its suburbs to the north and south and the proposed measures associated with the river corridors of the Bristol Avon and Frome. A large proportion of the measures relate to establishing the policy framework and mechanisms for promoting SuDs and their integration into new development. Where proposals could involve the retrofitting of SuDs in existing urban areas (for example the pilot in north Bristol) consideration will need to be given to potential impacts on heritage assets and the historic character of the area, including any designated conservation areas. Even outside of designated areas there can be valued townscape features, for example, pre and post war planned estates can be of historic interest in their own right as well as still retain features from earlier landscapes such as a historic hedgerow network. Potential impacts on heritage assets will also need to be considered in relation to the proposed measures for improving flood storage in the Bristol Avon and Frome river corridors. Measures, such as detention basins and habitat creation, can impact on historic landscape features as well as archaeological remains. Depending on the location and scale of the interventions potential impacts on the Bath World Heritage Site and its setting would also be important to consider at an early stage. Overall, it is concluded that potential negative effects are likely to be localised and not significant within the flood risk area. Appropriate mitigation will be delivered through the respective LLFAs local flood risk management strategies. The implementation of potential flood alleviation schemes (such as at Long Aston Brook in Bristol) could provide the opportunity to establish community based initiatives similar to the ‘Discover Brislington Brook’ project run by the Brislington Community Partnership. Funded by the Heritage Lottery and Bristol City Council the aims to bring the river to life and enable the people to discover its history and wildlife through fun activities, walks, talks and events.

Designated nature conservation sites (Existence values)

A negative effect on designated sites is predicted for the Bristol Flood Risk Area on a precautionary basis due to uncertainty as to the location and type of interventions (ongoing/agreed and proposed) and their potential affect on designated sites of nature conservation interest in the area (other aspects of existence values are addressed under cultural heritage services and aesthetic values). This includes potential schemes/works in Bristol and its suburbs to the north and south and the proposed measures associated with the river corridors of the Bristol Avon and Frome. The implementation of measures (such as creation of flood storage basins) could negatively impact designated sites through direct impacts such land-take or by indirectly altering the hydrological conditions of designated sites in the local area as, for example, by changing water flows or ground water levels. More generally, natural flood management / catchment management type measures associated with the Frome and Avon corridors could have positive effects by delivering local improvements in water quality and habitat diversity and connectivity through helping to promote sustainable land management practices, riparian buffer strips and habitat creation. Overall, it is concluded that potential negative effects are likely to be localised and not significant at the scale of the flood risk area. Appropriate mitigation will be delivered through the respective LLFAs local flood risk management strategies. In particular, where schemes/works could take place in the vicinity of designated nature conservation sites such as SSSIs, Natural England will need to be consulted to determine any potential negative effects on its nature conservation interest as well as possible opportunities to deliver improvements to the site and surrounding area.

Fresh water provision

There is potential for negative and positive effects on the provision of fresh water in the Flood Risk Area depending on the location, type and design of the identified measures. A large proportion of measures are linked to establishing the policy and implementation framework for delivering SuDs. The introduction of SuDs is likely to benefit fresh water by helping to attenuate urban surface water

run-off and reduce the input of sediments and pollutants to watercourses. Catchment management measures along the River Frome and Avon corridors for improving natural flood management are also likely to benefit fresh water through helping to reduce surface water run-off, soil erosion and the sedimentation of watercourses. There is uncertainty as to the scale and extent of these catchment management measures as well as the likely practical implementation of SuDs across the flood risk area in relation to new development as well as in the existing urban area. Overall, it is concluded that impacts on water quality and availability are likely to be localised and not significant at the scale of the flood risk area.

Soil erosion and sediment in water (Erosion regulation)

A considerable number of the measures relate to the promotion, testing and implementation of SuDs in planning policy and development in support of tackling surface water run-off and flooding. Such measures, and particularly where combined with habitat creation, have the potential to positively support the control of soil and sediment erosion in its urban and rural areas (such as in the Frome Catchment and Avon corridor) by helping to attenuate water, increase infiltration and reduce surface water run-off and the erosion of soil and other sediments. Natural flood management and catchment management measures in the Frome and Avon corridors could also consider opportunities for re-naturalising watercourses. There is uncertainty as to the scale and extent of these catchment management measures as well as the likely practical implementation of SuDs across the flood risk area in relation to new development as well as in the existing urban area. Overall, it is concluded that effects on the control of erosion of soil and sediment are likely to be localised and not significant at the scale of the flood risk area.

Landscape or townscape character (Aesthetic value)

In the Bristol Flood Risk Area the introduction of SuDS and associated habitat creation could serve to enhance the appearance and attractiveness of the urban area by introducing more naturalistic elements. Measures to improve flood storage in the River Avon and Frome corridors, however, will need to have regard to potential impacts on the character of the landscape in these areas depending on the type of intervention, its scale and location. In particular, any works within or in close proximity to the Cotswolds AONB will need to be carefully appraised. Improvements in landscape/townscape could be delivered locally where there are opportunities for re-naturalising and deculverting watercourses. Given the general focus of the measures in the Flood Risk Area and their relative number, it is considered that effects are likely to be localised and not significant within the flood risk area.

Recreation and tourism

There is potential for negative and positive effects on recreation and tourism in the Flood Risk Area depending on the location, type and design of the identified measures. Overall, it is concluded that effects are likely to be localised and not significant at the scale of the flood risk area. Measures within the urban area of Bristol will need to consider potential impacts on recreational provision (formal and informal activities), such as the use of existing urban green space or playing fields for flood storage areas or SuDs as well as any potential impacts on the Public Rights of Way network. Catchment management measures along the River Frome and Avon corridors will also need to consider potential impacts on the character and quality of the landscape, particularly if future actions are likely to extend to the Cotswold AONB and Bath World Heritage Site given their importance for tourism and recreation within the Avon Bristol & North Somerset Streams catchment. Given the general focus of the measures in the Flood Risk Area and their relative number, it is considered that impacts are likely to be localised and not significant at the scale of the flood risk area. As highlighted under the assessment of cultural heritage services, the implementation of potential flood alleviation schemes (such as at Long Aston Brook in Bristol) could provide the opportunity to establish community based initiatives that improve local understanding and use of the water environment.

Provision of habitat

There is potential for negative and positive effects on habitat and green infrastructure in the Flood Risk Area depending on the location, type and design of the identified measures. The future implementation of SuDs in new development may provide the opportunity for habitat creation (such

as wetlands or woodland) as part of their design. Wider proposed measures in the area for improving flood storage capacity in the Frome and Avon river corridors could also involve habitat creation opportunities associated with detention basins, re-naturalising watercourses and changes in land management such as the re-introduction of riparian buffer strips. The implementation of flood alleviation schemes (such as Long Aston Brook), could impact locally on habitat depending on the nature of the preferred option and the inclusion of habitat creation as part of the scheme design. Overall, taking into account the number and range of measures identified for the area it is considered that effects on habitat services are likely to be localised and not significant at the scale of the flood risk area.

Material assets

Flood risk management measures (ongoing/agreed and proposed), whether related to prevention, protection, preparedness, and recovery and review, are all likely to benefit material assets in the Flood Risk Area through helping to reduce their risk of flooding and its consequences. For example, ongoing prevention measures in the Flood Risk Area include collaborative working with Highways Agency and Network Rail to ensure active flood risk management of critical transport links. Prevention measures (ongoing) also include investigating and assessing the need, justification and outline design of a strategic flood mitigation solution for central Bristol - a tourism venue and economic hub, with significant infrastructure and regeneration areas such as the SS Great Britain and Local Enterprise Zone. The implementation of SuDs in the Flood Risk Area will also benefit local communities and property by helping to reduce the risk and or severity of surface water flooding. Overall, it is considered that there is likely to be a positive effect at the local level on material assets within the Flood Risk Area. This takes into account the number and type of protection measures (ongoing/agreed and proposed) identified for the Flood Risk Area. These measures will benefit property owners, employers, local communities and the users in the wider area that are dependent on the services the material assets provide.

5. Summary of results

In this section we summarise the results of the assessment in section 4 and consider the river basin management plan. This section covers:

- summary of main effects, mitigations and other effects considered
- alignment to the river basin management plan

Summary of main effects, mitigation and other effects considered

Overall, the Severn draft Flood Risk Management Plan is anticipated to have mainly positive effects on the water environment, including water quality, the natural flow of water and habitats. Potential negative effects are identified for cultural heritage, designated landscapes and designated sites of nature conservation interest. Table 5.1 summarises the effects of the draft plan on the environment grouped according to SEA receptors headings. This is to provide clarity on the effects of the Severn draft Flood Risk Management Plan on the receptors identified in the SEA regulations. Where negative effects have been identified, mitigation is proposed to manage these effects. Where there are opportunities to increase the positive effects, these have also been recorded.

Table 5.1 Summary of main effects of the draft FRMP

SEA receptor	Summary of effects	Mitigation and opportunity

Water	Localised positive effect associated with improvements in water quality due to reduced surface water run-off in rural and urban areas and the input of sediments, nutrients and other pollutants Localised negative effect on water quality in the delivery of flood alleviation schemes involving built defences due to the reduced attenuation of surface water runoff and sediments as a result of habitat loss and by reducing the capacity of the local area to naturally store water and deposit sediments	Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir The localised negative effects on water quality in the delivery of flood alleviation schemes can be mitigated by minimising habitat loss and including habitat creation as well as by developing schemes that work with natural processes to reduce surface water run-off (such as Sustainable Drainage Systems) and sustain or improve the connection of watercourses with their natural floodplain enabling water storage, infiltration and the natural deposition of sediments
Population and human health	Localised positive effect on regulating river flows and surface water run-off from agricultural land and urban areas by improved attenuation, infiltration and storage of water this helping to reduce and slow flows downstream and reducing the risk of flooding for communities and infrastructure Localised negative effect on agricultural production as a result of land take for new or improved flood risk management assets, habitat creation and changes in the local flooding regime. Localised positive effect on recreation and tourism through improved water quality, fisheries, habitats and attractiveness of	Opportunity in England to use the Midlands Woodlands for Water Project to identify priority areas for woodland planting and management in support of improved water storage Negative effects on agricultural production can be mitigated by avoiding high grade agricultural land and adapting farming practices as well as capitalising on opportunities such as high quality livestock grazing Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir

SEA receptor	Summary of effects	Mitigation and opportunity
	river corridors and reducing the risk of flooding of places and communities providing leisure and tourist destinations Localised negative effect on recreation and tourism in the delivery of flood alleviation schemes due to potential loss of recreational or amenity land, disruption to public rights of way and changes in water levels that could affect water-based activities	All flood risk management schemes/works will need to comply with European regulations to allow fish and eel passage. Opportunities for flood risk management schemes/works to improve fish habitats, especially in areas with important local fisheries Negative effects on recreational and tourism facilities can be mitigated by involving relevant interests at an early stage at the project level to identify possible impacts and agree scheme specific mitigation. Opportunities for schemes to improve public access, interpretation and footpath and cycling networks, and enhance recreational and amenity land Opportunity to engage local communities in the design of flood risk management schemes and to establish community based projects that promote the wildlife, heritage and recreational use of the water environment

Soil	Localised positive effect on soil in the longer term due to reduced rates of soil erosion and nutrient loss from reduced surface water run-off in rural areas	Opportunities for land management changes to be supported by grant schemes such as environmental stewardship and Glastir
Biodiversity, flora and fauna	Localised positive effect on biodiversity, especially water dependent habitats and species, resulting from improvements in water quality, habitat creation (wetlands, wet woodlands) and more natural watercourses Significant negative effect on the integrity of the Severn Estuary (Special Area of Conservation, Special Protection Area, Ramsar site) in some locations associated with actions in existing plans for maintaining flood risk management assets in the area and the impact of this in the longer term on intertidal habitats Localised negative effect on biodiversity and designated sites of nature conservation interest in the delivery of flood alleviation schemes resulting from potential habitat loss and changes to the water environment	Negative effect on the integrity of the Severn Estuary (Special Area of Conservation, Special Protection Area, Ramsar site) will be addressed through the Habitats Regulations Assessments of existing plans and compensatory habitat schemes The mitigation approach for potential negative effects on habitats and species will involve early consultation with nature conservation interests to identify and assess at the project level any potential impacts (including designated sites of nature conservation interest and protected species) and agree scheme specific mitigation. All flood risk management schemes will need to comply with European regulations to allow fish and eel passage. Opportunities also for schemes to improve fish habitats, especially in areas with important local fisheries Early engagement with nature conservation interests will enable opportunities to be identified for improving habitat diversity and the condition and connectivity of sites, and for improving fish and eel passage and other habitats for protected species Opportunities for habitat creation, such as
SEA receptor	**Summary of effects**	**Mitigation and opportunity**
		wetlands, to be included in the design of schemes, including Sustainable Drainage Systems, and for schemes to restore natural watercourses such as by deculverting
Cultural heritage	Localised negative effect on heritage assets subject to the location, type and design of flood risk management schemes Localised positive effects on heritage assets resulting from reduced risk of flooding in the local area associated with the implementation of flood risk management schemes	The mitigation approach at the project level for potential negative effects will include the identification of any heritage assets (including archaeology) and the early engagement of heritage interests to agree scheme specific mitigation Opportunity to engage local communities in the design of flood risk management schemes and to establish community based projects that promote the wildlife, heritage and recreational use of the water environment

Landscape	Localised negative effect on landscapes of recognised importance (Areas of Outstanding Natural Beauty, National Parks) subject to the location, type and design of flood risk management schemes Localised positive effect for urban and rural landscapes associated with the introduction of more naturalistic rivers and habitat creation	The mitigation approach to potential negative impacts will include early consultation at the project level with relevant landscape interests and the undertaking, where necessary, of landscape and visual impact assessments to inform scheme design and mitigation Opportunities to use green infrastructure strategies and landscape character studies to inform habitat creation and project designs
Material assets	Significant positive effect through reduced risk of flooding to infrastructure, services and property Potential localised negative effect on the use of water for other purposes such as navigation and hydropower	The potential negative effect on other uses of water can be mitigated by involving all interests at an early stage at the project level to identify and assess any potential conflicts in use and develop scheme specific mitigation
Climatic factors	Little or no effects	
Air	No effects	

Summary of mitigation measures

Along with the specific mitigation measures set out in table 5.1, the assessment identified a range of future assessment requirements in taking forward proposed measures more locally across the river basin district. These are additional safeguards to ensure that the environmental implications are addressed in related future implementation 'decision making' processes:

- SEA will be undertaken for plans and strategies developed by risk management authorities. This process will also identify local opportunities to integrate environmental benefits into proposed flood risk management solutions. Consideration will be given to the habitat creation and restoration requirements identified as a biodiversity 2020 priority, including rivers that are not part of designated site network, along with site management plans and water level management plans. Existing plans have their own governance structures which embed further environmental appraisal. For example, any modifications to shoreline management plans will go through an agreed change process which includes an environmental assessment.
- Existing plans have their own governance structures which embed further environmental appraisal. For example, any modifications to shoreline management plans will go through an agreed change process which includes an environmental assessment.
- Environmental impact assessment will be undertaken on projects that are likely to have significant environmental effects.
- Strategic flood risk assessments are produced by local planning authorities. These provide advice on flood risk within the local authority in order to influence decisions on the location of development and the incorporation of measures to avoid exacerbating flood risk, such as the use of SUDS.
- Habitats regulations assessments are undertaken to determine whether a proposed, plan, strategy or scheme is likely to adversely affect the integrity of a European designated site.
- Water framework directive assessments are undertaken to assure compliance with WFD objectives where this is feasible.

Other effects considered

The assessment identified other effects on ecosystem services that will need further consideration as part of implementation processes. The details of this are in Annex B and cover the following ecosystem services: Provision of food

- Water for non-consumptive use (the use of water that does not require its consumption)
- Landscape or townscape character (Aesthetic value)
- Supporting ecosystem services

Alignment to the Severn river basin management plan

Cumulative effects can also occur in association with other plans, and or particular relevance is the draft update to the Severn River Basin Management Plan. The draft Severn Flood Risk Management Plan has been developed in parallel to, and has taken account of, the draft update to the River Basin Management Plan, which proposes a programme of measures to improve the water environment. Flood risk management measures can have both positive and negative interactions with the water environment. Flood risk management measures which work with natural processes to help slow flow and store water tend to have beneficial effects on the water environment, whereas measures that involve building defences or artificially regulating water tend to have adverse effects on the water environment. Given the strategic nature of the draft FRMP and its broad scale we have not carried out a detailed WFD assessment of individual flood risk management measures as this will be undertaken at the project level when more certainty is available on the flood risk management measure type and location.

The ecosystem services assessment outlined above identified where there are significant effects from the draft FRMP on the water environment primarily through the fresh water, water regulation (natural flow of water), water purification and waste treatment services, erosion regulation (the natural control of soil and sediment erosion) and provision of habitat services. No significant effects were identified within the River Basin District.

In order to consider the interaction of the FRMP with the RBMP we compared the outcomes of the two environmental assessments for the ecosystem services that are related to the water environment. This is shown in table 5.2. We found that overall the draft FRMP has the potential to complement the positive effects of the draft RBMP with regard to fresh water, natural flow of water, the control of erosion of soils and sediment and habitat. In certain management catchments, such as the South East Valleys, the draft FRMP includes a comparatively high number of measures that could lead to future flood alleviation schemes/works. Depending on the type, scale and design of future actions this could potentially conflict locally with delivering the objectives of the draft RBMP in these areas. In the further development of scheme options in such areas, it will be important that early consideration is given to identifying solutions that address the objectives of both plans.

Table 5.2 Comparison of the outcomes of the draft update to the RBMP and draft FRMP environmental assessments

Service	RBMP assessment	FRMP assessment	Summary
Fresh water	Significant positive effect	Localised positive effect	Potential for measures in the FRMP to support the RBMP
Water regulation	Localised positive effect	Localised positive effect	Potential for measures in the FRMP to support the RBMP
Water purification and waste treatment	Localised positive effect	Neutral effect	No change anticipated as a result of the FRMP
Erosion regulation	Localised positive effect	Localised positive effect	Potential for measures in the FRMP to support the RBMP

Provision of habitat	Significant positive effect	Localised positive effect	Potential for measures in the FRMP to support the RBMP, although potential conflicts in certain catchments depending on the type and scale of actions

6. Monitoring the effects of the plan

This section sets out the monitoring that we propose to understand the significant effects of the plan in practice. The water environment is subject to considerable monitoring activity by the Environment Agency and Natural Resources Wales and others and so we propose an approach that takes advantage of this existing activity.

Measures are required to monitor the significant effects that the flood risk management plan is having on the environment. The indicators have to be practical, cost-effective and strategic, and must inform on the effects of the plan itself, rather than on wider trends. The proposed indicators reflect the effects identified as significant by the SEA process and are set out in table 6.1. Effects of significant individual projects will be monitored according to environmental action/monitoring plans devised during project level environmental impact assessment.

Table 6.1 Proposed sources of information for monitoring significant effects on the environment

SEA receptor	Proposed monitoring indicator	Recent trends	Source
Water	No additional monitoring proposed	Refer to the latest RBMP	Existing monitoring of water body quality and through River Basin Management Plan requirements
Population and human health	Flood risk to people and property	Approximately 100,000 people at medium to high risk of flooding from rivers and the sea	Draft Severn flood risk management plan
Biodiversity, flora and fauna	No additional monitoring proposed	Refer to the latest RBMP	Existing monitoring of water bodies includes benthic invertebrates, fish, phytoplankton and macrophytes.
Cultural heritage	Flood risk to designated heritage assets	Over 3000 listed buildings at medium to high risk of flooding from rivers and the sea Area of scheduled monuments (333 ha), parks and gardens (1435 ha), World Heritage Sites (206 ha) at medium to high risk of flooding from rivers and the sea	Draft Severn flood risk management plan

Material assets	Flood risk to economic activity (including infrastructure)	Over 27,000 non-residential buildings at medium to high risk of flooding from rivers and the sea Length of roads (over 170 km) and railways (approximately 100 km) at medium to high risk of flooding from rivers and the sea	Draft Severn flood risk management plan

7. This consultation

This section sets out how to respond to this environmental report that accompanies the draft FRMP. It provides the questions to prompt in your response to this consultation on the environmental report. It also sets out the next steps in the strategic environmental assessment process to the publication of the final flood risk management plan.

This environmental report has been published with the Severn draft flood risk management plan in October 2014 and is available for consultation for a three month period. In seeking your views on this environmental report we have set out some specific consultation questions provided below:

1. Do you agree with the conclusions of the environmental assessment? (yes / no) If not, please explain why.

2. Are there any further significant environmental effects of the draft plan which you think should be considered? (yes / no).
   If yes, please describe what they are.

   We have described potentially 'negative effects' of the draft plan on the environment which would need mitigation, as well as wider opportunities to achieve 'positive effects'.

3. Are there further mitigations or opportunities that should be considered for the plan? (yes / no)
   If yes, please give details.

Next steps

The flood risk management plan sets out how we will continue to develop the plans taking into account responses to this consultation. As the plan evolves we will consider any implications this might have for effects on the environment as part of our strategic environmental assessment requirements. In particular, if additional flood risk measures are included in the final plan that were not available for the draft plan we will carry out a screening exercise to consider if they are likely to have significant environmental effects and require assessment or further consultation.

The adopted flood risk management plan will be published in December 2015. This will be accompanied by a statement of environmental particulars which will provide:

- summary of how environmental considerations have been integrated into the plan.
- summary of how consultation responses to the draft plan and environmental report have been taken into account (with cross reference to the detailed consultation response report)
- summary of how the plan has changed since the draft plan and what this means in terms of changes to the environmental effects that were reported in the environmental report.
- the reasons for choosing the plan as adopted in the light of alternatives.

- the measures to be adopted to monitor the effects of the plan.

Annex A: Plans, policies and programmes reviewed for the SEA

Table A1 sets out the national plans, policies and programmes and Table A2 those that are only relevant to the catchment or River Basin District. Rather than identify every possible plan or programme we have focussed on those that are likely to significantly influence the plan or our consideration of the environmental effects.

Table A1: National plans, policies and programmes

Policy / Plan / Programme	Published by	Year
Water white paper: Water for life	Defra	2011
Water for people and the environment: Water resources strategy for England and Wales	Environment Agency	2009
A Water Strategy for Wales (In Consultation)	Welsh Government	2014
National Planning Policy Framework	Communities & Local Government (CLG)	2012
Planning Policy Wales (including Technical Advice Notes : Various)	Welsh Government	2012
People, Places, Futures - The Welsh Spatial Strategy	Welsh Government	2008
Natural environment white paper: The natural choice: Securing the value of nature	Defra	2012
Environment Strategy For Wales	Welsh Assembly Government	2006
Sustaining a Living Wales: A Green Paper on a New Approach to Natural Resources Management in Wales	Welsh Government	2012
The Welsh Government Strategy for Tourism 20132020. Partnership for Growth.	Welsh Government	2013
Biodiversity 2020: A strategy for England's Wildlife and Ecosystem Services	Defra	2012
Wales Biodiversity Framework	Welsh Biodiversity Partnership	2010
Wales Fisheries Strategy	Welsh Assembly Government	2008
Government Forestry & Woodlands Policy Statement	Defra	2013
Woodland Strategy for Wales	Forestry Commission Wales	2009
The invasive and non-native species framework strategy for Great Britain	Defra, Scottish Government, Welsh Assembly Government	2008
Coastal squeeze: Implications for flood management. The requirements of The European Birds and Habitats Directives. Defra policy guidance.	Defra	2005
Climbing Higher - The Welsh Government's 20 year strategy for sport and physical activity in Wales	Welsh Assembly Government	2005

Safeguarding our soils: A strategy for England	Defra	2009
Wales Soils Action Plan (In Consultation)	Welsh Government	2014
Understanding the risks, empowering communities, building resilience: The national flood and coastal erosion risk management strategy for England	Defra & Environment Agency	2011
Understanding the risks, empowering communities, building resilience: The national flood and coastal erosion risk management strategy for Wales	Welsh Government	2011
UK Marine Policy Statement	HMG, NI Executive, Scottish Government, Welsh Assembly Government	2011
Welsh Marine Spatial Plan (Emerging)	Welsh Government	tbc
National Policy Statements (Overarching Energy, Renewable Energy, Fossil Fuels, Oil and Gas Supply and Storage, Electricity Networks, Nuclear Power, Ports, Hazardous Waste, Waste Water Treatment)	HMG	2011-12
Managing the Environment in a Changing Climate	Environment Agency	2010
Climate Change Strategy for Wales	Welsh Assembly Government	2010
Low Carbon Wales	Welsh Assembly Government	2010
Low carbon Revolution - The Welsh Government Energy Policy Statement	Welsh Assembly Government	2010
Preparing Wales for Climate Change - Energy Wales a Low Carbon Transition	Welsh Government	2012
The Government's Statement on the Historic Environment for England 2010	HMG	2010
Valuing the Welsh Historic Environment	Valuing Our Environment Partnership	2010
All Landscapes Matter	Natural England	2009
Historic Landscape Register for Wales	CADW, CCW, ICOMOS	2001
Welsh Government Strategic Policy Position on Water	Welsh Government	2011
Rural Development Plan for Wales (2007-2013 and 2014-2020)	Welsh Government	2010
Wales Sustainable Development Scheme : One Wales, One Planet	Welsh Assembly Government	2009
Making the Most of Wales' Coast: ICZ Management Strategy for Wales	Welsh Assembly Government	2007
Farming, Food and Countryside: Building a Secure Future - A New Strategy for Farming	Welsh Government	2009
National Waste Strategy for Wales: Towards Zero Waste 2009-2050	Welsh Government	2010
Metal Mines Strategy for Wales	Environment Agency Wales	2002
Minerals Planning Policy Wales	National Assembly for Wales	2001
Wales Transport Strategy	Welsh Assembly Government	2008

When identifying plans, policies and programmes relevant to the RBD, we have concentrated on those plans that are similar in scale to the Flood Risk Management Plan or are likely to directly impact on the catchments within the RBD. We anticipate that as plans and projects are implemented, the implications of any local plans will also be considered. There are some plans that provide comprehensive coverage across the RBD, for example local council core strategies. Rather than list these individually, we have identified the type of plan.

Table 2:Plans, policies and programmes relevant to the Severn River Basin District

Policy / Plan / Programme	Published by	Year
Emerging River Basin Management Plans [Humber; Thames; Anglian; Western Wales; Dee; South West]	Environment Agency Natural Resources Wales	Ongoing
Unitary Development Plans / Local Development Plans	Local Authorities - Various	Various
Minerals and Waste Plans	Local Authorities - Various	Various
Local and Regional Transport Plans	Various	Various
Strategic Economic and Investment Plans	Local Enterprise Partnerships	Various
Catchment Flood Management Plans [River Severn; River Severn Tidal Tributaries; Wye and Usk; Bristol Avon; North and Mid Somerset; Eastern Valleys; Taff and Ely]	Environment Agency Environment Agency Wales	2009
Severn Estuary Flood Risk Management Strategy	Environment Agency Natural Resource Wales	Ongoing
Wales and Midlands Regional Catchment Abstraction Management Strategies (CAMS)	Environment Agency Environment Agency Wales	Various
Shoreline Management Plans [SMP19 Anchor Head to Lavernook Point; SMP 18 Anchor Head to Hartland Point)	Coastal Group Partnerships	Various
Fluvial River Severn Flood Risk Management Strategy	Environment Agency	2006
River Severn at Gloucester Flood Risk Management Strategy	Environment Agency	2005
River Severn Eel Management Plan	DEFRA	2010
Salmon Action Plans – Various	Environment Agency Environment Agency Wales	Various
Surface Water Management Strategies (Various)	Local Authorities – Various	Various
Water Resources Management Plans (Various)	Water Companies – Various	Ongoing
Drought Plans	Various	Various
SSSI River Restoration Strategies (Teme, Wye & Lugg)	Environment Agency/Natural England	Various
Nature Improvement Areas (Birmingham and Black Country; Meres and Mosses of the Marches)	Various	Various

Nutrient Management Plans	Environment Agency/Natural England	Various
Brecon Beacons National Park Management Plan 2010-2015	Brecon Beacons National Park Authority	2010
Areas of Outstanding Natural Beauty Management Plans	Various	Various
Strategic Waterway Plans (Various)	Canals & Rivers Trust	2013
Ironbridge Gorge World Heritage Site Management Plan	WHS Steering Group	2001
Green Infrastructure Strategies	Various	Various
Biodiversity Action Plans	Various	Various

Annex B: Other effects considered

Effects on other ecosystem services

In addition to these environmental effects outlined above, there were a number of ecosystem services for which minor effects were identified in some of the management catchments. To provide a more complete picture of the likely effects of the plan we have included an oversight of these.

Provision of Food

Ecosystems provide the conditions for growing food. Food comes principally from managed agroecosystems but marine and freshwater systems or forests also provide food for human consumption. Wild foods from forests are often underestimated.

A potential minor negative effect on the provision of food is predicted in three management catchments (Usk, South East Valleys, Bristol Avon and North Somerset Streams). This principally relates to the potential impacts from the land-take of agricultural land arising from the measures, such as the creation of storage areas and new or improved flood embankments, as well as potential changes in production resulting from the removal of existing raised flood defences and managed realignment. These latter measures could have local effects on agricultural production by changing the extent and frequency of inundations from watercourses or the sea. Although the effects are likely to be temporary in non-tidal areas, for tidal areas where managed realignment and habitat creation initiatives are planned, such as in the Bristol Avon and North Somerset Streams catchment, changes in agricultural production may be necessary depending on local circumstances.

More generally, river basin district wide measures to reduce surface water run-off via improved land management practices, including cropping techniques, compaction, soil management plans, and through habitat creation, such as wetlands and woodlands, are likely to support productivity in the longer term by reducing soil erosion and nutrient loss. This is also likely to benefit local fisheries by improved water quality, although any future schemes involving the artificial modification of a channel could adversely affect fish habitat and passage. In the longer term, improvements in natural movement of water across the river basin district have the potential to help reduce the frequency and or severity of flood events affecting agricultural land in the floodplain.

Overall, it is anticipated that impacts on the provision of food are likely to be localised, and measures in the FRMP (ongoing/agreed and proposed) are unlikely to be significant at the scale of the river basin district. Mitigation measures to avoid potential adverse effects will involve taking into account at an early stage potential impacts of measures on high grade agricultural land. Changes in agricultural practices can also be considered, such as the sustainable intensification on smaller areas and alternative crops or stocking regimes. There may also be opportunities for marketing high value alternatives such as saltmarsh/floodplain grazing for livestock. Future schemes and works will need to have regard to potential impacts on fish habitats and passage and ensure that all works are compliant with European Directives as well as seeking opportunities to enhance habitat diversity. This will be particularly important in catchments with locally important local fisheries and or spawning areas, such as the Wye and Usk.

Water for non-consumptive use

The use of water for economic activity that does not involve permanent abstraction, this includes water used for energy generation (hydroelectric, cooling for thermoelectric such as fossil fuel and nuclear plants), navigation and transport.

A potential minor negative effect on this service is predicted in four management catchments (Warwickshire Avon, Seven Vale, Usk and South East Valleys), principally due to the potential effects of measures on the use of watercourses for navigation. This is generally identified as a minor negative effect on a precautionary basis due to the extent of navigational use in these areas (such as on the River Avon and River Severn) and or the type and number of measures proposed (for example, in the South East Valleys). In the Warwickshire Avon and Severn Vale, for example,

catchment wide measures that may involve reducing the intensity of maintenance operations and re-naturalising watercourses that could hinder navigation where this is dependent on existing water flows and depths. Navigation may also be affected by the implementation of future flood alleviation schemes depending on their design and whether they restrict access to the bank or involve structures that cross the channel.

Overall, impacts on this service are likely to be localised and it is not anticipated that measures in the FRMP (ongoing/agreed and proposed) will significantly affect water for non-consumptive uses at the scale of the river basin district. In those management catchments, and elsewhere throughout the river basin district, where watercourses are used for navigation (recreational or commercial), it will be important that all relevant interests are engaged at an early stage to help identify are potential conflicts in use and to inform the location, design and scale of projects/works.

Landscape or townscape character (Aesthetic values)

Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks and scenic drives and in the selection of housing locations.

In a number of catchments, such as the Usk, Severn Vale, Bristol Avon and North Somerset Streams and Warwickshire Avon, a minor negative effect is predicted with respect to aesthetic values. This assessment is on precautionary basis due to uncertainty as to the location, type and scale of the measures and the potential for impacts on nationally designated landscapes in these areas, such as the Brecon Beacons National Park and the Cotswolds AONB. Whilst it is anticipated that measures encouraging improved land management practices, naturalising water courses and natural flood management/catchment management, are likely to have positive effects locally on the character and appearance of the landscape, actions such as the creation of detention/storage basin and larger scale habitat creation (such as wet woodlands) will still need to have regard to potential impacts on the landscape qualities of these designated areas and their setting. Similarly, potential new schemes to reduce flood risk in identified communities (for example, at Monmouth and Chepstow within the Wye AONB and villages within or surrounding the Cotswolds AONB) could be visually intrusive and have negative impacts on the landscape depending on their scale, type and design.

More generally across the river basin district there is the potential for positive impacts on aesthetic values at the local level. Improved land management (such as riparian buffer strips), habitat creation (such as wetlands, wet woodlands) and the naturalisation of watercourses will improve the visual appearance and attractiveness of local areas by introducing a more naturalised river corridor and enhancing the character of the landscape and townscape. Managed realignment and the removal/setting back of defences and associated habitat creation also has the potential to create a more natural appearance. In some instances, however, raised flood embankments may be an established part of the local landscape and link to other services such as recreation and tourism where part of long distance footpaths (such as the Severn Way). Reductions in the intensity of maintenance regimes could also improve the aesthetic appeal of a watercourse by facilitating habitat establishment and a more naturalised and diverse appearance. The replacement/refurbishment of existing flood risk management assets may provide the opportunity for designs to better reflect the local context, for example in terms of their scale, materials and associated landscaping.

Overall, it is anticipated that impacts on landscape character are likely to be localised, and the measures in the FRMP (ongoing/agreed and proposed) will not have a significant effect on this service at the scale of the river basin district.

To mitigate any potential adverse impacts, any scheme/works within or in close vicinity to a designated landscape will require early engagement with the local planning authority and or conservation board. Where actions are likely to involve physical interventions (such as flood storage basins, built structures, raised embankments) a landscape and visual impact assessment may be necessary to help inform the project design. National Park and AONB management plans and landscape character studies and can be used to help identify opportunities for partnership working and to inform project development and design.

Effects on supporting ecosystem services

Supporting services underpin the delivery of all other ecosystem services. They include the formation of soils, the cycling of nutrients and water and the provision of habitat. The National Ecosystem Assessment[13] notes that these services are strongly interrelated and are underpinned by a vast array of physical, chemical and biological interactions. General understanding of these interactions and their influence on supporting services is limited, particularly when considered at a wider scale.

The assessment had identified that these supporting services are likely to be influenced by the flood risk management plan. However, there is a great deal of uncertainty as to the likely scale and therefore the significance of these effects. We have therefore provided an oversight of the likely effects in this section without attempting to assign any significance to these. The one exception to this is the provision of habitat. As the creation and improvement of habitats within the water environment can be affected by flood risk management activities we have addressed this within the section on the assessment of significant effects.

Soil formation

The National Ecosystem Assessment identifies that the main drivers of change in soil formation and associated threats in the UK are land use, climate change and urbanisation. In the last 50 years, UK agricultural soils have been subject to significant change. The flood risk management plan could promote land management measures such as new planting of trees. Significant tree planting on agricultural land could influence soil formation because trees root deeper and accumulate litter and organic matter at the surface, with likely consequences for physical properties and nutrient cycling.

Nutrient cycling

Nutrient cycling refers to the uptake, use, release and storage of nutrients by plants and their environments. The National Ecosystem Assessment noted that the most dramatic trend in nitrogen cycling over the last 50 years has been the enrichment of UK terrestrial habitats with nitrogen due to the application of fertiliser nitrogen in managed land and atmospheric nitrogen deposition in semi-natural systems. Increasing the availability of nutrients can affect the composition and diversity of plant communities, favouring those plants that are fast growing and able to take advantage of the additional resource. The flood risk management plan will have little interaction with either source.

Primary production

Primary production is focused on the formation of biological material by fixing carbon dioxide through photosynthesis and the assimilation of nutrients. The production of food and fibre and the developments that have resulted in increases in yields over the last 150 years are considered to be the main influence on primary production. The addition of nutrients has been successful in increasing primary production for food crops. However, there have been detrimental effects, particularly where this affects water bodies, their water quality and species composition. In some cases eutrophication occurs affecting fish, shellfish and invertebrates in rivers, lakes and marine environments.

The flood risk management plan includes measures that promote river restoration and reconnection of rivers to their floodplains that can reduce the extent to which nutrient enrichment of agricultural land is washed into rivers. This will have the benefit of supporting more efficient use of nutrient enrichment for food and fibre provision, while reducing the adverse effects on the water environment. **Water cycling**

[13] UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, Cambridge. TECHNICAL REPOR**T -** UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment: Technical Report. UNEP-WCMC, Cambridge.

As supporting ecosystem services, water cycling the major water flows (rainfall, evapotranspiration, river flow) and water storage (soil, groundwater, lakes) that combine to determine the availability of water. Human activity has a significant influence over the water cycle through land use, drainage, impounding water, changing the structure of rivers (particularly associated with flood risk management) and abstracting water. The effects of these activities are likely to be exacerbated by climate change, population growth and associated increased urbanisation. These will increase competition for a limited resource, particularly during the predicted dryer summers associated with climate change.

Conflicts in water resource management are common and managing flooding is one such conflict. Flood defences that involve engineered structures can disrupt the water cycle by disconnecting the river from its flood plain, whilst measures that restore rivers and natural processes will help to ensure that water is available to support the provision of other ecosystem services.

Annex C: Ecosystems services approach and SEA

The ecosystems approach is based on the principle that a healthy functioning ecosystem will provide services that derive benefits to society that are essential for sustainable development. Examples include the essentials for life, such as clean air, water, food and fuel; services that help to regulate natural processes such as flooding; and services that contribute to wellbeing and the quality of life, such as recreation and tourism and beautiful landscapes.

Ecosystem services are usually categorised into one of four types of service; provisioning, regulating, cultural or supporting services. Definitions of these are provided in Table C.1.

Table C.1: Definitions of ecosystem service categories*

Ecosystem service category	Definition
Provisioning	Provisioning services are ecosystem services that describe the material or energy outputs from ecosystems. They include food, water and other resources.
Cultural	Regulating services are the services that ecosystems provide by acting as regulators for example regulating the quality of air and soil or by providing flood and disease control.
Regulating	The non-material benefits people obtain from ecosystems.
Supporting	Ecosystem services that are necessary for the production of all other ecosystem services.

* Definitions are adapted from the Millennium Ecosystem Assessment and The Economics of Ecosystems and Biodiversity.

There is no definitive list of ecosystem services, although those set out in the Millennium Ecosystem Assessment, or adaptations of them, are in widespread use. The economic appraisal used an adapted version of the list used by the UK National Ecosystem Assessment to ensure that specific benefits provided by the water environment were accounted for in the assessment. Water for non-consumptive use was added to account for uses of water that provided economic benefit, but didn't require consumption. This includes navigation, ports and harbours, energy generation and cooling water. Existence value was added to account for those components of the ecosystem that are valued regardless of the services society receives from them. In practice, to maintain the strategic level of the assessment we have primarily focused on sites that are internationally designated for their nature conservation value.

Table C.2 sets out the full list of ecosystem services considered as part of the strategic environmental assessment together with a description that provides further explanation **Table C.2: Description of ecosystem services.**

Ecosystem services		Description
Provisioning services	fresh water	People obtain fresh water from rivers and groundwater and it is used, amongst other things, for drinking and irrigation. The provision of fresh water also supports a greater diversity of wildlife.
	food (such as crops, fruit)	Environmental conditions provide the context for growing food. Food comes principally from managed agricultural land but marine and freshwater systems also provide food for human consumption.
	fibre and fuel (such as timber	Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils.
	and wool)	

	genetic resources	This includes the genes and genetic information used for animal and plant breeding and biotechnology.
	biochemical, natural medicines	Many medicines, biocides, food additives such as alginates and biological materials are derived from ecosystems.
	ornamental resources (such as shells)	Animal and plant products, such as skins, shells and flowers are used as ornaments, and whole plants are used for landscaping and as ornaments.
	water for nonconsumptive use	Water has a number of uses that do not require consumption, such as transport (shipping, barges), hydroelectric power generation, cooling water for industry. Changes in quantity or flow can affect this benefit.
Regulating services	air quality regulation	Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.
	climate regulation	Habitats and land cover influence climate both locally and globally. For example, at the local level, changes in land cover can affect both temperature and precipitation. At the global level, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
	water regulation (including flooding)	The timing and magnitude of run-off, flooding and groundwater recharge can be strongly influenced by changes in land cover, including, alterations that change the water-storage potential of the system such as the conversion of wetlands or the replacement of forests with farmland or farmland with urban areas.
	natural hazard regulation	The presence of coastal ecosystems such as saltmarsh can reduce the damage caused by hurricanes or large waves.
	pest regulation	Ecosystems are important for regulating pests that attack plants, animals and people. Ecosystems regulate pests through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.
	disease regulation	Ecosystems are important for regulating vector borne diseases that attack plants, animals and people. Ecosystems regulate diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.
	erosion regulation	Vegetative cover plays an important role in soil retention and the prevention of landslides.
	water purification and waste treatment	The right environmental conditions can help in the filtering out and decomposition of organic wastes introduced into inland, coastal and marine waters and can also assimilate and detoxify compounds through soil and subsoil processes.
	pollination	Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds.
	noise and light regulation	Noise, or unwanted sound, and light can have a negative effect on human well-being and wildlife, but can be regulated by ecosystems.
Cultural services	cultural heritage	Society values the maintenance of both historically important landscapes ('cultural landscapes') and other features (buildings, archaeology, links to past uses of the land).
	recreation and tourism	The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement. Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits.
	aesthetic value	Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for national parks, the selection of housing locations and tourism destination choices.
	intellectual and scientific, education value	Ecosystems and their components and processes provide the basis for both formal and informal research and education.
	inspiration of art, folklore, and so on	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture and advertising.
	social relations	Ecosystems influence the types of social relations that are established and can support social cohesion and community activity.

	spiritual and religious value	Many religions attach spiritual and religious values to ecosystems or their components.
	existence value	The value that society places on habitats and species regardless of the direct benefits it provides, indicated by national and international designations for nature conservation.
Supporting services	soil formation	Because many provisioning services depend on soil fertility, the rate of soil formation influences human wellbeing in many ways.
	primary production	The assimilation or accumulation of energy and nutrients by organisms.
	nutrient cycling	Approximately 20 nutrients essential for life, including nitrogen and phosphorus, cycle through ecosystems and are maintained at different concentrations in different parts of ecosystems.
	water recycling	Water cycles through ecosystems and is essential for living organisms.
	photosynthesis	This process produces oxygen, which is necessary for most living organisms.
	provision of habitat	Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.

There is an increasing level of support for the adoption of an ecosystems approach outlined in section 2 of this document. Figure C.1 shows the relationship between ecosystem services and the environmental factors that need to be considered under the strategic environmental assessment regulations. This demonstrates that the ecosystem services based assessment provides coverage of the factors required to be covered by the regulations.

Nevertheless, to ensure that we have adequately addressed all of the benefits to the built environment we have included a 'material assets' category to the assessment. Flood risk management measures are likely to have significant benefits for material assets, for example transport or energy infrastructure, that are part of the man made environment rather than the natural environment.

Figure C.1: Relationship between ecosystem services and the factors required to be considered by the strategic environmental assessment regulations.

	Ecosystem services	SEA regulations environmental factors								
		Biodiversity, flora and fauna	Population and human health	Soil	Water	Air	Climatic factors	Cultural heritage	Landscape	Material assets
Provisioning services	fresh water				*					
	food (such as crops, fruit)	*	*							*
	fibre and fuel (such as timber and wool)		*							
	genetic resources	*								
	biochemical, natural medicines		*							
	ornamental resources (such as shells)		*							
	water for non-consumptive use		*		*					*
	air quality regulation					*				
	climate regulation						*			
	water regulation (including flooding)		*		*					*
	natural hazard regulation		*							
	pest regulation		*							
	disease regulation		*							

Regulating services	erosion regulation	*	*	*						
	water purification and waste treatment	*			*					
	pollination	*								
	noise and light regulation	*	*							
Cultural services	cultural heritage							*	*	
	recreation and tourism		*							*
	aesthetic value								*	
	intellectual and scientific, education value		*							
	inspiration of art, folklore, and so on		*						*	
	social relations		*							
	spiritual and religious value		*							
	existence value	*						*	*	
Supporting services	soil formation			*						
	primary production	*								
	nutrient cycling			*						
	water recycling				*					
	photosynthesis	*								
	provision of habitat	*								

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