



# Dee River Basin District

## Consultation on the draft Flood Risk Management Plan

October 2014

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

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# Foreword

The storms and subsequent flooding in the winter of 2013 / 14 had a significant impact on some communities, businesses, infrastructure and the environment. There could be more extremes in the weather with a changing climate leading to more frequent and more severe flooding.

Through our investment in flood risk management infrastructure we not only reduce the risks of flooding but also support growth by helping to create new jobs and by bringing confidence to areas previously affected by floods and create and restore new habitats.

We are committed to producing flood risk management plans (FRMPs) required by the EU Floods Directive by December 2015. This draft FRMP is an important part of meeting that objective and will meet the objectives of the English and Welsh National Flood and Coastal Erosion Risk Management Strategies.

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

This document has been produced in consultation with our partners. We are consulting on this draft plan which sets out the proposed measures to manage flood risk in the Dee River Basin District (RBD) from 2015 to 2021 and beyond.

We want your views on this draft plan by 31 January 2015. We will publish the final FRMP by 21 December 2015.

This draft plan should be read in conjunction with the relevant LLFA FRMPs.

Risk Management Authorities (RMAs) include the Environment Agency, Natural Resources Wales, Lead Local Flood Authorities (LLFAs), district councils (where there are no unitary authorities), internal drainage boards, water companies and highway authorities. These RMAs work in partnership with communities to reduce the risk of flooding.

People in England and Wales face many challenges in the future with ageing assets, a growing population and a changing climate. There are choices in how to manage flood risk and we would value your views on these proposals. Flood risk management planning is not new and we have been able to draw on the experience of partners and earlier plans. This FRMP brings together for the first time all sources of flooding.

We have also set out how these proposed measures can contribute to improving the environment and how they support the objectives of river basin management plans (RBMPs) and specifically the Dee RBMP that the Environment Agency and Natural Resources Wales are consulting on in parallel with this FRMP.



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# PART A

## The draft plan and how we developed it

### 1. What is a Flood Risk Management Plan?

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 (RMAs) will work together with communities to manage flood risk.

#### What is the FRMP for?

FRMPs set out where and how to manage flood risk to provide most benefit to communities and the environment. It is integral to the way RMAs work and the European legislation has formalised this.

#### Why are FRMPs being prepared?

This is the first cycle of implementing the Flood Risk Regulations 2009. As a result of this legislation, lead local flood authorities must prepare FRMPs in Flood Risk Areas, where the risk of flooding from local flood risks is significant (for instance from surface water, groundwater and ordinary watercourses). The Environment Agency (EA) and Natural Resources Wales (NRW) are required to prepare FRMPs for all of England and Wales covering flooding from main rivers, the sea and reservoirs, in line with government guidance.

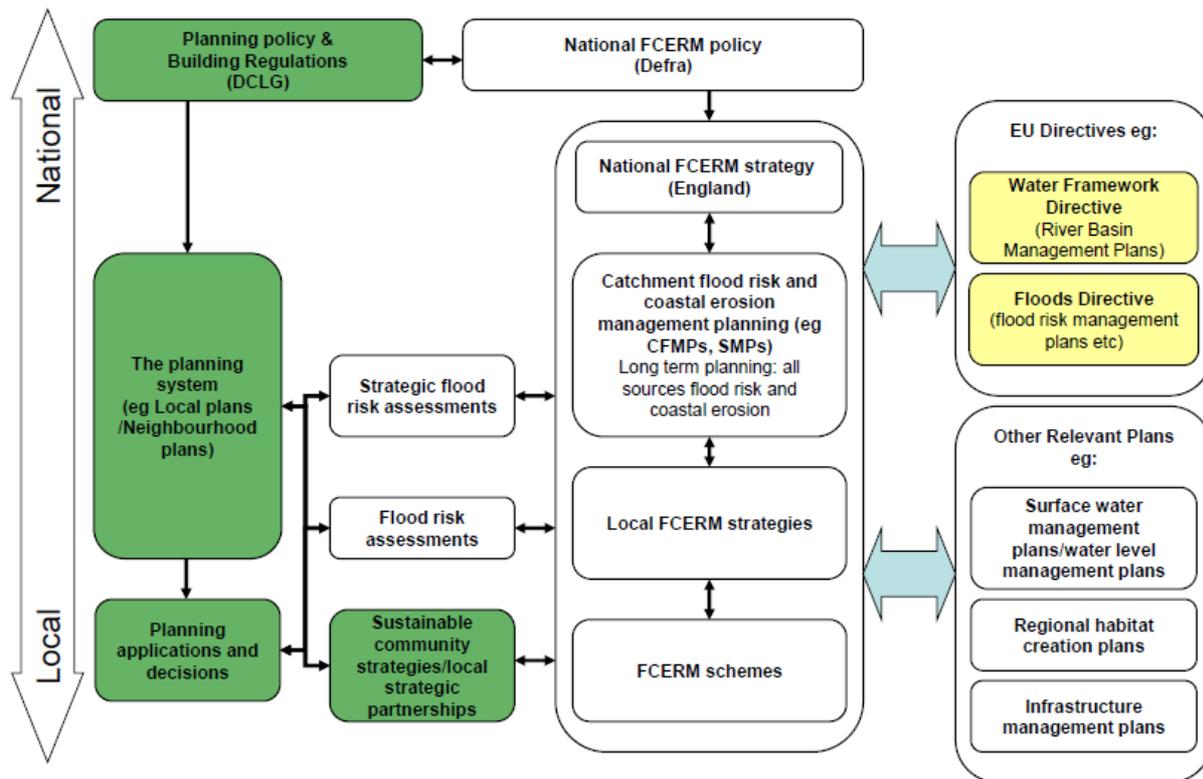
The Environment Agency, Natural Resources Wales and lead local flood authorities are developing FRMPs by drawing existing information together, building on and supplementing the existing planning process (see Figure 1).

#### What the plan does

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

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

**Figure 1: Flood risk management plans and their relationship to other planning initiatives (adapted from the National Flood and Coastal Risk Management Strategy for England)**



## What types of flood risk are included in the FRMP?

The draft FRMP covers the flood risks that the Environment Agency and Natural Resources Wales are responsible for. This is a joint FRMP which the Environment Agency and Natural Resources Wales have acted jointly to produce.

The FRMP draws from relevant information, in particular, flood hazard and flood risk maps published under the Flood Risk Regulations. It summarises the risk of flooding from rivers, the sea and reservoirs.

The FRMP draws relevant conclusions from the flood and hazard risk maps about risks and opportunities. It sets out and prioritises what needs to be done to manage those risks. The FRMP shows how flood risk management measures co-ordinate with measures outlined through river basin management planning under the Water Framework Directive (WFD).

Find out more about flood risk management on the Natural Resources Wales and GOV.UK websites.

## 2. Your views count

This consultation is an important step in shaping the management of flood risk and gives you the chance to influence the approach and contribute ideas.

This is a public consultation and, as RMAs working in partnership, we welcome everyone's views.

### We would like to hear your views on the following aspects:

1. Do you agree this draft plan sets out the most significant flood risk issues for your area? (yes / no)
  - a. If not, please explain what you think is missing.
2. What do you consider to be the highest priorities for managing the risk of flooding in your area?

It is important to have the right objectives for managing the risk of flooding, taking account of the impacts of flooding on people, property and the environment.

3. Do you understand the objectives as described in the draft plan? (yes / no)
  - a. If not, what would help you understand them better?
4. Is the balance right between the 'social', 'economic' and 'environmental' objectives, as explained in the draft plan? (yes / no)
  - a. If not, what would you change and why?
5. Are there other flood risk management objectives that should be included? (yes / no)
  - a. If so, please explain what they are and why they should be included?

This draft plan proposes new 'measures' to manage flood risk, alongside measures which are already 'agreed' and 'ongoing'.

6. Do you understand the difference between ongoing, agreed and proposed measures, as explained in the draft plan? (yes / no)
  - a. If not, what would help you understand them better?

Across all proposed, agreed and ongoing measures, the plan describes 'prevention', 'preparation', 'protection' and 'recovery and review' approaches.

7. Is the balance right between these different types of approach, as explained in the draft plan? (yes / no)
  - a. If not, which proposed measures would you change, and why?
8. Are there other proposed measures that should be included? (yes / no)
  - a. If yes, please explain what they are and why they should be included.
9. How can you support the work set out in the draft flood risk management plan to reduce flood risk?

As well as draft flood risk management plans, the Environment Agency and Natural Resources Wales are consulting on draft updates to river basin management plans, which set out measures

to improve water in rivers, lakes, estuaries, coasts and in groundwater.

**10.** Are there things you think should be done to improve co-ordination of river basin and flood risk management planning?

## This consultation

This consultation runs from 10 October 2014 to 31 January 2015. We will let you know what people have said in April 2015. We will summarise the comments received, how we have taken them into account and what changes will be made before we publish the final FRMP by 21 December 2015.

We have undertaken a strategic environmental assessment (SEA) to consider the wider context of the draft FRMP. The Environmental Report sets out the results of the SEA and we also welcome your comments on that.

# 3. The layout of this document

We have divided the plan into two parts:

Part A sets the scene for the FRMPs - what they are, what they are for and how we have developed them.

Part B goes on to describe the River Basin District (RBD), the flood and coastal erosion risk and the proposed approach to managing that risk.

## How we have developed the plan

Section 4 describes how in partnership the Environment Agency and Natural Resources Wales have prepared this draft FRMP.

## How to manage risk

Section 5 describes some of the terminology we are using, such as 'conclusions', 'objectives' and 'measures', and how they relate to flood and coastal erosion risk management in this context.

## The River Basin District

Section 6 of the plan introduces the Dee RBD. The flood and coastal erosion risks are set out for the RBD in section 7. We also introduce the 'sub-areas' that divide the RBD further.

## The sub-areas

Section 8 introduces each of the sub-areas which make up the RBD.

## The risk conclusions, management objectives and measures

Sections 9 to 11 set out the risk conclusions, objectives and measures for the RBD and sub-areas.

## Implementing the plan, monitoring and reporting

Section 12 sets out the proposals for implementing the plan, including co-ordination with the implementation of the RBMPs prepared under the WFD. Section 13 concludes with how the measures will be monitored and reported.

## Find out more

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

# 4. How we have developed the plan

## The approach to developing FRMPs

In 2013 the government agreed that the preferred approach to developing FRMPs would be for the Environment Agency and Natural Resources Wales to work in partnership with other RMAs, in particular LLFAs, to pool information to develop an overall plan for managing all sources of flood risk and coastal erosion. For the first cycle of production of FRMPs, joint FRMPs are not being pursued in Wales. In preparing this draft FRMP, RMAs have built on relevant information from existing work (see Figure 1 and Table 1).

**Table 1: Sources of FRMP information according to flood risk**

Flood risk	Existing plans and FRMP information
Flooding from main rivers	River Dee Catchment Flood Management Plan
Flooding from the sea	North West England and North Wales Shoreline Management Plan SMP2
Flooding along estuaries	Estuary Management Plans
Flooding from reservoirs	Reservoir Plans

## Consultation and engagement

We believe that inputting to this plan will help improve, inform and shape the final plan. To develop and finalise the FRMP, we will engage a wide range of stakeholders, including other risk management authorities (for example Lead Local Flood Authorities) and targeted local communities at risk of flooding. We will inform people of the process and the opportunity they have to comment on the draft plans. We also recognise that some of the stakeholders we engage will be interested in both flood risk management planning and river basin management planning. We need to make it easy for people to be involved in both, where appropriate.

## How we plan and set objectives

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

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

How each authority delivers against their FRMP objectives differs in England and Wales, as described in the following sections.

### England

The Environment Agency's flood risk management work is focussed where each pound of public money spent can provide the greatest amount of economic benefit. RMAs can apply for an allocation of government funding annually from the Environment Agency. Flood and coastal erosion risk management grant in aid (FCERM GiA capital grants) money can be used towards the

costs of building new flood and coastal erosion defences. The amount of government funding the Environment Agency allocates to projects depends on the public benefit it provides. Benefits include reducing flood risk to households, businesses and infrastructure and creating habitat for wildlife. The amount of government funding available each year is limited. There are always more schemes proposed than there is government funding available.

The Environment Agency annually collates the bids from all risk management authorities across England in the Medium Term Plan (MTP). This captures the flood risk need for the following 6 years. Working within the FCERM GiA available for a given year, the Environment Agency prioritises those projects on the MTP which demonstrate the best value for money and provide greatest benefits.

This is informed by the strategic framework provided by catchment flood management plans (CFMPs) and shoreline management plans (SMPs).

## **Wales**

In order to deliver measures to meet the FRMP objectives, Natural Resources Wales takes a risk based community approach to prioritise where to best direct investment. This is informed by the strategic framework provided by CFMPs and SMPs. The strategic framework set by these plans enable Natural Resources Wales to make short term decisions to manage present day risk whilst also considering the longer term prediction of risk (for further information on CFMPs and SMPs please refer to Annex 2).

The risk based community approach of present day risk is done through the Natural Resources Wales Communities at Risk Register. This is a tool that considers a number of factors to give an indication of where the most vulnerable communities at risk of flooding from main rivers and the sea are located across Wales. This is then used to plan and prioritise the Natural Resources Wales investment programme to target investment in the most at risk communities. Prioritisation is then done at a Wales-wide level and takes into account the risk calculation from the Communities at Risk Register but also considers other factors such as the cost-benefit ratio, level of investment to date and other aspects such as the potential for external funding opportunities. There is also a facet of Natural Resources Wales work which is reactive to severe weather events, where severe damage may have occurred, leading to the need for emergency works.

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

## **Strategic Environmental Assessment and Habitats Regulations**

The primary purpose of a strategic environmental assessment (SEA) is to ensure that wider environmental effects are considered during the development of a plan. SEA aims to contribute to a higher level of protection of the environment and promote sustainable development. The relevant legislation sets out the requirements for SEA19.

The FRMP for each river basin district is intended to bring together information from a number of plans covering different sources of risk, prepared by different authorities across the river basin district. A list of the plans from which information has been drawn to compile the FRMP is shown in Annex 1.

SEA is a statutory requirement under the SEA Regulations for FRMPs. For the joint information brought together in the FRMP from Risk Management Authorities, the scope will include:

- a high level assessment at the river basin district scale of all objectives and measures brought together in the draft FRMP
- a detailed assessment at a more local scale of any new measures or changes to measures in existing plans where they may have significant effects on the wider environment.

As the lead for the FRMP, the Environment Agency and Natural Resources Wales will consider the effects of the plan at the catchment scale to ensure that we consider how any nationally

designated environmental features would be affected. We consider it more appropriate that local designations are considered at lower tiers of planning or within projects.

We will refine our approach to SEA by taking into consideration the views of statutory bodies in response to scoping letters and will continue to work with them on this.

As part of the local strategy process lead local flood authorities must complete an SEA considering the wider environmental effects of their proposed flood risk management actions.

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

The Environment Agency and Natural Resources Wales lead on the development of flood risk management plans and river basin management plans (RBMPs). We aim to co-ordinate our work effectively, and support others to do the same, so that there is an integrated approach to overall water management for the benefit of people, the environment and the economy.

Dee FRMP Objectives have been developed through internal discussion and subsequently tested and validated by FRMP and RBMP Strategic Themes and Integration Workshop.

Each river basin district has a Liaison Panel made up of representatives for the key sectors. Members bring their experience, knowledge and their sector views acting as a two-way channel between the panel and their sector. This way of working provides an open to discuss and influence the development of the RBMPs to help us improve water quality.

Find out more about river basin management plans on [the Natural Resources Wales](#) and [GOV.UK](#) websites.

## 5. How to manage risk

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

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

The conclusions, objectives and proposed measures are set out for consultation within this draft FRMP. Following feedback from the consultation RMAs will work with interested parties to finalise the FRMP and:

- seek to secure the necessary funding
- implement the measures, with clarity on which organisation is accountable for which measures
- monitor and review how the plan works

RMAs will monitor, and report annually, on progress in implementing the measures set out in the final FRMP published in December 2015. As RMAs, we will continue to work in partnership, ensuring that we can maintain a forward look of prioritised proposals for managing flood risk. Our next review of the FRMP under the Flood Risk Regulations will be completed by 2021.

### Measures for managing risk

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

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

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

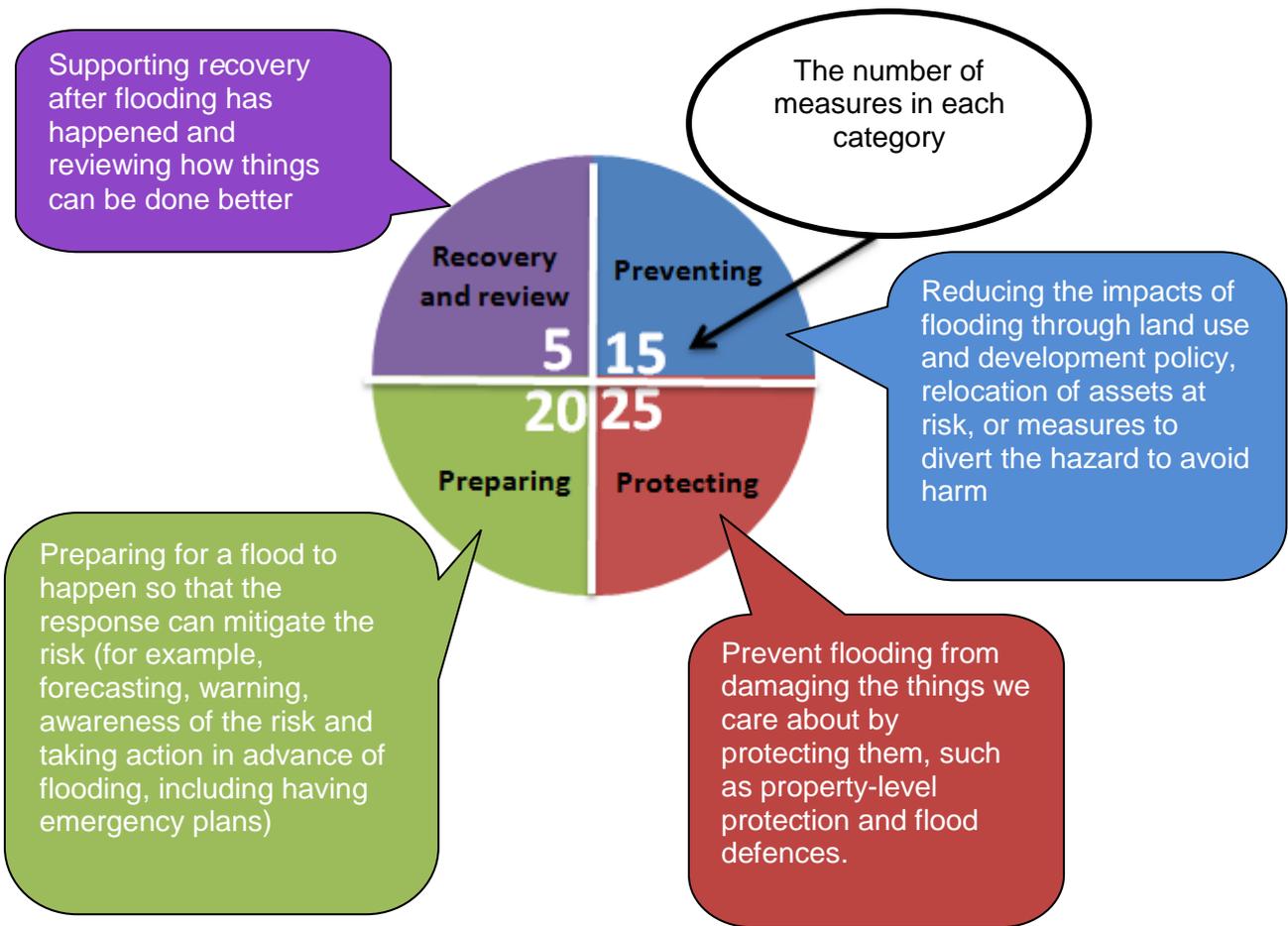
**Protecting:** by protecting people from the risk of flooding, For example, by the maintenance or refurbishment of existing defences or using waterproof boards over doors and airbricks, people can protect their properties from the damaged caused by flood water.

**Recovery and review:** by learning from when flooding happens and how to recover from it, for example, by improving the availability of recovery services such as providing temporary accommodation, after flooding has occurred.

Flood and coastal erosion risk management may require a combination of measures outlined above.

Figure 2 sets out how measures are displayed in this document. The number of measures is presented simply to enable the measures to be recorded and monitored. The absolute number is not important since measures will vary in complexity.

**Figure 2: The types of measures for managing risk**



We want your views on the measures to manage risk. This draft FRMP sets out ‘proposed’, ‘ongoing’ and ‘agreed’ measures to manage flood risk (see Figure 3).

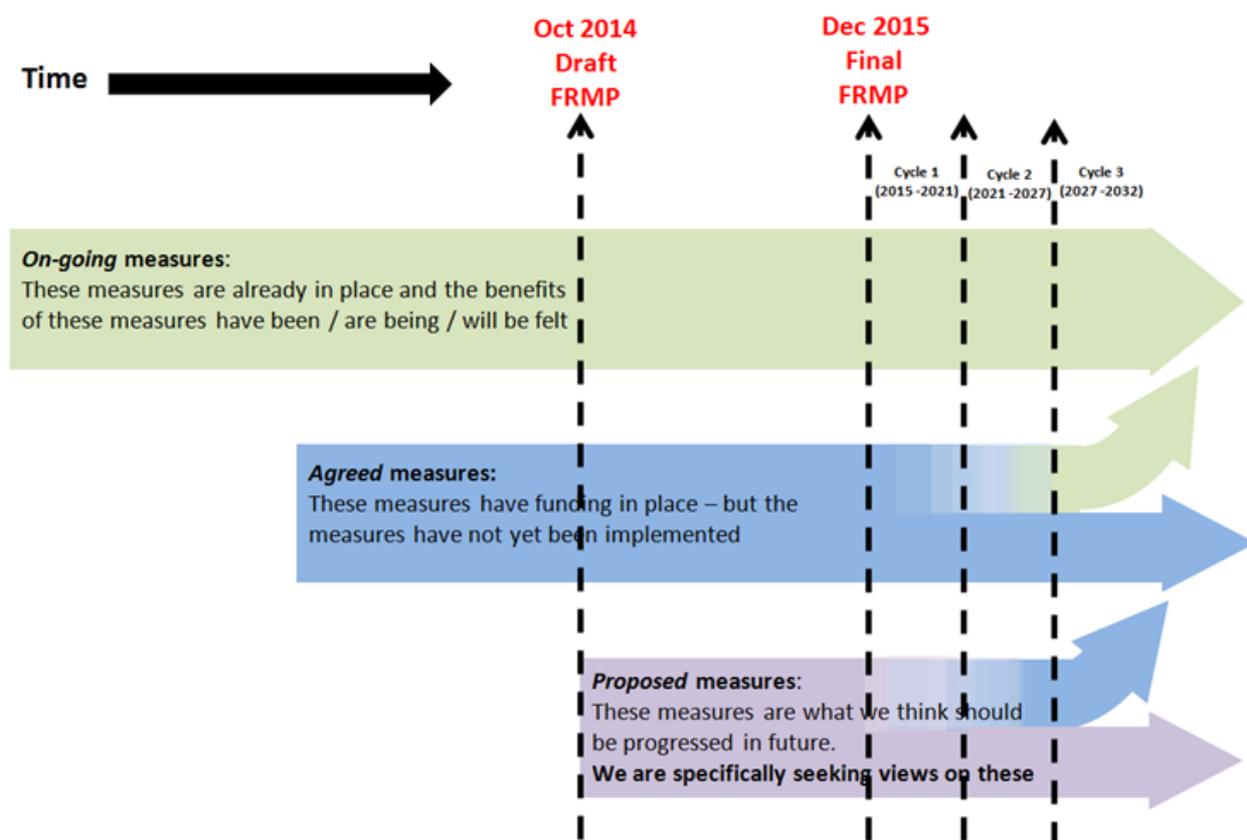
We are specifically seeking your views on the ‘**proposed**’ measures: those that we think should be progressed from 2015 onwards. These are new measures that have not been taken from an existing plan and therefore have not been consulted on previously.

There are already many measures being implemented to manage flood and coastal erosion risk. These are ‘**ongoing**’ measures. An example of this type of measure would be existing planning policies. We set out these measures for context, but we are not specifically seeking views on them. In the future some ongoing measures may need to change, for example because new technology offers opportunities to do things differently. We will work with communities and other interested parties to develop new and innovative ways of managing risk and propose changes or new measures when appropriate.

Some measures have already been provisionally agreed. This means they are very likely to go ahead, subject only to final design and planning permissions where necessary. These are called ‘**agreed**’ measures and are already set out in plans that have been consulted on, such as Local Flood Risk Management Strategies. These measures are already agreed and we are not specifically seeking views on them during this consultation.

We are not specifically seeking views on the ongoing and agreed measures because they are already in place or likely to be implemented. However, we would welcome your feedback if you think that modifications to ongoing and agreed measures should be considered in the context of the proposed measures.

Figure 3: The series of measures for managing flood and coastal erosion risk



## Flood Risk Information

The Dee FRMP discusses flood risk from rivers, the sea and reservoirs. The following section outlines flood risk classifications for the various sources.

### Flooding from rivers and the sea

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

These are categorised as shown in Table 2 and are referred to in the key statistics tables in Section 7 of this report.

Table 2: Flood risk likelihood categories

Flood risk category	Criteria
<b>High</b>	Greater than or equal to 1 in 30 (3.3%) chance in any given year.
<b>Medium</b>	Less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year.
<b>Low</b>	Less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year.
<b>Very Low</b>	Less than 1 in 1,000 (0.1%) chance in any given year.

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

### **Flooding from Reservoirs**

Reservoir flood risk maps show the area that could be flooded if a large reservoir were to fail and release the water it holds. A large reservoir is one that holds over 25,000 cubic meters. Since this is a worst case scenario, it's unlikely that any actual flood would be this large.

# PART B

## Managing flood risk in the Dee river basin district

### 6. Getting to know the Dee river basin district

#### Introduction

The River Dee RBD (shown in Figure 4) covers an area of approximately 2,200km<sup>2</sup>, the majority of which is situated in north east Wales with the eastern part of the RBD in England. The River Dee is approximately 110km long from its source in the Snowdonia National Park to where its estuary discharges into Liverpool Bay.

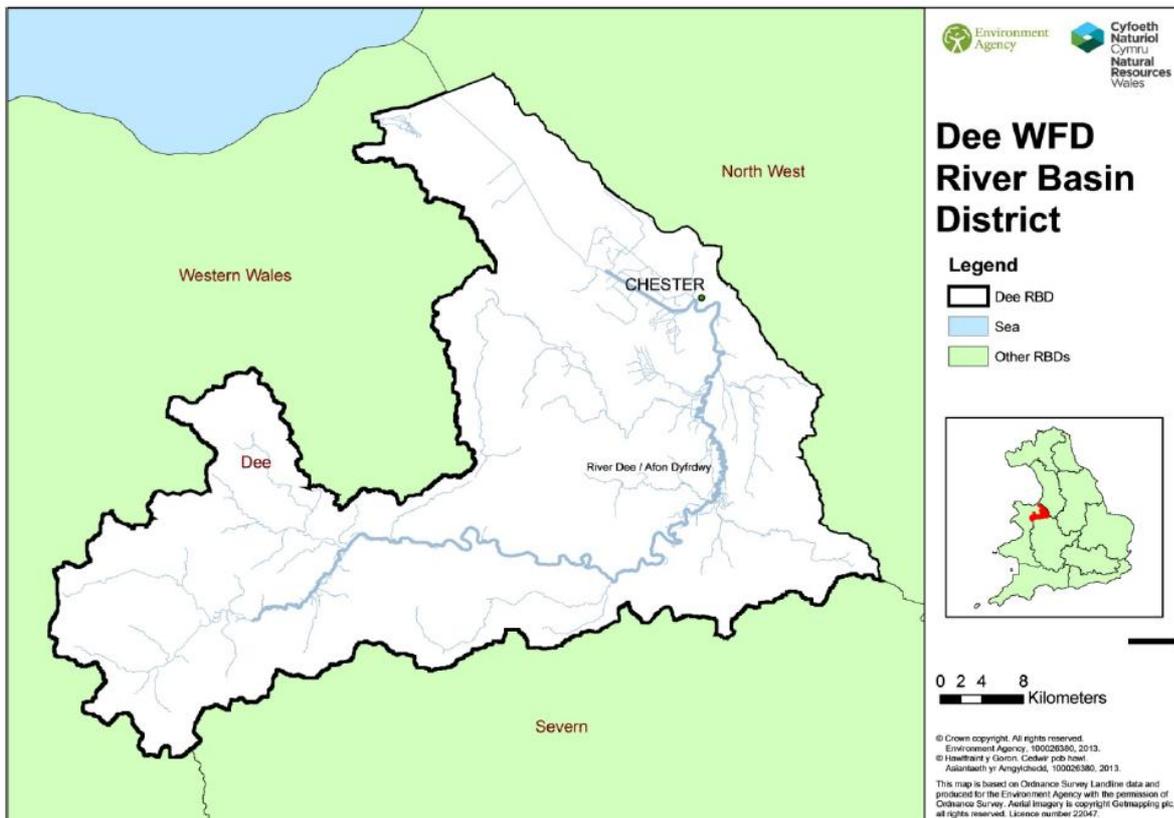
From its source the River Dee flows eastwards to Llyn Tegid, an integral part of the River Dee system. Upstream of Llyn Tegid the river is fast flowing in a narrow incised valley, whilst downstream of the lake the valley bottom and natural floodplain opens out to approximately 1km wide. The natural river system is modified through flow control at the Bala sluices located where the River Dee is joined by the River Tryweryn. From Bala, the river flows north eastwards towards Corwen where the River Alwen joins the Dee. There are two major reservoirs in the upper reaches of the Alwen catchment, Llyn Brenig and Alwen Reservoir.

The River Dee continues in an easterly direction through Llangollen and downstream to Erbistock, once again following a narrow incised valley. Between Erbistock and Chester the floodplain is flat and very wide, with the main tributaries; Rivers Ceiriog, Clyweddog and Alyn, joining the Dee along this reach.

Downstream of Chester Weir the river was canalised over 200 years ago and flood defences, which are still maintained today, were constructed to protect land from tidal inundation. The River Dee is normally tidal up to Chester Weir; however this boundary is exceeded for spring high tides when tidal influence can affect river levels as far upstream as Shocklach, 15km upstream of Chester Weir.

The Dee RBD comprises a range of landscapes including mountains, steep sided wooded valleys, the plains of Cheshire and the mudflats in the estuary. The different topography within the Dee River Basin District gives rise to different flooding responses. In the west the steep slopes give rise to more rapid runoff and faster flooding responses, whereas runoff occurs more slowly on the gently sloping land in the east.

Figure 4: The Dee River Basin District



## Society and health

The population of the district is generally stable at around 458,000. Chester, Wrexham and Deeside (the conurbation including Connah's Quay, Queensferry, Pentre, Sandycroft and Hawarden Airport) are the main urban areas in the RBD. Other significant towns in the RBD are Bala, Llangollen, Corwen, Flint, Mold, Buckley, Whitchurch, Neston, Heswall and West Kirby. There are some health inequalities evidenced by greater social deprivation in urban areas. Significant housing growth along with creation of jobs and services is proposed in many towns.

## Land use

The upland catchment is predominantly rural, with sheep farming on the poorer areas of grassland and significant areas of commercial forestry. Frequent flooding in the lower Dee between Bangor-on-Dee and Chester has resulted in very little urban development and the area is extensively used for agriculture, particularly intensive dairy farming on the fertile land in and around Wrexham and on the Cheshire Plain. Arable farming dominates on the Wirral side of the estuary and around Deeside and Sealand. Approximately 6% of the catchment is urban with Wrexham, Chester, and Deeside being the main urban centres accounting for over 60% of the population. Canalisation of the tidal section of the River Dee downstream of Chester has enabled urban development to take place on both banks. Changes in land use within the catchment have led to physical changes to the water environment and pollution from agricultural runoff and industry.

## Economic activity

The economy of the River Dee RBD is characterised by:

- Forestry, tourism, cottage industries and hill farming in the upper Dee,
- Mainly agriculture (arable and pasture) in the lower Dee area
- Retail, commercial and industrial activities in and around Chester, Wrexham, Deeside and tourism in Chester itself

- Industrial development (manufacturing and commercial) adjacent to the Dee Estuary, on both banks

Retail and distribution, health and education, and manufacturing and construction are the three most significant employment sectors in the Dee RBD. Commerce is important, particularly in Chester and the other urban areas. Tourism, farming and rural industries, and transport and communications, although smaller, are key in sustaining rural communities. Fisheries and the Dee cockle beds are also important to the local economy.

## Recreation and tourism

The diversity of the landscape in the River Dee RBD offers a wide range of recreational activities and opportunities which contribute to people's quality of life and bring economic benefit from tourism. The majority of visitors to the River Dee RBD enjoy informal recreation such as: walking, camping, water sports, angling, horse-riding, mountain biking and rock climbing. Popular areas for recreation include the Clwydian Mountains, River Dee Valley, and the lakes and reservoirs (Bala, Celyn, Brenig and Alwen). Tourism is a major part of the local economy, especially within Snowdonia National Park, Llangollen, Chester and Erddig near Wrexham.

## Infrastructure

The RBD contains regionally important infrastructure, including railways (for example the Chester to Holyhead mainline), primary roads (for example the A55 and A483), energy infrastructure, canals, the Hawarden Airport, ports (including the Port of Mostyn) and industrial and commercial development alongside the Dee Estuary. Recently there has been an increasing demand for hydropower, with a number of sites being investigated.

## Landscape

Agriculture and forestry dominate the upper reaches of the district and there are a variety of landscape and settlement patterns. The upper catchment includes part of the Snowdonia National Park and is predominantly rural in character. In the mid to lower catchment, the landscape changes to rolling hills that gradually form the Cheshire Plain. The most tranquil areas of the district are in the upper reaches with the mid to lower reaches being more disturbed by traffic and settlements around Wrexham and Chester. In the lower reaches, urban development has had a significant impact and many river channels and floodplains do not function naturally.

## Biodiversity

The Dee RBD is hugely varied, from the mountains of Snowdonia to the internationally important mudflats of the Dee Estuary. The importance of this habitat is reflected by a variety of international, national and local nature conservation designations. There are 7 Special Areas of Conservation (SACs), 3 Special Protection Areas (SPAs) and 3 Ramsar sites. The River Dee itself is a SAC and Site of Special Scientific Interest (SSSI). The tidal Dee estuary is also a SPA and Ramsar wetland.

Many of the SSSIs (approximately 70) have close links with the water environment. Water bodies and wetland areas within the district support a number of protected species (for example otter, water vole) and priority species listed in the UK Biodiversity Action Plan (for example White-clawed Crayfish and Freshwater Pearl Mussel). The highly modified nature of the Dee has led to there being 45 barriers to fish migration in the district. Invasive species in the RBD include Japanese Knotweed, Himalayan Balsam and North American Signal Crayfish.

Many of the sites with environmental designations are affected by flooding and may be dependent on periodic flooding to maintain their habitats and species. Fisheries are important in all the rivers within the River Dee RBD and there are a significant number of stretches of river that are designated under the Freshwater Fish Directive and are important for salmon and other species.

## Cultural heritage

The River Dee RBD area has a diverse historic environment resulting from over 6000 years of human settlement, including remnants of Neolithic and Bronze Age settlements in the River Dee

Valley, and Roman settlements in Bangor-on-Dee and Chester. The Pontcysyllte Aqueduct and Canal is a World Heritage Site and there are 5 landscapes listed on the Register of Landscapes of Historic Interest in Wales. There are around 400 scheduled ancient monuments and numerous registered park and gardens, listed buildings and heritage sites. Many structures directly associated with the water environment have listed status, for example mills, bridges, weirs and sluices. Archaeological features associated with the flood plain and land saturated by groundwater can be put at risk from drying out, erosion or inundation.

## Geology

The underlying geology of the bedrock in the River Dee RBD results in the clear topographical distinction between the upland areas in the west and the low areas in the east, with the escarpment of the Welsh foothills near to Llangollen providing the divide.

The upper River Dee and River Alwen catchments west of Llangollen are underlain almost entirely by fine grained sedimentary mudstones and siltstones. These older consolidated rocks are largely impermeable, encouraging overland flow. Rainfall falling in these steeper, upland areas gives rise to high run-off rates, and a rapid response within the watercourses. The overlying superficial deposits help in attenuating surface flows from rain in the drier summer months, but when waterlogged will also contribute to the fast responding surface water flows.

The River Alyn rises in the centre of the RBD and drains an area of faulted and fractured carboniferous limestone and coarse sandstones. The limestone is a major aquifer where much of the rainfall percolates through the rock to contribute to groundwater flows. Throughout its length the River Alyn is affected by numerous sinkholes and mine shafts with the consequence that the course of the river can run dry in prolonged periods without rainfall.

The middle, lower and tidal Dee sub-catchments predominantly drain the wide low lying Cheshire Plain, with sandstone bedrock underlying much of the area. The superficial deposits in this part of the catchment comprise glacial till, glacio-fluvial sand and gravel and more recent river terrace deposits and alluvium of fluvial origin.

## Soil

Soil types in the RBD are strongly influenced by topography, with a clear difference between the upper Dee, and the lower Dee. The upper Dee contains some areas of peatland habitat (for example upland blanket bogs). When in good condition these areas are valuable for biodiversity, carbon storage and sequestration, regulation of stream base flows, water runoff and nutrient regulation and retention. However, they mainly have low permeability and are interspersed with seasonally waterlogged soils.

Seasonally waterlogged impermeable soils dominate the Lower Dee catchment with significant areas of loamy and sandy free draining soils. Soils with a high groundwater table occur downstream of Chester, and upstream in the River Dee valley from Worthenbury in the south to Aldford in the north. The impermeable soils covering most of the lower catchment give rise to higher rates of runoff to the rivers and streams although the relatively flat topography through much of the lower Dee means that flooding response times are longer. Where there are high groundwater levels and flat areas with seasonably waterlogged soils any flooding is slow to recede.

Soil quality has been adversely affected by inappropriate management, reliance on pesticides and loss of nutrients and organic wastes from agricultural sources, all of which also impact on water.

## Water

The River Dee is an important source of drinking water for nearly 3 million people in Wales and North West England. Given the importance of maintaining this supply, opportunities to abstract for other purposes are very limited and carefully regulated. Reservoirs in the upper part of the RBD store water and regulate flow in the Dee. They sustain abstractions for public and industrial water supply and modify flood response in the river. The strategic importance of the Dee for water supply

has led to it becoming one of the most regulated rivers in Europe and in 1999, the lower part of the Dee was designated as the UK's first Water Protection Zone.

There are 115 water bodies across the district comprising rivers, lakes, groundwater and the Dee estuary. In 2009, 28% of the water bodies were at "good" status, this rose to 30% in 2013. Significant water issues identified for the Dee are; physical modifications, pollution from sewage and waste water, pollution from rural areas and invasive non native species.

## Climate

UKCIP (UK Climate Impacts Programme) predicts that, by the 2050s, temperatures across Wales could rise by 1.1 to 4.1°C. Annual average rainfall in Wales is predicted to remain roughly the same as present, but there is likely to be a large difference in the patterns of summer and winter rainfall. Increased winter rainfall is expected as a result of increased storminess, leading to intense, but short-lived, rainfall events. Summer rainfall may decrease and short duration droughts (12-18 months) are likely to become more frequent.

Future sea level rise along Wales' coast is likely to result in more severe coastal erosion and inundation events in low-lying coastal areas. The relative sea level rise around Wales is predicted to be 36cm by the 2080s. These extremes impact on water related issues such as decreased water availability and an increase in people and properties at risk from the effects of flooding.

# 7. Key Flood Risk Issues in the Dee river basin district

## Sources of risk

Based on historic flooding and the latest flood risk information the main sources of risk in the Dee River Basin District are described below.

### River flooding

This occurs fairly frequently in the upper sub-catchments of the River Dee, River Alwen and River Alyn. In the remainder of the catchment, floodplains are generally wider, with flooding affecting large areas of agricultural land and urban areas such as Wrexham, Mold, Chester, and the Deeside and Sealand communities. The River Dee at Chester responds slowly to heavy rainfall, taking up to 3 or 4 days to peak following a rainfall event.

### Tidally influenced river flooding

Downstream of Farndon, the River Dee is influenced by high tides which regularly exceed the Chester weir level, resulting in flow reversals on the river. These tides can restrict the discharge of tributary rivers into the Dee. The most severe flooding can occur when extreme tidal events coincide with high river flows.

### The sea

Communities on the North Wales coast are at risk of flooding, particularly when high tides coincide with large waves and / or a storm surge.

### Reservoirs

The River Dee is highly regulated by controlled releases from reservoirs in the upper catchment. The main reservoirs in the RBD are Bala (Llyn Tegid), Llyn Celyn, Llyn Brenig and Alwen reservoir, which means that areas downstream of these could be flooded if a large reservoir were to fail, however, reservoir flooding is extremely unlikely to happen

### Other sources

Surface Water flooding is extensive in the Lower Dee (Mold and Wrexham) and Dee estuary sub-catchments (Deeside, Sealand and Chester), and also in the lower reaches of the River Alyn catchment near the confluence with the River Dee. (Note, surface water flood risk is the responsibility of Lead Local Flood Authorities. For further information on surface water flood risk, contact the relevant Local Authority).

Groundwater and sewer flooding has occurred in some areas and caused road flooding and some property flooding. These are localised issues and flood risk from these sources is considered to be low at a catchment scale.

## Historical flooding

Prior to 1800, flooding mainly impacted on agricultural land and isolated properties. Industrial development after 1800 focused development on towns and villages, many of which were located near to rivers, and often partly within the natural floodplains, to make use of water power. This resulted in greater flooding impacts on people, their homes and workplaces. These changing development patterns have influenced historical flood risk management over the past 200 years.

The River Dee RBD has a long history of flooding, with records dating back to the 13<sup>th</sup> Century. The River Dee itself has suffered significant flooding many times, with probably the most extensive instances occurring in 1890, 1946, 1964 and 2000.

During autumn 2000, exceptional rainfall caused widespread flooding throughout the Dee RBD. Many areas, which had no previous record of flooding, were affected on this occasion. The main towns and villages affected in the Upper Dee were Bala, Llandrillo, Llandderfel, Llangollen and Corwen. Those affected in the middle and lower Dee were Trevalyn, Mold, Rhydymwyn, Rossett, Bangor-on-Dee, Nant Alyn, Pentre (Queensferry) and Cefn Mawr. 613 residential properties and 25 businesses were flooded. 182 people had to be evacuated and 90 caravan and chalet holiday homes were flooded, almost all in the lower Dee. About half the flooding resulted from main rivers and the remainder being due to ordinary watercourses and surface water flooding. There was no reported loss of life or serious injuries.

In December 2013, a tidal surge coinciding with a high spring tide caused some localised flooding to areas along the Dee estuary.

## Future risk

Future flood risk will be largely influenced by climate change, with changes in land use and rural land management also having an impact. The number of properties at risk will increase unless actions are taken to manage the increasing risks.

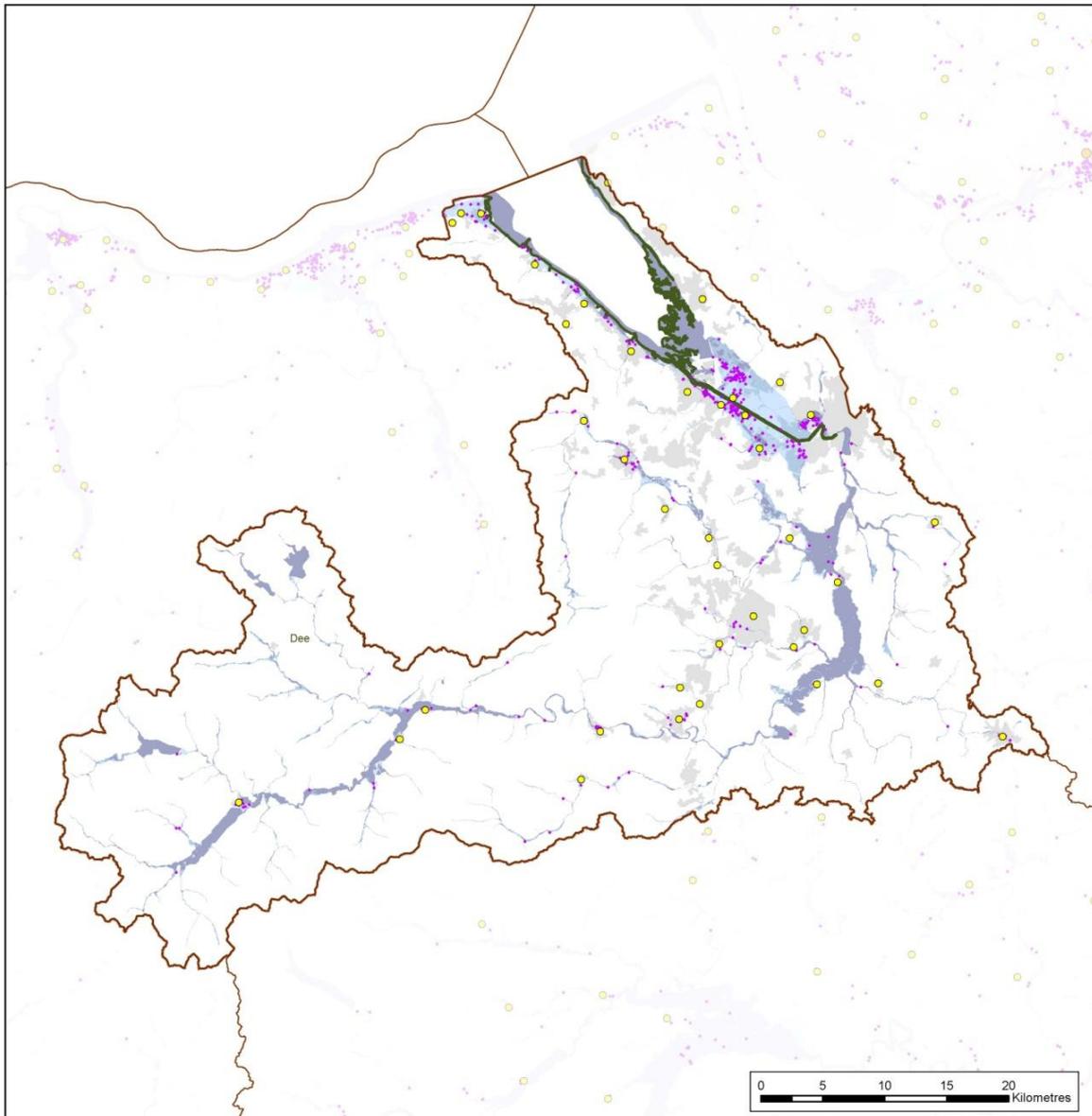
Future increase in flood risk is likely to be concentrated in towns located near the mouth of rivers or where there are tidal influences. This is where the effects of sea level rise and increased river flows will combine, resulting in more frequent, extensive flooding. The most significant increases in future risk are likely to occur in Deeside, Sealand and Chester.

The following maps illustrate the broad scale of flood risk across the RBD. You can see this information in more detail at the links below. In parallel to flood risk management planning, the Environment Agency and Natural Resources Wales are updating RBMPs across England and Wales. You can consider the pressures on the water environment and what plans are proposed using the additional links below.

Find out more about flood risk on the [Natural Resources Wales](#) and [GOV.UK](#) websites.

# Flood and coastal erosion risk to people

Map of flooding from rivers and sea:



**Rivers and Sea  
Flood Risk Map**

**Dee  
River Basin District**

**Risk to People**

**Flood Risk Source**  
Rivers and Sea

- High
- Medium
- Low
- Very Low

**People at Risk**

- 0 - 1000
- 1001 - 5000
- 5001 +

**Reporting Boundaries**

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

Built-up Areas

Services at Risk



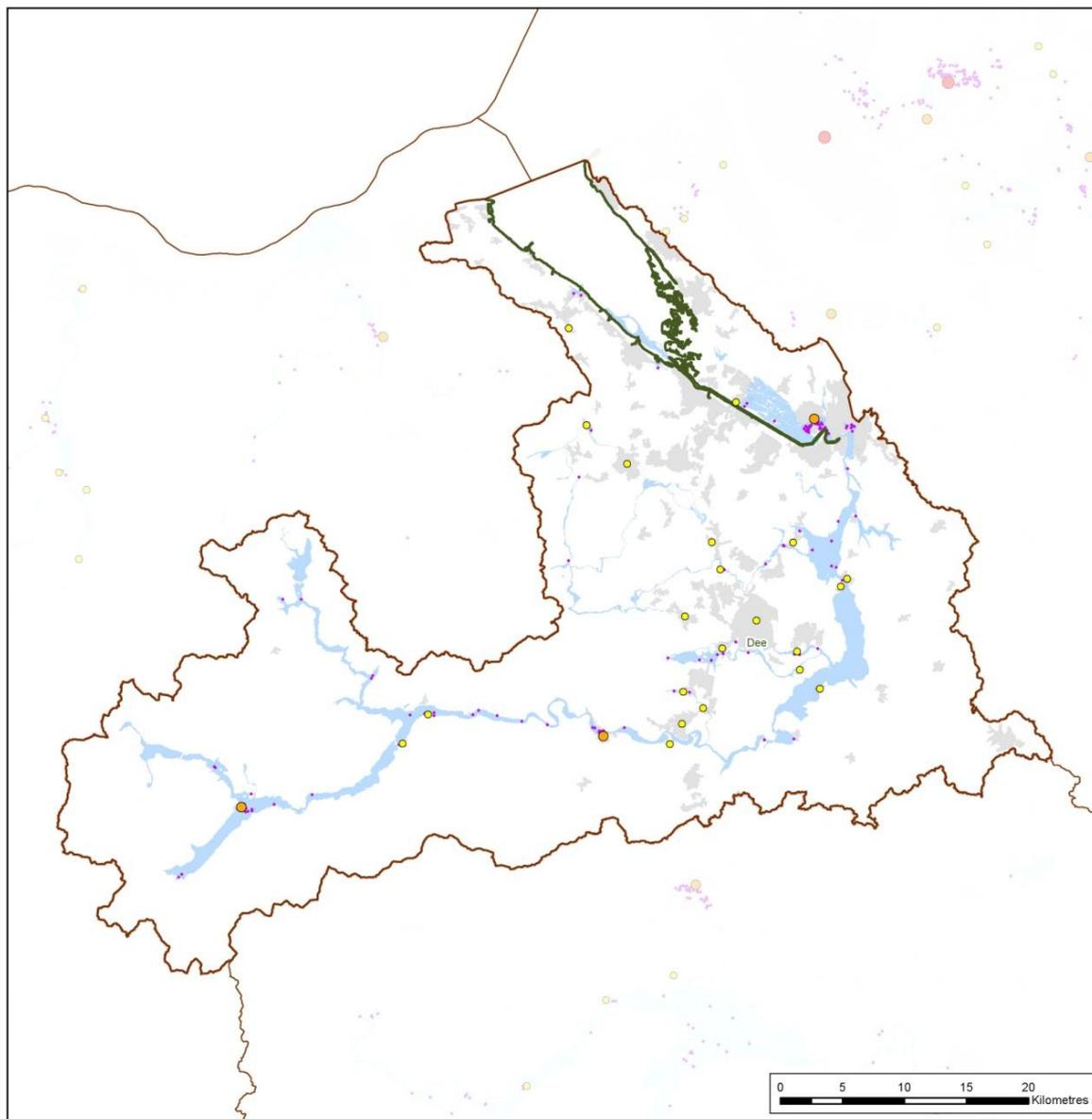

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Map of flooding from reservoirs:



<p><b>Reservoirs Flood Risk Map</b></p> <p><b>Dee River Basin District</b></p> <p><b>Risk to People</b></p>	<p><b>Flood Risk Source</b></p> <p><b>Reservoirs</b></p> <ul style="list-style-type: none"> <li>Maximum extent of flooding</li> </ul>	<p><b>Reporting Boundaries</b></p> <ul style="list-style-type: none"> <li>River Basin District</li> <li>River Basin Districts (Neighbouring)</li> <li>Management Catchment</li> </ul>	<p><b>People at Risk</b></p> <ul style="list-style-type: none"> <li>0 - 1000</li> <li>1001 - 5000</li> <li>5001 +</li> </ul> <p>Services at Risk</p> <p>Built-up Areas</p> <p><b>Cyfoeth Naturiol Cymru Natural Resources Wales</b></p> <p><b>Environment Agency</b></p>

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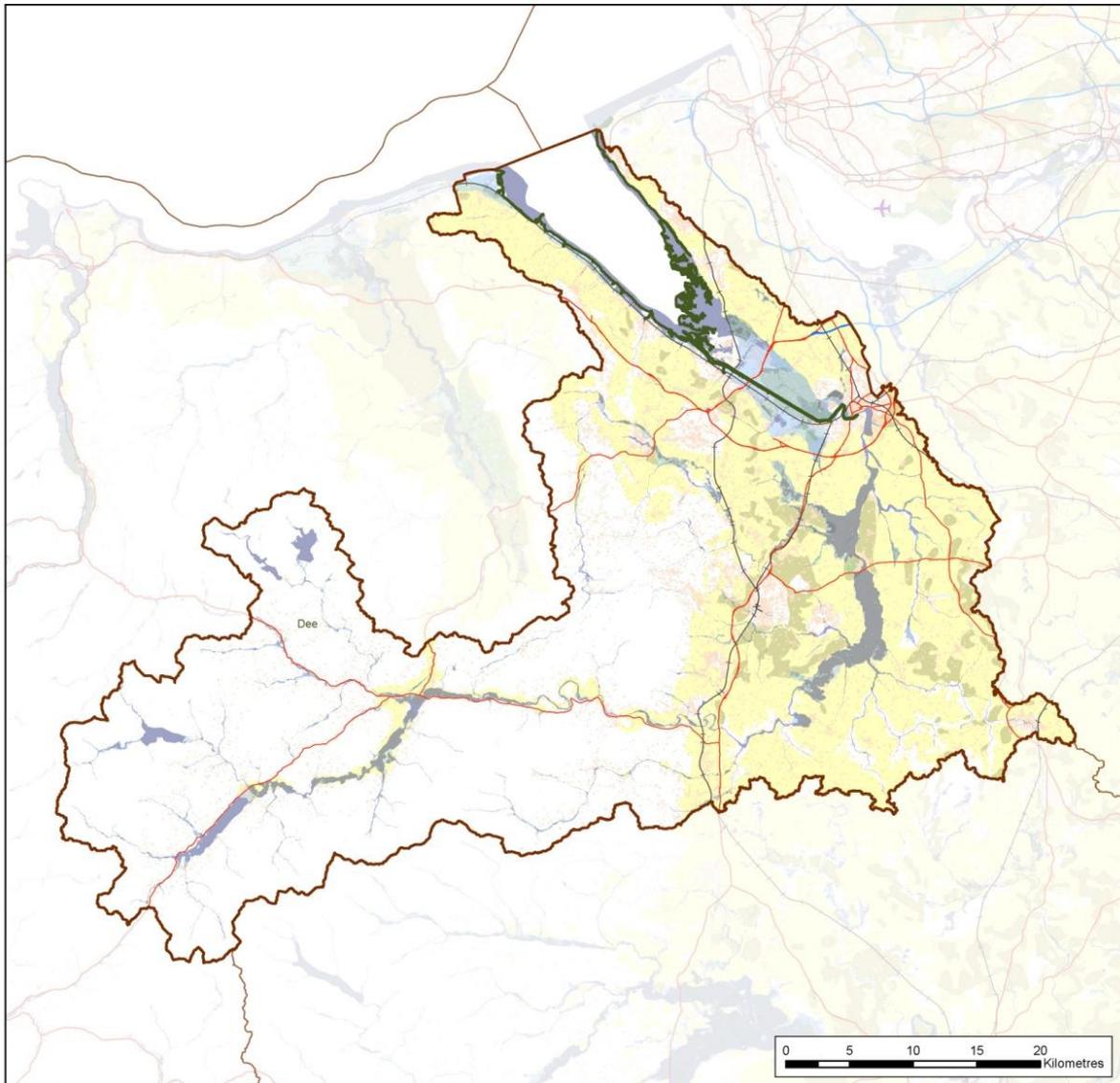
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# Flood and Coastal Erosion Risk to Economic Activity

Map of flooding from rivers and sea:



<p><b>Rivers and Sea Flood Risk Map</b></p> <p><b>Dee River Basin District</b></p> <p><b>Risk to Economic Activity</b></p>	<p><b>Flood Risk Source</b></p> <p><b>Rivers and Sea</b></p> <ul style="list-style-type: none"> <li>High</li> <li>Medium</li> <li>Low</li> <li>Very Low</li> </ul>	<p><b>Reporting Boundaries</b></p> <ul style="list-style-type: none"> <li>River Basin District</li> <li>River Basin Districts (Neighbouring)</li> <li>Management Catchment</li> </ul>
	<p><b>Economic Activity</b></p> <ul style="list-style-type: none"> <li>Airports</li> <li>Main Line Railways</li> <li>Motorway</li> <li>Other Primary / Trunk Roads</li> <li>Non-residential Properties</li> </ul>	<p><b>Agricultural Land Classification</b></p> <ul style="list-style-type: none"> <li>Grade 1</li> <li>Grade 2</li> <li>Grade 3</li> </ul>

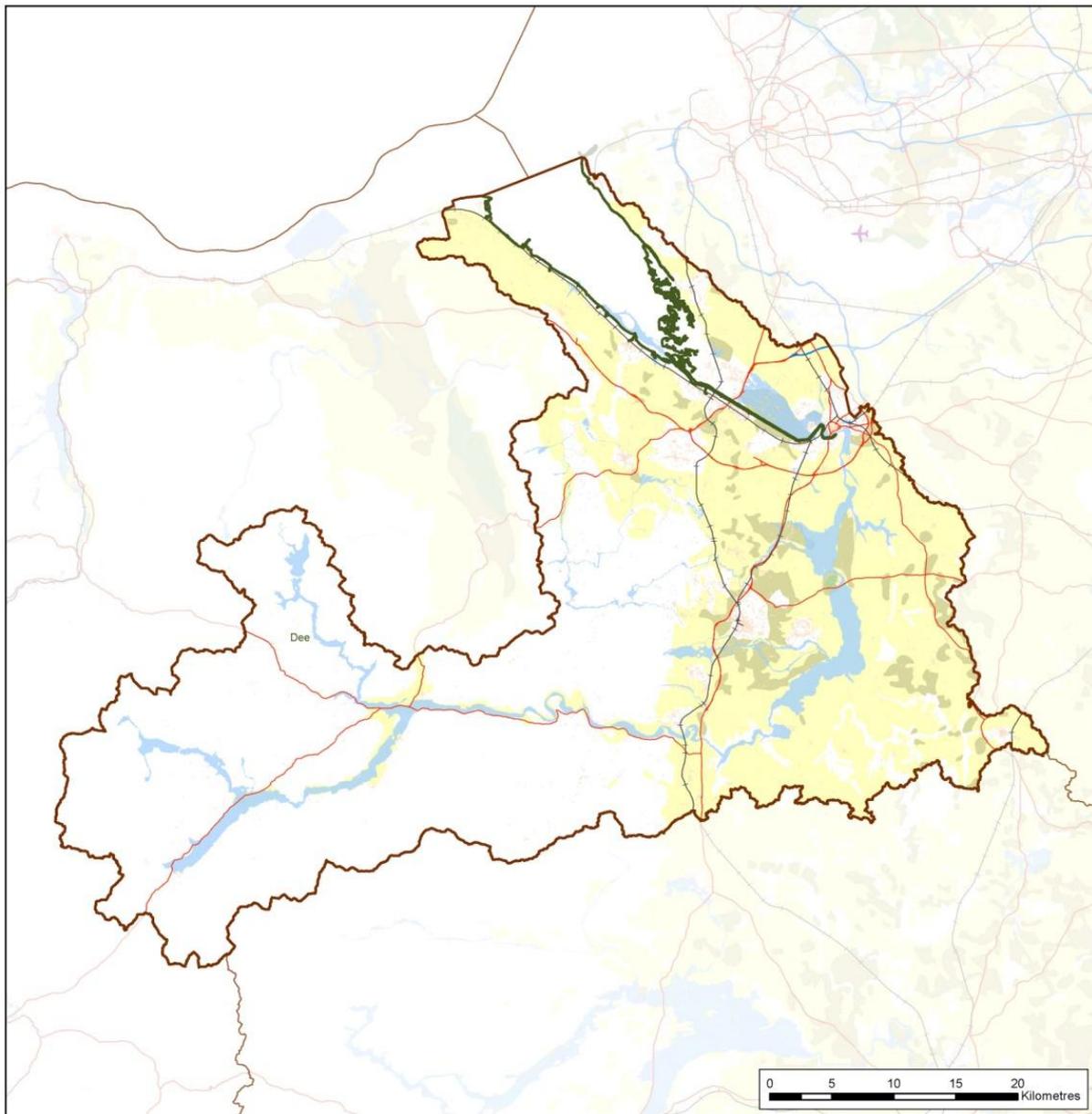
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Map of flooding from reservoirs:



<p><b>Reservoirs Flood Risk Map</b></p> <p><b>Dee River Basin District</b></p> <p><b>Risk to Economic Activity</b></p>	<p><b>Flood Risk Source</b></p> <p><b>Reservoirs</b></p> <ul style="list-style-type: none"> <li>Maximum extent of flooding</li> </ul>	<p><b>Reporting Boundaries</b></p> <ul style="list-style-type: none"> <li>River Basin District</li> <li>River Basin Districts (Neighbouring)</li> <li>Management Catchment</li> </ul>	
	<p><b>Economic Activity</b></p> <ul style="list-style-type: none"> <li>Airports</li> <li>Main Line Railways</li> <li>Motorway</li> <li>Other Primary / Trunk Roads</li> <li>Non-residential Properties</li> </ul>	<p><b>Agricultural Land Classification</b></p> <ul style="list-style-type: none"> <li>Grade 1</li> <li>Grade 2</li> <li>Grade 3</li> </ul>	
			
			

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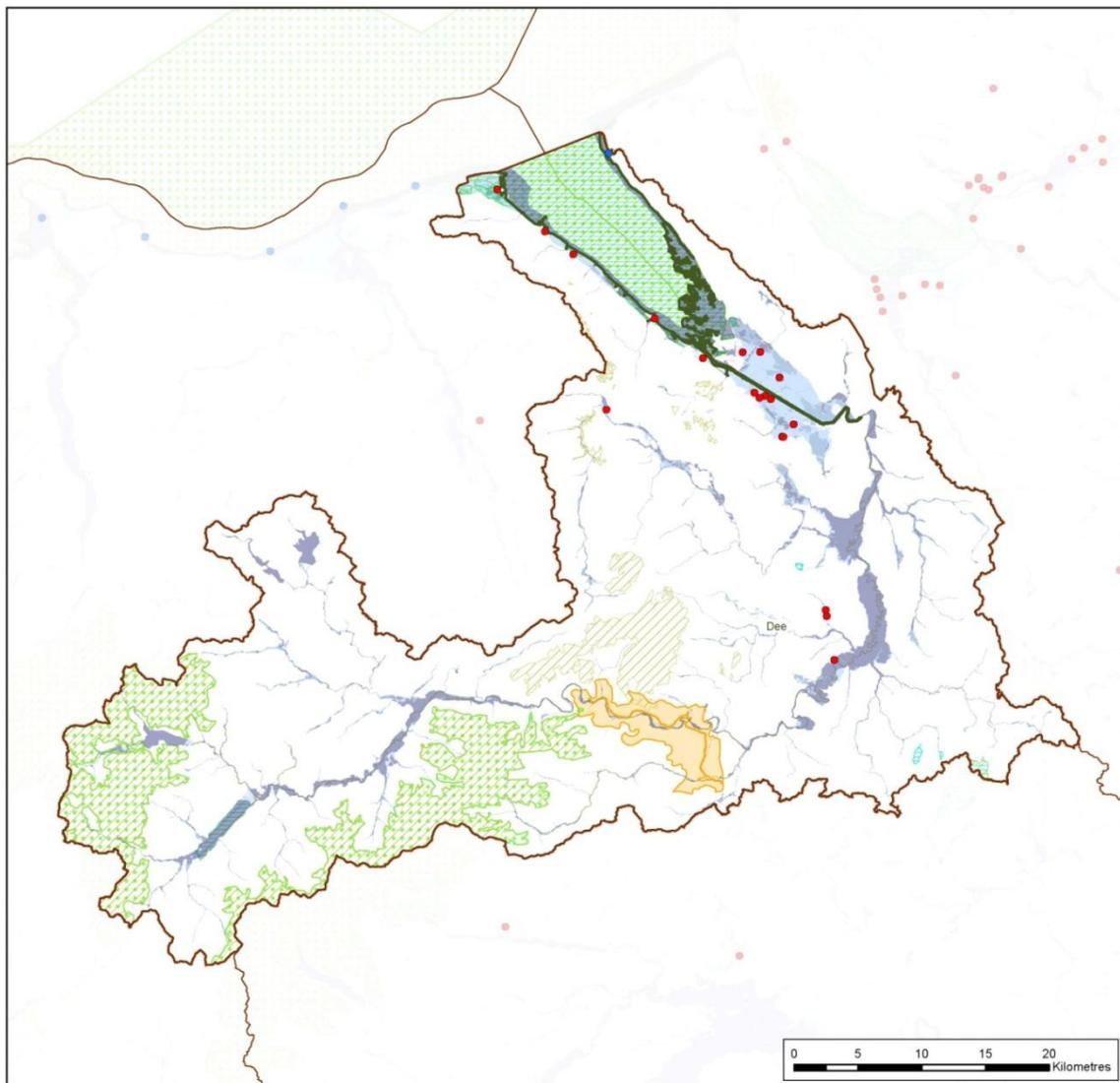
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# Flood and coastal erosion risk to the natural and historic environment

Map of flooding from rivers and sea:



**Rivers and Sea  
Flood Risk Map**

**Dee  
River Basin District**

**Risk to the  
Natural and Historic  
Environment**

**Flood Risk Source**

**Rivers and Sea**

- High
- Medium
- Low
- Very Low

**Internationally Designated Sites**

- Bathing Waters that may be adversely affected by heavy rainfall and are within 50m of flood risk
- EPR (Environmental Permitting Regulations) Installtions within 50m of Risk

**Reporting Boundaries**

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

- Special Areas of Conservation
- Special Protection Areas
- RAMSAR Sites
- World Heritage Sites

Cyfoeth  
Naturiol  
Cymru  
Natural  
Resources  
Wales

Environment  
Agency

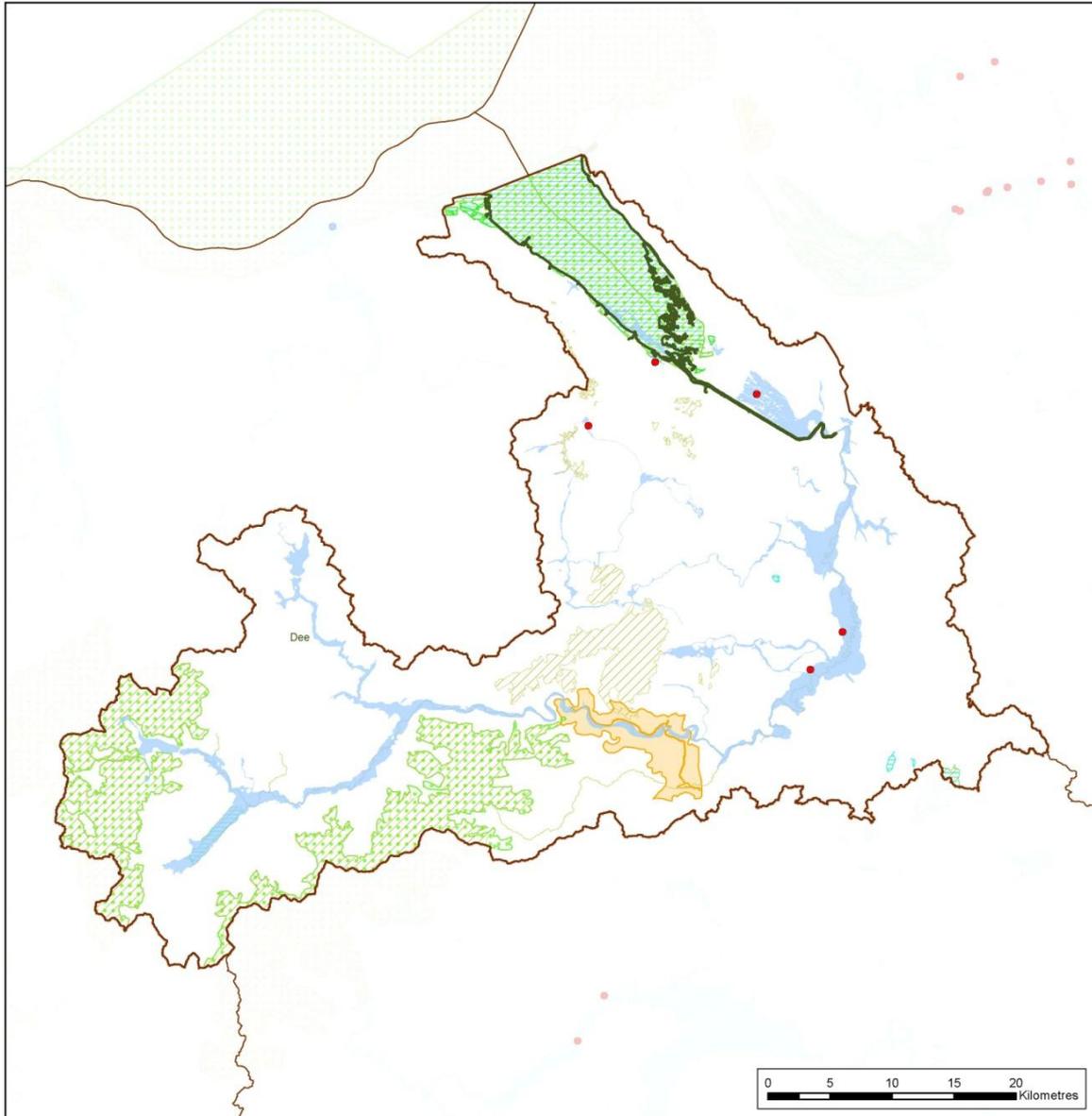
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Map of flooding from reservoirs:



<p align="center"><b>Reservoirs Flood Risk Map</b></p> <p align="center"><b>Dee River Basin District</b></p> <p align="center"><b>Risk to the Natural and Historic Environment</b></p>	<p><b>Flood Risk Source</b></p> <p><b>Reservoirs</b></p> <ul style="list-style-type: none"> <li>Maximum extent of flooding</li> </ul>	<p><b>Reporting Boundaries</b></p> <ul style="list-style-type: none"> <li>River Basin District</li> <li>River Basin Districts (Neighbouring)</li> <li>Management Catchment</li> </ul>
	<p><b>Internationally Designated Sites</b></p> <ul style="list-style-type: none"> <li>Bathing Waters that may be adversely affected by heavy rainfall and are within 50m of flood risk</li> <li>EPR (Environmental Permitting Regulations) Installations within 50m of Risk</li> </ul>	<ul style="list-style-type: none"> <li>Special Areas of Conservation</li> <li>Special Protection Areas</li> <li>RAMSAR Sites</li> <li>World Heritage Sites</li> </ul>

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## Key Statistics

**Table 3: Summary of flood risk to people, economic activity and the natural and historic environment across the Dee river basin district.**

River and Sea	Total in RBD	High risk	Medium risk	Low risk	Very low risk
<b>Risk to people:</b>					
<b>Number of people in area:</b>	458,085	3287	2491	20,463	166
<b>Number of services:</b>	936	31	14	62	3
<b>Risk to economic activity:</b>					
<b>Number of non-residential properties:</b>	67,242	1094	1260	4,503	34
<b>Number of airports:</b>	1	0	0	1	0
<b>Length of roads (km):</b>	374	6	5	14	0
<b>Length of railway (km):</b>	127	5	3	20	0
<b>Agricultural land (ha):</b>	86,416	5,777	1,868	2,820	20
<b>Risk to the natural and historic environment:</b>					
<b>Number of EU designated bathing waters within 50m:</b>	1	1	0	0	0
<b>Number of EPR installations within 50m:</b>	56	2	2	15	0
<b>Area of SAC within area (ha):</b>	29,670	3,176	94	148	0
<b>Area of SPA within area (ha):</b>	23,334	2,161	156	298	0
<b>Area of RAMSAR site within area (ha):</b>	3,256	2,556	85	276	0
<b>Area of World Heritage Site within area (ha):</b>	4,266	188	10	84	12
<b>Area of SSSI within area (ha):</b>	34,253	3,987	195	403	0
<b>Area of Parks and Gardens within area (ha):</b>	3,048	156	51	51	0
<b>Area of Scheduled Ancient Monument within area (ha):</b>	531	11	5	6	0
<b>Number of Listed Buildings within area:</b>	4,386	146	65	215	1
<b>Number of Licensed water abstractions within the area:</b>	208	51	17	7	0

**Table 4: Summary flood risk from reservoirs to people, economic activity and the natural and historic environment across the Dee river basin district.**

<b>Reservoirs</b>	<b>Total in RBD</b>	<b>Maximum extent of flooding</b>
<b>Risk to people:</b>		
<b>Number of people in area:</b>	458,085	12,408
<b>Number of services:</b>	917	48
<b>Risk to economic activity:</b>		
<b>Number of non-residential properties:</b>	67,242	3606
<b>Number of airports:</b>	0	0
<b>Length of roads (km):</b>	374	27
<b>Length of railway (km):</b>	127	3
<b>Agricultural land (ha):</b>	86,416	8,267
<b>Risk to the natural and historic environment:</b>		
<b>Number of EU designated bathing waters within 50m:</b>	1	0
<b>Number of EPR installations within 50m:</b>	56	5
<b>Area of SAC within area (ha):</b>	29,670	1227
<b>Area of SPA within area (ha):</b>	23,334	107
<b>Area of RAMSAR site within area (ha):</b>	3,256	542
<b>Area of World Heritage Site within area (ha):</b>	4,266	461
<b>Area of SSSI within area (ha):</b>	34,253	2,066
<b>Area of Parks and Gardens within area (ha):</b>	3,048	256
<b>Area of Scheduled Ancient Monument within area (ha):</b>	531	38
<b>Number of Listed Buildings within area:</b>	4,386	498
<b>Number of Licensed water abstractions within the area:</b>	208	51

# 8. Sub-areas in the Dee river basin district

## Introduction

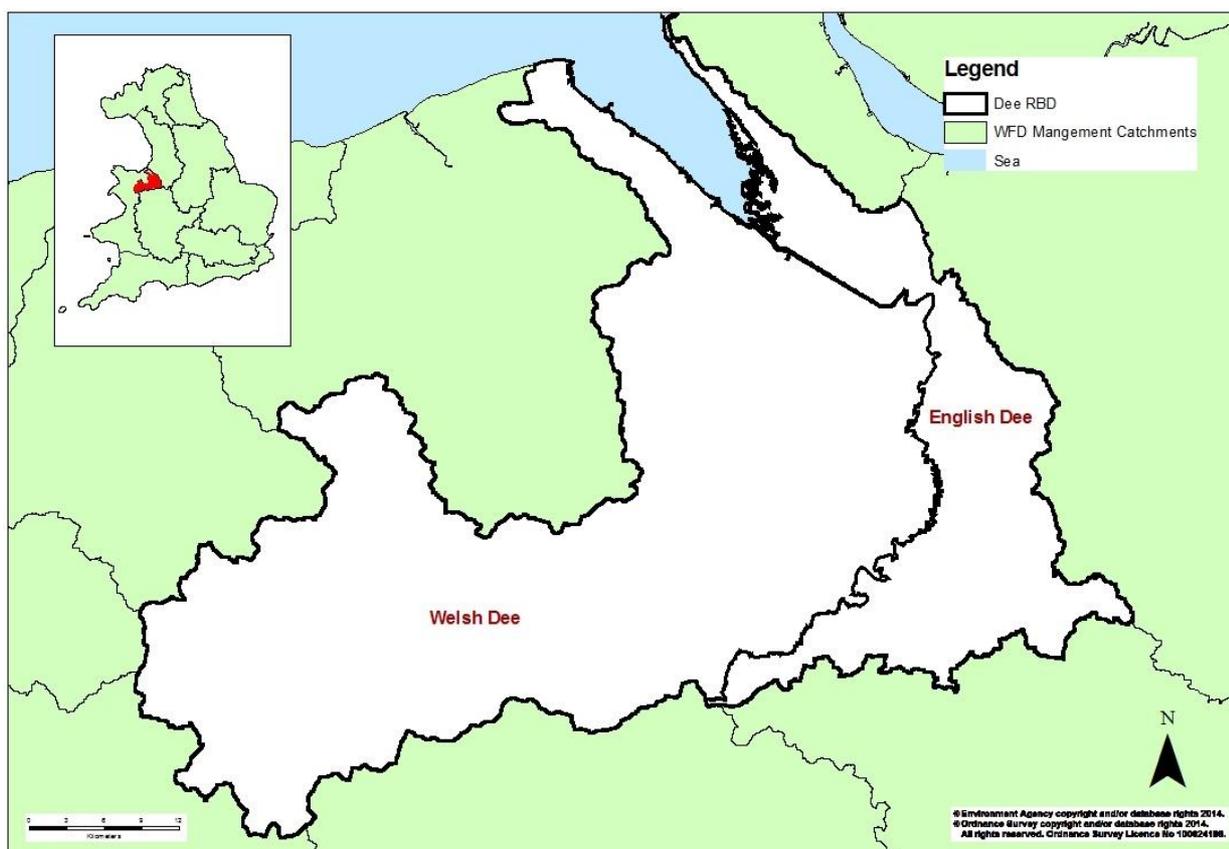
Where possible, this plan has been co-ordinated at RBD scale covering the whole of the Dee RBD. As the Dee RBD covers parts of both England and Wales, there are elements of flood risk management work that are not applicable to the whole RBD and just cover the Welsh section or the English section, due to different administrations. This plan includes two large strategic areas, as shown in Figure 5. These are:

- The English part of RBD
- The Welsh part of RBD

This will enable risk conclusions, objectives and measures to be developed for the English Dee as a strategic area and the Welsh Dee as a strategic area.

The Dee RBD is unique from the other RBDs that cover England and Wales in that the Dee is an RBD only and is not split into smaller WFD Management Catchments. In addition, there are no Flood Risk Areas as designated under the Flood Risk Regulations in the Dee RBD.

**Figure 5: Dee RBD showing Catchments, Flood Risk Areas and other Strategic Areas**



# 9. Conclusions, objectives and measures to manage risk for the Dee river basin district

This draft plan sets out the type of measures proposed to manage the risk. In developing the proposed measures the RMA's contributing have:

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

These conclusions, objectives and measures are set out for the Dee RBD. Conclusions, objectives and measures for the sub areas are set out in the following sections.

## Conclusions and objectives for the Dee RBD

The following conclusions and objectives have been set out for the Dee RBD.

### Conclusions

In the Dee RBD there are approximately 26,400 people at flood risk from main rivers and the sea; over 3000 of these are considered to be at high risk. Large areas of agricultural land are at risk, including 5,777 hectares at high risk of flooding. Parts of the road and railway networks are at risk and many of the environmentally designated sites in the RBD are also at risk.

The hazard maps show the largest area that might flood if a reservoir were to fail. The chances of a reservoir failing and causing flooding are very low; however the extent of flooding from a reservoir can perpetuate a long way from its source. This is because the local geography, such as valleys, can channel flood water long distances. In the RBD there are 12,408 people and 48 services at risk from flooding from reservoirs.

Under the Reservoirs Act 1975 the Environment Agency and Natural Resources Wales regulate all reservoirs with a capacity of 25,000 cubic metres or more above ground level, which could escape in the event of a dam failure. We are currently going through a process of identifying which of the reservoirs with a capacity of 25,000 cubic metres or more is 'high-risk'. 'High-risk' reservoirs will be those reservoirs that we think, in the event of an uncontrolled release of water, could endanger human life.

In the future the Environment Agency will continue to maintain a register of all reservoirs with a capacity of over 25,000 cubic metres in England, but will only fully regulate the 'high-risk' reservoirs. In Wales, Natural Resources Wales will identify and register reservoirs with a capacity of over 10,000 cubic metres and these will also be subjected to the risk classification process. However, we will only fully regulate the 'high-risk' reservoirs.

### Objectives

The Environment Agency and Natural Resources Wales have developed a set of eight overarching objectives for this plan at RBD level, shown in Table 5.

These objectives were developed and agreed based upon understanding of flood risk and issues that are important now or in the future. Their suitability has been reviewed against the National FCERM Strategies for England and Wales and the flood risk management plan requirements and are deemed to sufficiently reflect the key objectives of flood risk management work in England and Wales.

**Table 5: Objectives for the Dee FRMP River Basin District**

FRMP Objective Number	FRMP Objective
1	Reduce the risk and impact of flooding on people and communities (from main rivers, reservoirs and the sea).
2	Increase resilience of services, assets and infrastructure to the risk of flooding.
3	Improve understanding of flood risk so that decisions are based upon the best available information.
4	Improve community awareness and resilience to flooding.
5	Provide an effective and sustained response to flood events.
6	Allocate funding and resources for all sources of flooding on a risk basis.
7	Incorporate and promote an integrated approach to flood risk management, working with natural processes at a catchment scale, to provide multiple benefits to people and the environment.
8	Incorporate climate change adaption into all aspects of flood risk management.

## Ongoing measures across the Dee RBD

The Environment Agency and Natural Resources Wales are responsible for many flood risk management activities across the Dee RBD. Ongoing measures include:

- **Preventing risk:**

- We provide advice and support to the government.
- We regulate all 'high-risk' reservoirs in accordance with the Reservoirs Act 1975.
- We work closely with local planning authorities, developers, businesses and infrastructure operators to help them understand the consequences of flood risk in the locations they choose for development. We provide advice on how new development can be designed to be more resilient to flooding. This helps to prevent inappropriate development through the planning process and ensures there is no increase in run-off from new developments.
- We ensure works in, over, under and next to main rivers do not increase flood risk or cause pollution through effective consenting. We use the consenting process to identify opportunities to improve the water environment.
- We undertake a prioritised programme of mapping and modelling to ensure our flood risk information remains up to date and fit for purpose. We use this data to prioritise and allocate funding in locations that are most at risk, and to influence sustainable development and emergency response.
- We contribute to research and development, and work with partners to identify best practice for reducing runoff through land use change, whilst contributing wider benefits where possible (biodiversity, soil conservation and water quality improvements).
- We work with local authorities, emergency services and other key partners and explore opportunities for joint outcomes.

- **Preparing for risk:**
  - We undertake hydrometric monitoring across Wales to inform our flood warning service.
  - We undertake flood forecasting and alert households and individuals of potential flood events.
  - We undertake work to maintain and improve our flood forecasting, flood warning and flood incident management services. We focus on areas for improvement as highlighted by recent flooding events and routine exercises.
  - We undertake a risk based programme to increase awareness of flood risk, what actions they need to take and encourage registration to Floodline.
  - We take account of future flood risk when making our decisions, including consideration of climate change.
  - We review Asset System Management Plans regularly with regard to maintenance, funding requirements and asset condition related works across each catchment.
  - We provide a flood incident response service 24 hours a day, 7 days a week, 365 days a year.
  - We have on-site reservoir plans in place for all 'high-risk' reservoirs.
  - We provide advice and information to Local Resilience Fora to enable them to reduce the impact of flooding.
  
- **Protecting from risk:**
  - We maintain high risk flood and coastal risk management assets, prioritising our efforts on those at highest risk.
  - We undertake an asset inspection programme to ensure our flood risk management assets are at the appropriate standard.
  - We undertake a maintenance programme to replace / refurbish flood risk management assets, including pumping stations and outfalls, prioritising our efforts on those which have the highest flood risks.
  - We deliver our Flood and Coastal Risk Management Capital Programme which includes building flood defences and implementing innovative ways of managing the landscape to hold and slow down water to help reduce flood risk to communities.
  
- **Recovery and review of risk:**
  - We deliver an effective and co-ordinated response to flood incidents and provide a physical response on the ground where required.
  - We undertake post-event reviews to learn and improve the service we provide.

## Agreed and Proposed measures across the Dee RBD

Within the Dee RBD, there are no agreed and proposed measures applicable to the whole RBD as these have been set at a more local level. They are therefore included in the England and Wales only sub-sections.

## Contributing to broader benefits

The ongoing, agreed and proposed measures can also help us deliver broader benefits, in particular to biodiversity, water and ecological quality. In parallel to flood risk management planning, we also work with others to improve the quality of the water environment through River basin management planning. As we develop FRMPs we aim to co-ordinate effectively with the river basin management planning so we and others can deliver more for the environment.

The FRMP will be closely aligned with the RBMP. As the plans are both being prepared at the river basin district scale and following the same timescales, we will use much of the same information (environmental baseline and contextual information) for the SEAs. Opportunities for the FRMP to

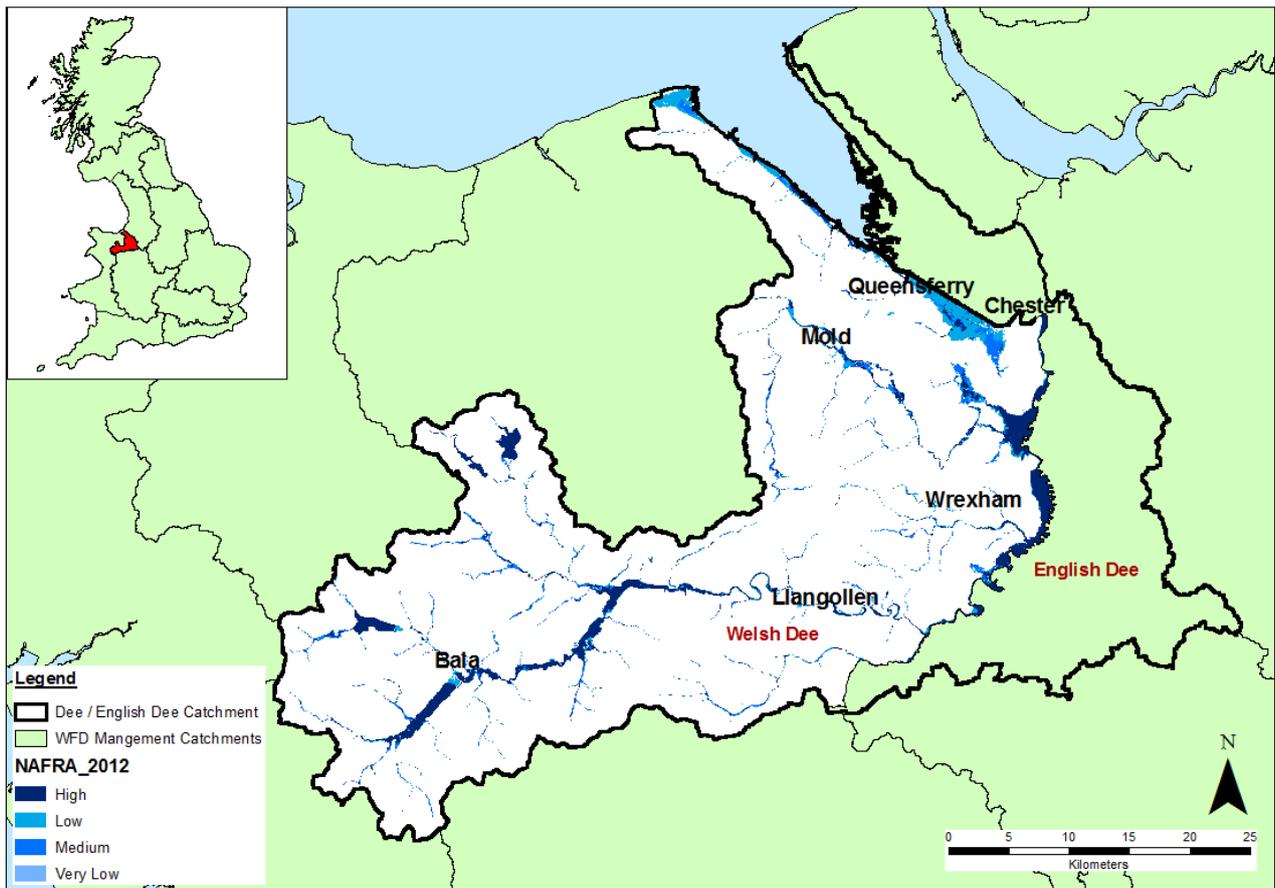
contribute to WFD objectives will be explored as part of the FRMP preparation process and will be highlighted in the Environmental Report.

# 10. Wales only section

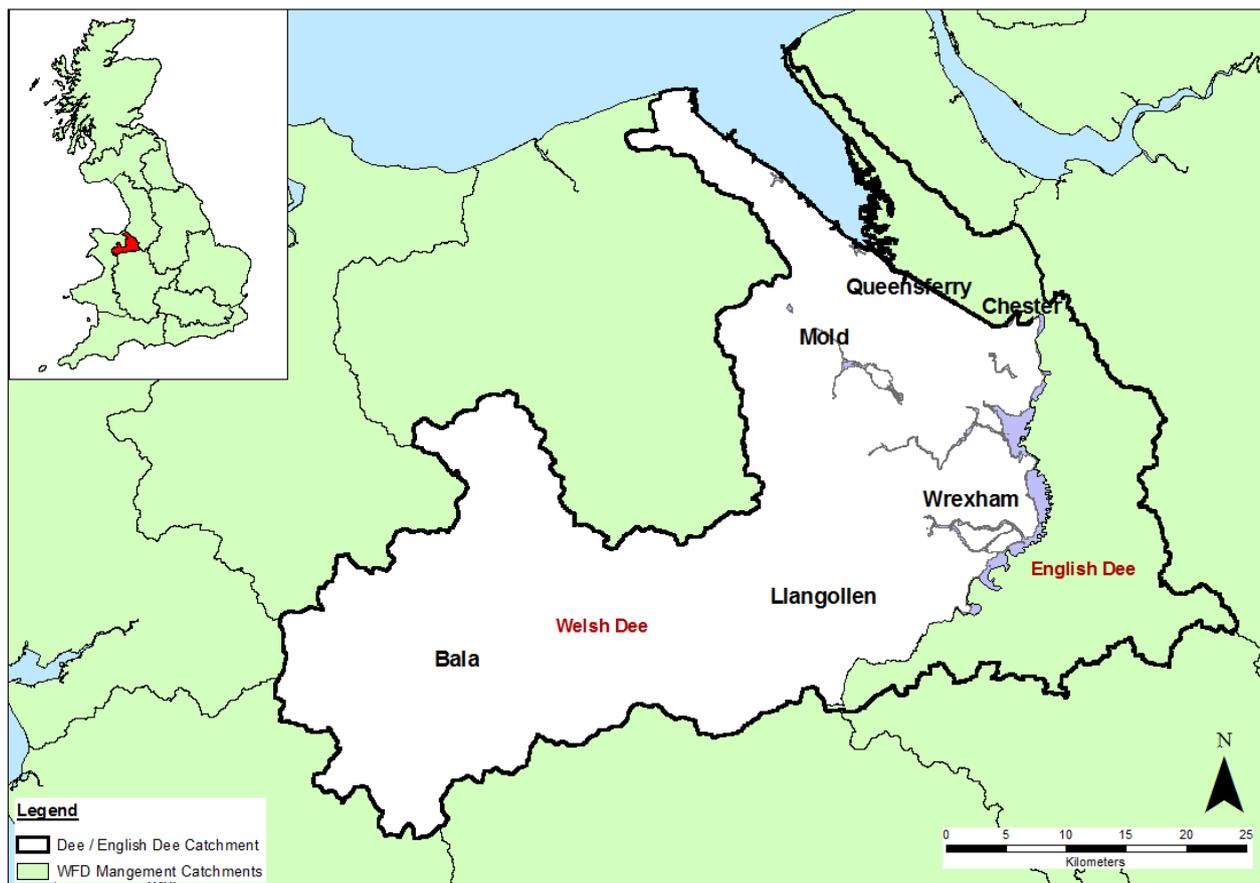
The following section considers the objectives and measures that are only applicable to the Wales only side of the RBD (these will include objectives and measures that are applicable at a scale that is larger than a single catchment but not applicable across the border in the RBD. This also includes community specific measures that are within the Wales only section). The flood risk maps for the Welsh Dee area are shown in Figure 6 and Figure 7.

## Flood Risk Maps

**Figure 6: Flood Risk from Rivers and the Sea in the Welsh Dee area**



**Figure 7: Flood Risk from Reservoirs in the Welsh Dee area**



## Conclusions and Objectives for the Wales section of the Dee

### Conclusions

The majority of the Dee catchment is situated in Wales and includes Queensferry, Mold, Wrexham, Llangollen and Bala. The River Dee responds relatively slowly to rainfall, taking a few days to peak in the downstream reaches following rainfall events further up the catchment. The river Dee becomes tidally locked on spring tides and this tidal impact can be observed as far upstream as Holt.

The highest risk areas in the Welsh part of the RBD are those communities situated along the tidally affected stretch of the River Dee, downstream of Chester. The primary flood risk here is from high tide levels; however a combination of high tides and a fluvial event can lead to high river levels in the transition zone. The communities considered to be at highest risk in this area are Garden City and Deeside, Connah's Quay and Shotton, Queensferry and Sandycroft, Sealand, Bretton and Lache.

Further out in the estuary and on the coastal areas of the Dee RBD, communities including Flint, Bagillt, Walwen and Whelston, Greenfield, Ffynnongroyw, Talacre and Gronant are at highest risk. In the upper and middle catchments, the primary flood risk is from main rivers, with the highest risk areas being Bala, Ffrith, New Broughton, Cefn-Mawr, Bangor-is-y-coed and Mold.

### Objectives

The Welsh Government National Flood and Coastal Erosion Risk Management Strategy objectives set the framework for flood and coastal erosion risk management work within Wales as follows:

- **Reducing the consequences** for individuals, communities, businesses and the environment from flooding and coastal erosion.

- **Raising awareness of and engaging people in the response** to flood and coastal erosion risk.
- **Providing an effective and sustained response** to flood and coastal erosion events.
- **Prioritising investment** in the most at risk communities.

Every flood risk management action undertaken in Wales has the National Flood and Coastal Erosion Risk Management strategy objectives as the overarching deliverable.

Sitting under the National Strategy objectives, Natural Resources Wales has developed a set of seven objectives for this plan. The majority of these objectives were developed and agreed by the CFMP steering groups based upon understanding of flood risk and issues that are important now or in the future. Their suitability has been reviewed against the National Strategy and flood risk management plan requirements and is deemed to still sufficiently reflect the key objectives of flood risk management work in Wales. The sub-objectives were developed by considering the three main aspects of sustainable flood risk management:

1. Social: people and communities
2. Economic: potential cost and economic benefit
3. Environment: cultural heritage, landscape and habitat diversity.

The principles of sustainable flood risk management remain the key deliverables for the flood risk management work of Natural Resources Wales.

Table 6 provides details on the seven FRMP sub-objectives and how they link to the Welsh Government National Flood and Coastal Erosion Risk Management Strategy and the aspects of sustainable flood risk management.

**Table 6: FRMP objectives for Wales**

FRMP Objective Number	Wales FRMP Objective	Link to Welsh Government National Flood and Coastal Erosion Risk Management Strategy Objectives	Principles of sustainability		
			People	Environment	Economy
1	Reduce the risk of harm to life from flooding to people and communities from main rivers, reservoirs and the sea.	1, 3	Y		Y
2	Increase resilience of services, assets and infrastructure to the risk of flooding.	1, 3	Y		Y
3	Improve understanding of flood risk so that decisions are based upon the best available information.	1, 3	Y	Y	Y
4	Improve community awareness and resilience to flooding.	2	Y		Y
5	Provide an effective and sustained response to flood events.	3	Y		Y

6	Allocate funding and resources for all sources of flooding on a risk basis.	4	Y	Y	Y
7	Incorporate the ecosystem approach into the delivery of flood risk management.	1, 4	Y	Y	Y

### Selecting measures to achieve objectives

Any measure that Natural Resources Wales undertakes as part of this Flood Risk Management Plan will be for the purpose of meeting the sub-objectives set out above, and ultimately, those set out in the Welsh Government National Flood and Coastal Erosion Risk Management Strategy. The measures within this plan have been selected after:

- considering the source and severity of the risk;
- what risk management processes are already in place;
- how the risk might change in the future; and
- what the options to address the risk are.

The most appropriate measure is selected after considering all of these factors along with the technical feasibility and the cost. The appropriate measure is then assessed against the plan objectives to ensure the proposed measure is in keeping with the preferred Welsh approach.

The measures within the latter sections of this plan are linked to the relevant plan objectives so it is possible to see which measures will deliver which objectives.

There are a number of communities within the catchment where we feel there is still more to be done to manage and reduce the risk of flooding. In the Welsh Dee area there are many ongoing, agreed and proposed measures to manage risk from 2015 to 2021. Figure 8 summarises these measures in the Wales part of the RBD. Some of these measures are described in the following sections and are detailed in Natural Resources Wales' delivery plan in Table 7.

## Ongoing measures in the Wales side of the RBD

### Preventing risk: 3 measures

- We are reviewing and updating hydrology in new and existing models to ensure we and our partners are using the latest guidance and methodologies, for example at Leeswood (Pontblyddyn) and Mold.
- We are building new hydraulic models to assess the current and future risk at specific locations, for example at Leeswood (Pontblyddyn).

### Preparing for risk: 18 measures

- We are maintaining community plans for specific locations including; Bagillt, Bangor-is-y-coed, Ffynnongroyw, Garden City and Deeside Greenfield, Queensferry and Sandycroft, Sealand and Talacre.
- We are improving the flood forecasting model for the River Alyn which would improve information and the provision of flood warnings to many communities along its reach.

### Protecting from risk: 15 measures

- We are maintaining existing defences and carrying out regular inspections to check their integrity at specific locations such as; Bagillt, Ffrith, Ffynnongroyw, Greenfield, Gronant, Lache, Mold, Sealand and Talacre.
- We are developing scheme appraisals for flood alleviation schemes.
- We design and construct flood alleviation schemes.

- We carry out structural assessment on existing structures to ensure they are fit for purpose.

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

## Agreed measures across the area

### Preventing risk: 3 measures

- We will review and update hydrology on new and existing models for example at Connah's Quay and Shotton.
- We will build new hydraulic models to improve our flood risk information in specific locations including; Gronant and Talacre.

### Preparing for risk: 6 measures

- We will undertake hydrometric surveys to see if hydrometry and telemetry improvements can be made in communities such as; Ffirth, Llong, Mold, New Broughton, Queensferry and Sandycroft.
- We will undertake hydrometry and telemetry improvements where we already know these can provide a benefit.

**Protecting from risk:** there are no measures proposed over and above our existing flood risk work.

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

## Proposed measures in the Wales side of the RBD

### Preventing risk: 6 measures

- We propose to review and update hydrology on new and existing models to ensure we are using the latest guidance and methodologies.
- We propose to continue with our programme of reviewing and updating hydraulic models in the future, to include communities such as Greenfield, Queensferry and Sandycroft, and Walwen and Whelston.

### Preparing for risk: 15 measures

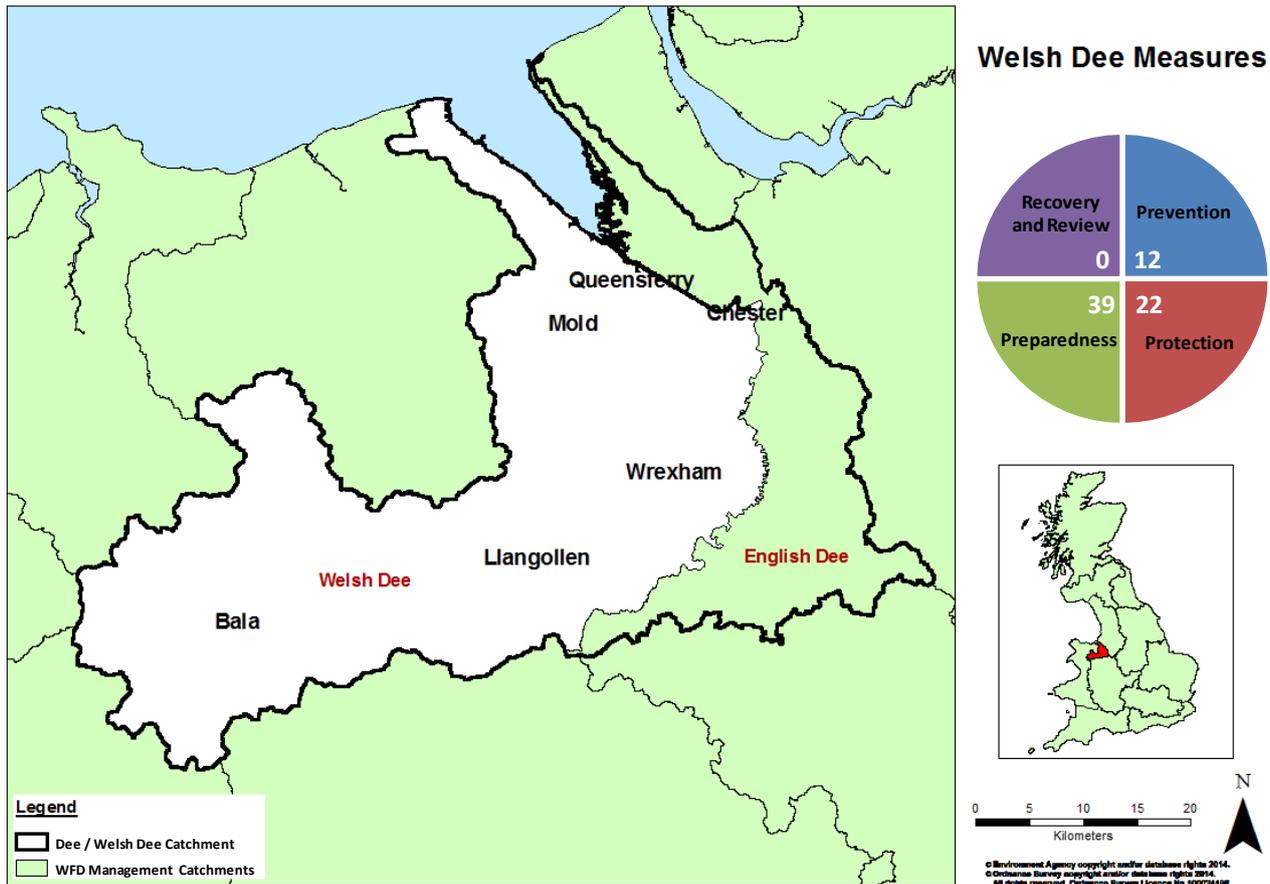
- We propose to investigate the feasibility of new flood warning services where we think there is potential benefit to specific communities, such as at Ffrith and Llong.
- We propose to further improve our existing flood warning service, particularly to sites affected by tidal flooding along the coast and within the Dee estuary.

### Protecting from risk: 7 measures

- We propose to implement alternative risk reduction measures (such as individual property protection at Cefn-Mawr and New Broughton).
- We propose to undertake initial assessments and feasibility work for reducing flood risk, for example at Connah's Quay and Shotton, Walwen and Whelston and Wrexham.
- We propose to continue carrying out structural assessments on existing structures to ensure they are fit for purpose, for example at Queensferry.

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

Figure 8: Summary of measures in the Wales side of the RBD



**Table 7: Wales only measures**

Note: Natural Resources Wales are the responsible authority for all measures in this table and all are planned to be delivered in the first FRMP cycle (2015 – 2021).

Location	Source	Measure Name	Measure	Link to FRMP objective	Priority	Measure Status
Bagillt	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Bala	Main River	Develop scheme appraisal for flood alleviation scheme	M3 - Protection	1, 2	Very High	Ongoing
Bangor-is-y-coed	Main River	Design and construction of flood alleviation scheme	M3 - Protection	1, 2	Very High	Ongoing
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
Bradley	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Bretton	Main River / Sea	Design and construction of flood alleviation scheme	M3 - Protection	1, 2	Very High	Ongoing
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
Caergwrle	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Cefn-Mawr	Main River	Implement alternative risk reduction measures	M3 - Protection	1, 2	Medium	Not Started Proposed
Cefn-y-bedd	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Connah's Quay and Shotton	Main River / Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	High	Not Started Agreed
		Derive hydrology	M2 - Prevention	1, 2, 3	Very High	Not Started Agreed
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2	High	Not Started Proposed
Ffrith	Main River	Investigate feasibility for new flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started Proposed
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started Agreed
Ffynnongroyw	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Flint	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Garden City and Deeside	Main River / Sea	Carry out structural assessment on existing structures to ensure they are fit for purpose	M3 - Protection	1, 2	Very High	Ongoing
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
Greenfield	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
		Review or update hydraulic model	M2 - Prevention	1, 2, 3	High	Not Started Proposed
Gresford	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Gronant	Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	High	Not Started Agreed
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started Proposed
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Holt and Plas Devon	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Hope	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Lache	Main River / Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Leeswood	Main River	Build hydraulic model	M2 - Prevention	1, 2, 3	High	Ongoing
		Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
		Review / update hydrology	M2 - Prevention	1, 2, 3	Very High	Ongoing
Llong	Main River	Investigate feasibility for new flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started Proposed
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started Agreed
Mold	Main River	Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing

Location	Source	Measure Name	Measure	Link to FRMP objective	Priority	Measure Status
		Review / update hydrology	M2 - Prevention	1, 2, 3	Very High	Ongoing
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started Agreed
New Broughton	Main River	Implement alternative risk reduction measures	M3 - Protection	1, 2	Medium	Not Started Proposed
New Broughton	Main River	Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started Agreed
Padeswood	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Pen-y-ffordd	Main River	Implement alternative risk reduction measures	M3 - Protection	1, 2	Medium	Not Started Proposed
Queensferry and Sandycroft	Main River / Sea	Carry out structural assessment on existing structures to ensure they are fit for purpose	M3 - Protection	1, 2	Medium	Not Started Proposed
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Review / update hydrology	M2 - Prevention	1, 2, 3	Medium	Not Started Proposed
		Review or update hydraulic model	M2 - Prevention	1, 2, 3	Medium	Not Started Proposed
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started Agreed
Rossett and Burton	Main River	Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
Sealand	Main River / Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
		Undertake hydrometry and telemetry improvements	M4 - Preparedness	1, 2, 4	Very High	Not Started Agreed
Sealand Basin Wales	Main River / Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started Proposed
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Talacre	Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	Very High	Not Started Proposed
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started Proposed
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2	Very High	Ongoing
Walwen and Wheston	Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	Medium	Not Started Proposed
		Review / update hydrology	M2 - Prevention	1, 2, 3	Medium	Not Started Proposed
		Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2	High	Not Started Proposed
Wrexham	Main River	Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2	High	Not Started Proposed

# 11. England only section

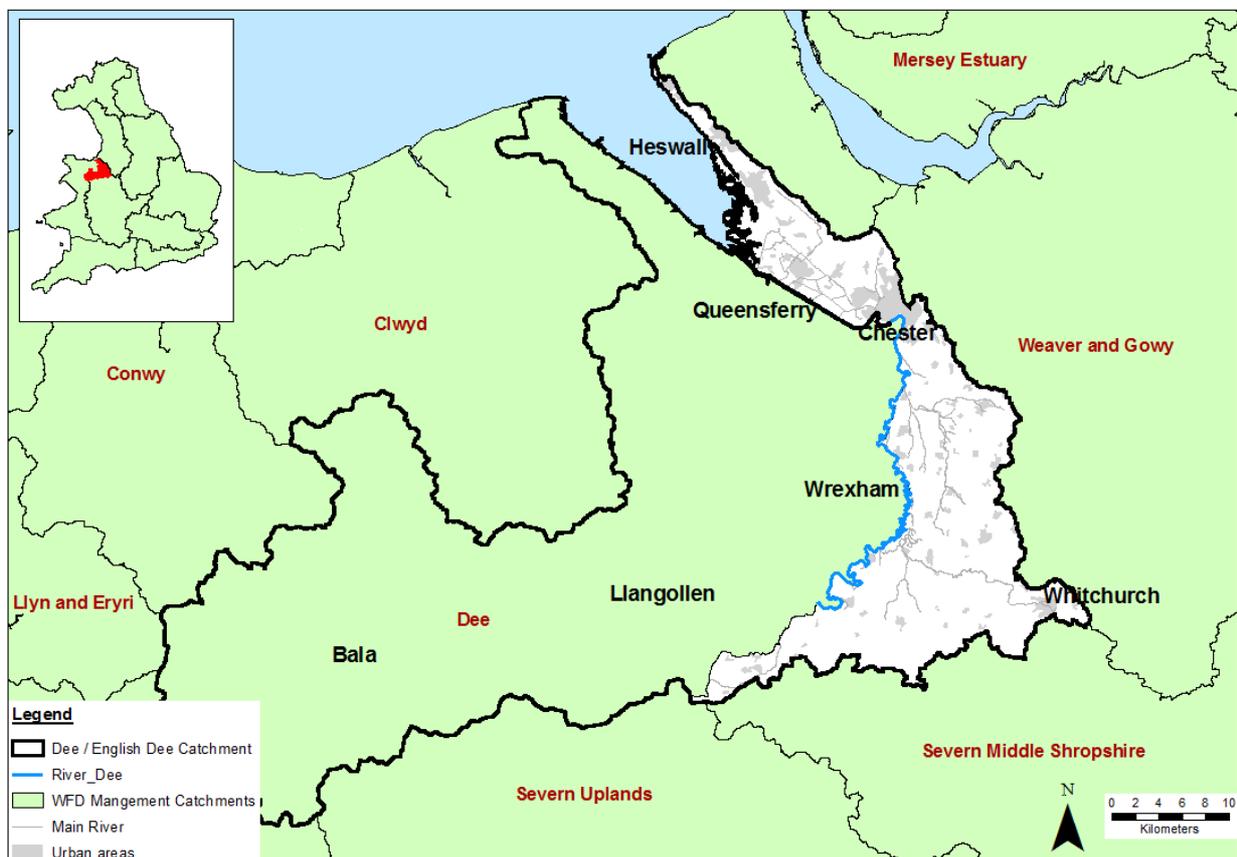
The following section considers the objectives and measures that are only applicable to the England only side of the RBD (these will include objectives and measures that are applicable at a scale that is larger than a single catchment but not applicable across the border in the RBD). The flood risk maps for the Welsh Dee area are shown in Figure 10 and Figure 11.

The English Dee area covers 500km<sup>2</sup> of the River Dee catchment, including Chester, part of the Wirral, and tributaries east of the River Dee. The River Dee itself forms the entire western boundary of the English Dee area, and flows northwards through Chester to the Dee Estuary. The area covers the Dee catchment that falls within England, from Whitchurch in the south east, through Tattenhall and Chester, the Dee Estuary at Queensferry and the south western shoreline of the Wirral, including Heswall. The hydrological catchments in this area are the Dee Estuary, Lower Dee and Worthenbury.

The River Dee is fed by a number of tributaries, including Shotwick Brook, Finchett's Gutter and Wych Brook. The total length of Main Rivers in the English Dee area is 265 km. River flows are influenced by regular high spring tide levels and extreme tide levels up as far as Farndon.

In the lower Dee Catchment, improved arable farming practices on steeper sloping ground could increase infiltration and water retention and hence reduce run-off rates. Wetlands outside the flood plain in the lower catchment will attenuate peak run-off rates. Conversely livestock farming can reduce infiltration and increase run-off through land trampling by cattle. Land drainage in the lower catchment can increase run-off rates.

**Figure 9: Overview map of the English Dee area**



## **Partnership Working**

The English Dee area is covered by 4 local authorities; Cheshire West and Chester Council, Wrexham Council, Flintshire Council and Shropshire Council.

Welsh Water and Dee Valley Water are the water and sewerage providers in this catchment and they actively participate in partnership working to identify and address flood risk issues within the River Dee catchment.

In addition to those partners mentioned we also work closely with the Regional Flood and Coastal Committee, and Natural England.

# Flood Risk Maps

Figure 10: Flood Risk from Rivers and the Sea in the English Dee area

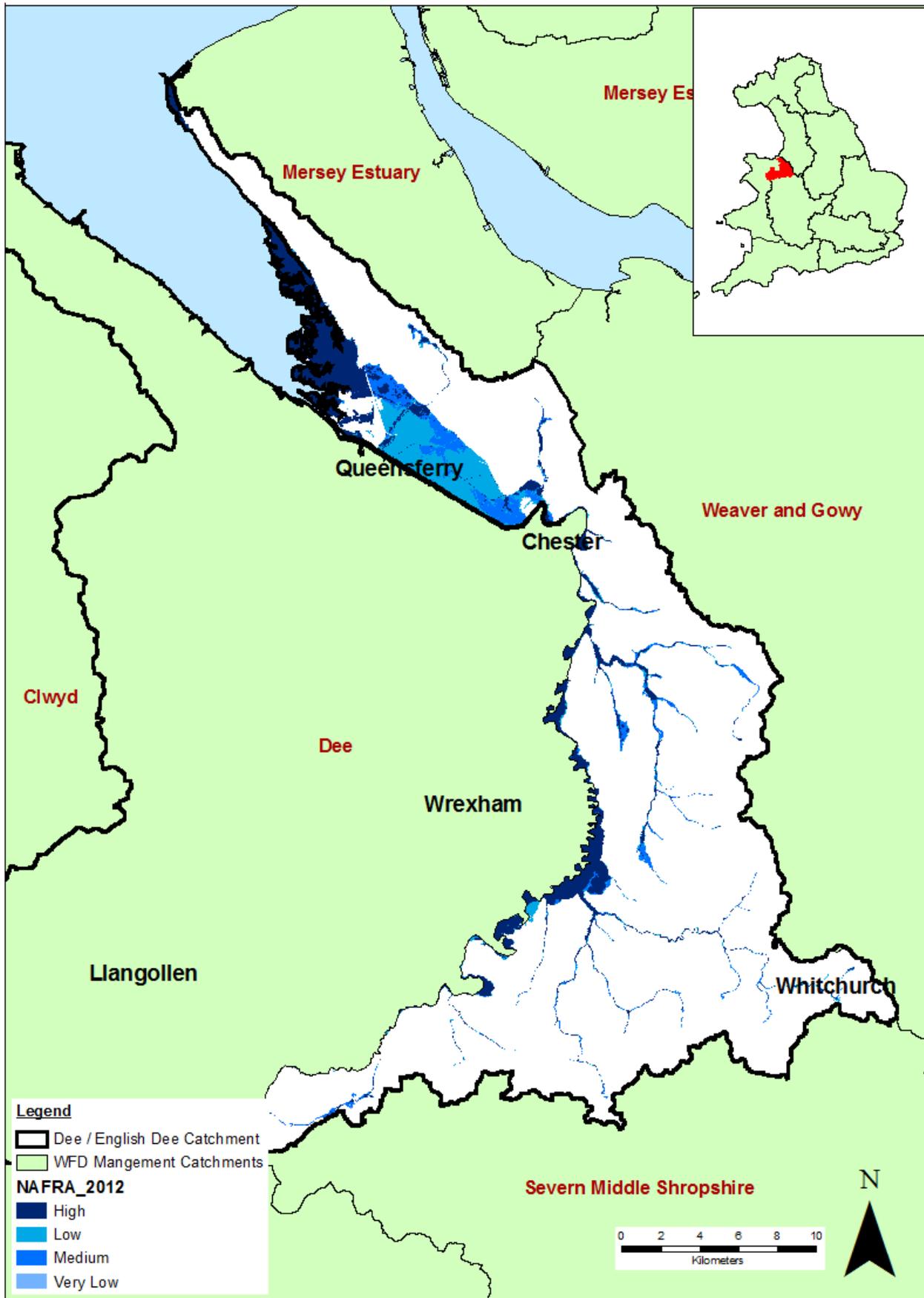


Figure 11: Flood Risk from Reservoirs in the English Dee area



# Conclusions and objectives for the England section of the Dee

## Conclusions

This part of the Dee catchment covers a significant area; and includes Whitchurch, Farndon, Chester and Queensferry.

The River Dee at Chester responds slowly to heavy rainfall, taking up to 3 or 4 days to peak following a rainfall event. The river becomes tidally locked on spring tides and this tidal impact can be observed as far upstream as Farndon. The weir at Chester regularly drowns out and the flow is often reversed through the city because of the tidal influence. This weir acts as a flow control to allow recreational navigation upstream.

The primary flood risk downstream of Chester is from high tide levels. A tidal surge with a high spring tide occurred in December 2013 and caused flooding along the Dee and Mersey estuaries. In Chester, the Groves were inundated and the canal basin at Dee Lock experienced high levels. There was flooding recorded to one business and one property along the River Dee.

In Chester and further upstream, the combination of a fluvial event with high tides is a scenario that could lead to high river levels and potential flood risk to properties alongside the river. Fluvial flood risk in the catchment is limited to isolated rural properties.

The interface with the Canal at Dee Lock is an area that the Environment Agency are working in partnership with Cheshire West and Chester and the Canal and River Trust to reduce the risk of flooding.

Just downstream of Farndon, there are a number of dwellings by the river's edge that would be inaccessible during a flood event as the surrounding area is floodplain. This can be a regular occurrence. In working with Cheshire West and Chester and the property owners, the Environment Agency now issue a flood warning to this area from which residents are able to take the appropriate action. Other flood warning areas have also been developed in Chester.

Properties that flooded in December 2013 are benefitting from the Local Governments Repair and Renew Grant to improve flood resilience.

Key flood defence assets within English Dee Catchment are the River Dee flood embankments in Chester, Sealand Main Drain Flood Basin at Clifton Drive, Chester and Finchetts Gutter outfalls and debris screens at Sealand Road, Chester. Critical infrastructure would include the Scottish Power Substation in Chester.

There is key environmental interest as the River Dee is designated as SSSI and SAC and therefore we have to implement mitigation measures to reduce habitat and ecological impacts. This will be in partnership with Natural England and Natural Resources Wales and a programme will be developed to look at this.

Previously the Dee CFMP considered possible increases in flood levels, extent and risk if climate change were to increase flood flows by 20%. Climate projections since then suggest flood flows could increase by more than that but acknowledge significant uncertainty. No additional analysis is proposed at this stage; instead our preferred approach is to emphasise the uncertainty in climate change impacts. Planners, Emergency Planners, Asset Managers should consider what should be reasonably done to address realistic worse case scenarios.

The CFMP, written in 2008/09, sets out how flood risk can be managed sustainably within the catchment. The FRMP summarises some of that information but in no way changes the approach developed in the CFMP, which was the subject of substantial consultation.

## Objectives

### Social

1. Minimise impact on people from all sources of flooding.
2. Minimise disruption to critical infrastructure and services.
3. Contribute to recreational amenity and the conservation of cultural heritage.
4. Promote understanding of flood risk to landowners and roles and responsibility of river maintenance and management.
5. Promote the concept of ecosystem services (environmental benefits to people) as part of work to manage flood risk.

### Economic

6. Minimise flood risk impact to the local economy and business.
7. Promote an integrated approach to water management and sustainable drainage at the catchment scale.

### Environmental

8. Work with natural processes, including the sediment system and river features (the hydromorphology) and sustainable soil management.
9. Conserve biodiversity and develop ecological connectivity, including 'green infrastructure'.
10. Support landscape scale climate change adaptation required by increasing flood risk.
11. Support delivery of Water Framework Directive objectives.

## Ongoing measures across the English Dee area

Across the English Dee area there are 10 ongoing measures from earlier catchment flood management plans to manage flood risk including;

**Preventing risk:** there are no measures proposed over and above our existing flood risk work.

### **Preparing for risk: 11 measures**

- Produce local community flood plans covering key communities including; Tattenhall, Whitchurch, Farndon, Aldford, Neston, West Kirby and Heswall (7 measures at different locations).
- Support Cheshire Constabulary in Developing Multi-Agency Flood Plans for Cheshire County.
- Improve existing Flood Awareness Plans to encourage more people to sign up to and respond to flood warnings as well as using self help methods to protect themselves and their properties.
- Encourage and support our partners to produce local long term plans to manage all sources of flooding at Chester.

### **Protecting from risk: 1 measure**

- Encourage the owners and operators of storm water pumping stations and associated infrastructure to undertake an assessment of their current and future risks to determine their resilience to flooding. Develop a flood resilience and adaptation plan as appropriate.

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

## Agreed measures across the English Dee area

**Preventing risk:** there are no measures proposed over and above our existing flood risk work.

**Preparing for risk:** there are no measures proposed over and above our existing flood risk work.

**Protecting from risk: 1 measure**

- Dee Lock Flood Risk Management scheme

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

## Proposed measures to manage risk in the English Dee Catchment

In the English Dee area there are 5 measures proposed to manage risk from 2015 to 2021. The following measures are proposed for specific locations:

Proposed measures in specific locations are summarised as follows, and described more fully in Table 8.

**Preparing for risk: 5 measures**

- Produce local community flood plans covering key communities including Malpas, Shocklach, Almere, Eccleston and Lower Kinnerton (5 measures at different locations).

**Preventing risk:** there are no measures proposed over and above our existing flood risk work.

**Protecting from risk: 1 measure**

- Inform the owners/operators of the storm water pumping stations and associated infrastructure of their flood risks now and in the future.

**Recovery and review of risk:** there are no measures proposed over and above our existing flood risk work.

**Figure 12: The English Dee - Measures**

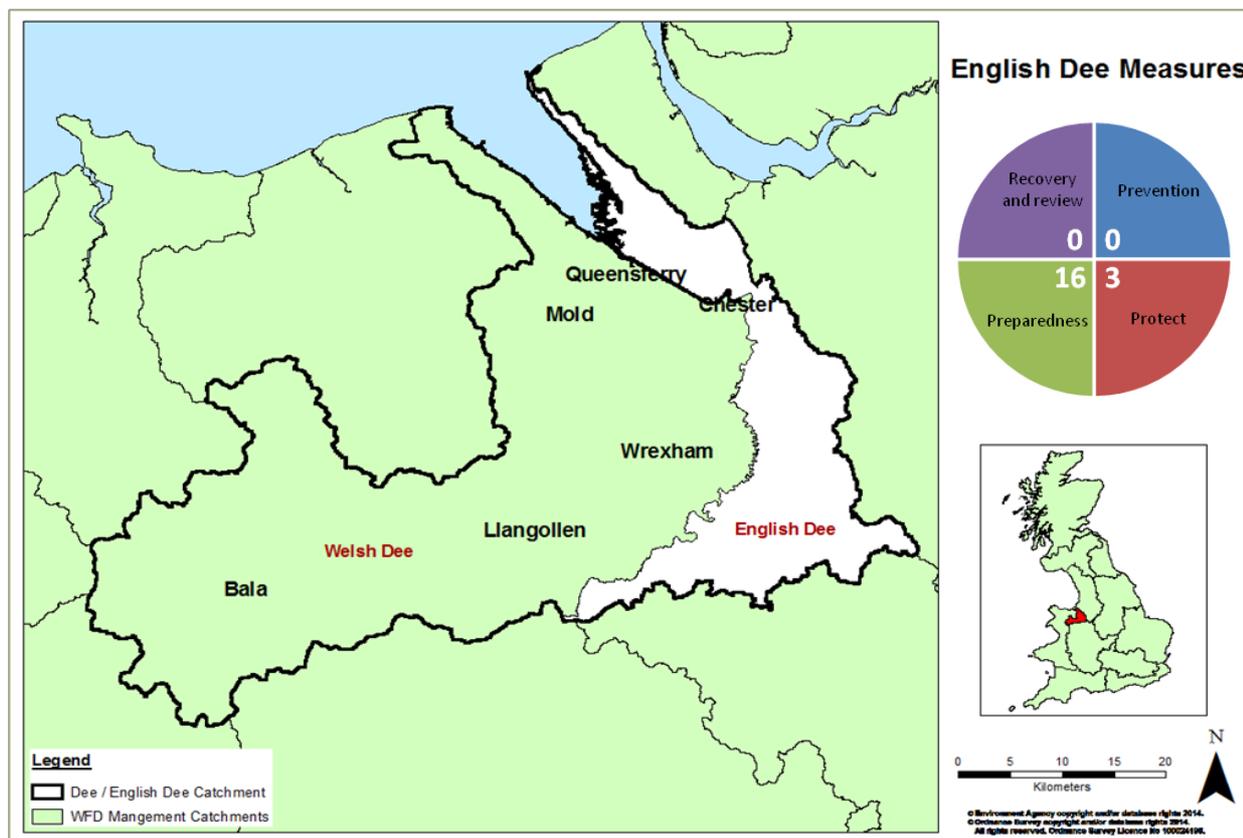


Table 8: England only measures

Action Name	Action Details	Source of flood risk or coastal erosion									Category of objective			Measures	Timing	Priority	Partnership	Statutory or voluntary measure	Type of measure
		Flooding from rivers (main river)	Flooding from Rivers (ordinary watercourses)	Flooding from Rivers (main river plus ordinary watercourses)	Flooding from the Sea	Coastal erosion	Flooding from reservoirs	Surface water flooding	Groundwater flooding	Sewer flooding	Social	Environment	Economic						
														Prevention, protection, preparedness etc	FRMP Planning Cycles e.g. 2015 - 2021; 2021 - 2027 etc	Critical, Very High, High, Moderate, Low	Action owner (bold), plan owner and support organisations	Statutory or voluntary	Ongoing, agreed or proposed
DEE03.013A	Produce local community flood plans covering key communities including Whitchurch. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. The local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing
DEE03.013C	Produce local community flood plans covering key communities including Malpas.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed
DEE03.013B	Produce local community flood plans covering key communities including Tattenhall.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing
DEE03.014	Support Cheshire Constabulary in Developing Multi-Agency Flood Plan for Cheshire County.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing
DEE05.012A	Produce local community flood plans for Shocklach. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed

Action Name	Action Details	Source of flood risk or coastal erosion									Category of objective			Measures	Timing	Priority	Partnership	Statutory or voluntary measure	Type of measure
		Flooding from rivers (main river)	Flooding from rivers (ordinary watercourses)	Flooding from Rivers (main river plus ordinary watercourses)	Flooding from the Sea	Coastal erosion	Flooding from reservoirs	Surface water flooding	Groundwater flooding	Sewer flooding	Social	Environment	Economic						
DEE05.012B	Produce local community flood plans for Farndon. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing
DEE05.012C	Produce local community flood plans for Almere. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed
DEE05.012D	Produce local community flood plans for Aldford. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing
DEE05.012E	Produce local community flood plans for Eccleston. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed

Action Name	Action Details	Source of flood risk or coastal erosion										Category of objective			Measures	Timing	Priority	Partnership	Statutory or voluntary measure	Type of measure
		Flooding from rivers (main river)	Flooding from rivers (ordinary watercourses)	Flooding from Rivers (main river plus ordinary watercourses)	Flooding from the Sea	Coastal erosion	Flooding from reservoirs	Surface water flooding	Groundwater flooding	Sewer flooding	Social	Environment	Economic							
DEE05.012F	Produce local community flood plans for Lower Kinnerton. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. These local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed	
DEE05.013	Support Cheshire Constabulary in Developing Multi-Agency Flood Plan for Cheshire County	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE06.014A	Produce local community flood plans for all the communities in the estuary area including Neston. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. The local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE06.014B	Produce local community flood plans for all the communities in the estuary area including West Kirby. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. The local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	

Action Name	Action Details	Source of flood risk or coastal erosion											Category of objective	Measures	Timing	Priority	Partnership	Statutory or voluntary measure	Type of measure	
		Flooding from rivers (main river)	Flooding from rivers (ordinary watercourses)	Flooding from rivers (main river plus ordinary watercourses)	Flooding from the Sea	Coastal erosion	Flooding from reservoirs	Surface water flooding	Groundwater flooding	Sewer flooding	Social	Environment								Economic
DEE06.014C	Produce local community flood plans for all the communities in the estuary area including Heswall. These local plans will be based on an understanding of the current and future risks of flooding, both probability and consequence. The local plans will identify all the potential action that could be undertaken to manage the local risks. They will identify what actions are currently undertaken and will identify the gaps where more could be done. They will identify what additional actions are proposed.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE07.002	Inform the owners/operators of the storm water pumping stations and associated infrastructure of their flood risks now and in the future.	N	N	Y	N	N	N	N	N	N	N	N	Y	M3 - Protection	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Not started - proposed	
DEE07.003	Encourage the owners and operators of storm water pumping stations and associated infrastructure to undertake an assessment of their current and future risks to determine their resilience to flooding. Develop a flood resilience and adaptation plan as appropriate.	N	N	Y	N	N	N	N	N	N	N	N	Y	M3 - Protection	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE07.012	Improve existing Flood Awareness Plans to encourage more people to sign up to and respond to flood warnings as well as using self help methods to protect themselves and their properties.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE07.014	Encourage and support our partners to produce local long term plans to manage all sources of flooding at Chester. These plans should include an assessment of the consequences of flooding, including from overtopping of defences, and actions to manage these. They should consider future options and investment needs for defences, emergency planning and response, and development control issues to avoid inappropriate development in high risk areas.	N	N	Y	N	N	N	N	N	N	N	N	Y	M4 - Preparedness	2015 - 2021	Moderate	Environment Agency	Statutory FRMP	Ongoing	
DEE07.015	Dee Locks Flood Risk Management Scheme. Improve the standard of protection for Dee Lock gates to bring in line with the adjacent flood embankments along the lower Dee.	Y	N	N	Y	N	N	N	N	N	N	N	N	M3 – Protection	2015 - 2021	High	Environment Agency	Statutory FRMP	Not started - agreed	

## 12. Implementing the plan

This draft FRMP sets out ongoing, agreed and proposed measures to manage flood risk. Implementing the measures set out in the final FRMP will be through a number of established mechanisms, as set out in the National FCERM Strategies for England and Wales.

### The Catchment based approach in England

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

### Natural Resource Management in Wales

Natural Resources Wales is developing its implementation of the ecosystem approach and Area-Based Natural Resource Management (NRM). The current area of focus is on designing and embedding the ecosystem approach. This has begun with three trial areas which will help to shape future delivery of natural resource management, including flood risk management in Wales.

### Monitoring delivery of actions

It is a requirement of the Flood Risk Regulations that this Flood Risk Management Plan must be reviewed, and if necessary updated, every 6 years. The Environment Agency and Natural Resources Wales will undertake and publish the review, and will prepare an updated Flood Risk Management Plan if required.

In the interim years, we will review the measures within the FRMP on an annual basis. The progress of delivery of each measure will be assessed and updated. There will be no published update from each annual review so for the most up to date information on what actions we are taking in your area, please contact us.

We may also need to add actions in response to flooding that might be experienced during the six year cycle of this FRMP. If this is the case, measures will be added and monitored without an update to this report on an ad-hoc basis.

## 13. What happens next?

The consultation on this draft plan will run from the 10 October 2014 until 31 January 2015. After January 2015 we will prepare a consultation response document that outlines the responses we received. We will publish this document in April 2015.

Consultation on the draft updates to the river basin management plans closes in April 2015 and we will also consider any feedback that is relevant to the FRMP.

By July 2015 we will publish our response to the feedback we received, including how we intend to address the points raised in the consultation. We will publish the final FRMP by December 2015.

# 14. Glossary and abbreviations

Catchment	The watershed of a surface water river system
CaBA	Catchment based approach: an approach to environmental planning that focuses on local engagement and partnerships
CFMP	Catchment Flood Management Plan
Coastal Groups	Voluntary coastal defence groups made up of maritime district authorities and other bodies with coastal defence responsibilities.
Cross Border Advisory Group (CBAG)	Set up under The Flood Risk (Cross Border Areas) Regulations 2012 (SI No. 1102). A statutory group made up of representatives from SEPA, Environment Agency and local authorities within the cross border areas.
Cross Border Areas	Those areas designated as 'cross border' under The Flood Risk (Cross Border Areas) Regulations 2012 (SI No. 1102).
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EU	European Union
FCERM	Flood and coastal erosion risk management
Floods Directive	The European Floods Directive (2007/60/EC) on the assessment and management of flood risks.
Flood Risk Area (FRA)	Areas where the risk of flooding from local flood risks is significant as designated under the Flood Risk Regulations.
FRMP	Flood Risk Management Plan – plan produced to deliver the requirements of the Regulations.
Government	The term government is used within this report to refer to Defra (the Department for Environment, Food and Rural Affairs) and Welsh Government.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
HRA	Habitats Regulations Assessment: an assessment undertaken in relation to a site designated under the Habitats and Birds Directives
LLFA	Lead local flood authority
Local FRM Strategy	Local flood risk management strategy produced by LLFAs under the Flood and Water Management Act 2010.
Main river	A watercourse shown as such on the main river map, and for which the Environment Agency and Natural Resources Wales has responsibilities and powers
National FCERM Strategy	National flood and coastal erosion risk management strategy: these are strategies prepared under the Flood and Water Management Act 2010, by the Environment Agency for England and by Welsh Government for Wales.
NRW	Natural Resources Wales. NRW took over the functions of the Environment Agency in Wales on 1st April 2013.
Ordinary watercourses (OW)	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, Internal Drainage Boards.

PFRA	Preliminary Flood Risk Assessment – these were required to be published by December 2011 and were the first stage in delivering the Regulations.
Ramsar	Wetlands of international importance designated under the Ramsar Convention
Reservoir	A natural or artificial lake where water is collected and stored until needed. Reservoirs can be used for irrigation, recreation, providing water supply for municipal needs, hydroelectric power or controlling water flow.
Risk management authorities (RMAs)	Organisations that have a key role in flood and coastal erosion risk management as defined by the Act. These are the Environment Agency, Natural Resources Wales, lead local flood authorities, district councils where there is no unitary authority, internal drainage boards, water companies, and highways authorities.
RFCCs	Regional Flood and Coastal Committees
River Basin District (RBD)	These are the reporting units to the European Commission for the Water Framework Directive and the Floods Directive.
RBMP	River Basin Management Plan – plan required by the European Water Framework Directive.
River flooding	Occurs when water levels in a channel overwhelms the capacity of the channel.
SAC	Special Area of Conservation
SEA	Strategic environmental assessment
SMP	Shoreline Management Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Surface water flooding	Flooding from rainwater (including snow and other precipitation) which has not entered a watercourse, drainage system or public sewer.
SWMP	Surface Water Management Plan
WG	Welsh Government

# Annex 1 - Sources of information for the draft FRMP

Strategy	Purpose and scope of plan or strategy	Drivers	Lead authority
<b>Catchment Flood Management Plans (CFMPs)</b>	<p>Current and future inland flood risk management across all catchments.</p> <p>These plans set out preferred policies for managing river flooding in England and Wales.</p>	<p>Voluntary plans.</p> <p>Published in 2009-10.</p>	<p>Natural Resources Wales and the Environment Agency</p>
<b>Shoreline Management Plans (SMPs)</b>	<p>Current and future coastal flood and coastal erosion risk management.</p> <p>These plans set out preferred policies for managing the coastline of England and Wales.</p>	<p>Voluntary plans.</p> <p>Second round of SMPs published in 2010-13.</p>	<p>Coastal Groups (comprising NRW, EA, LLFAs and others)</p>
<b>River, estuary and coastal strategies</b>	<p>Outline investment proposals for flood and coastal erosion risk management.</p> <p>Prepared to support an investment proposal for funding.</p>	<p>Voluntary plans.</p>	<p>Risk Management Authorities</p>
<b>Reservoir Flood plans</b>	<p>These include on-site and off-site flood plans that set out procedures for the management of flood risk in the event of an emergency.</p> <p>On-site plans deal with the management of the on-site risk and off-site plans deal with the risk in areas adjacent to the</p>	<p>Voluntary plans.</p>	<p>On-site Flood Plans are developed by the owners of the reservoir.</p> <p>Off-site Flood Plans are developed by the Local Resilience Forums.</p>
<b>System Asset Management Plans</b>	<p>Plans that set out the maintenance regime for asset systems.</p>	<p>Voluntary plans.</p>	<p>Owners and operators of assets.</p>

# Annex 2 - CFMP and SMP policies

## Catchment Flood Management Plans (CFMPs)

The CFMPs published by the Environment Agency in 2009 set out the preferred policy approach to managing flood risk from the main rivers in England and Wales through broad areas known as policy units. The policy units and associated policies within the CFMPs were determined by considering the extent, nature and scale of current and future flood risk across the whole catchment in order to show the broad area where the policy decision should be applied.

The six pre-defined policies that were adopted are illustrated in

Figure 12 and can be described as:

- Policy 1 – no active intervention (including flood warning and maintenance). Continue to monitor and advise.
- Policy 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time).
- Policy 3 - Continue with existing or alternative actions to manage flood risk at the current level.
- Policy 4 - Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).
- Policy 5 - Take further action to reduce flood risk.
- Policy 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

It is important to note at this point that these are our current strategic policies for undertaking flood risk management work and will be adopted by this plan. Future review will be included within the overall Flood Risk Regulations cycle of delivery if deemed necessary.

The action plans contained in the CFMPs are now largely complete. Where actions are outstanding and yet to be delivered, they have been brought forward into this FRMP. This Plan now contains all the actions applicable to main river flood risk and supersedes those in the CFMP.

Figure 13: Dee CFMP Policies



## Shoreline Management Plans (SMPs)

In addition to CFMPs, SMPs were produced in partnership by Coastal Groups to set the strategic direction for the management of the coast for the next 100 years. SMPs are non-statutory policy documents for coastal defence management planning. They provide a large-scale assessment of the risks associated with coastal evolution and present a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner.

The first edition SMPs were created in the late 1990s. The second edition plans (SMP2s) were produced by consultants for Coastal Groups from 2005 onwards. There is one shoreline management plan, the North West England and North Wales Shoreline Management Plan, which falls within the Dee RBD.

SMP2s address a 100 year timeframe across 3 epochs being Epoch 1 (short-term) = years 0 to 20, Epoch 2 (medium term) = years 20 to 50 and Epoch 3 (long term) = 50 to 100 for proposed management of our coastline.

One of four policies can be applied per Epoch to each coastal management unit (i.e. defined length of coastline) and these policies are:

- No Active Intervention (NAI): where there is no planned investment in coastal defences or operations, regardless of whether or not an artificial defence has existed previously.
- Hold the Line (HTL): an aspiration to build or maintain artificial defences so that the current position of the shoreline remains.
- Managed Realignment (MR): by allowing the shoreline to move backwards or forwards naturally, but managing the process to direct it in certain areas.
- Advance the Line (ATL): by building new defences on the seaward side of the original defences.

As the SMP2s were recently completed, they will remain as plans in their own right and where applicable and appropriate, certain sea flooding actions have been brought forward into this Flood Risk Management Plan.

**Would you like to find out more  
about us or about your  
environment?**

## **Environment Agency**

**Call us on: 03708 506 506 (Monday - Friday, 8am - 6pm)**

**Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)**

**Incident hotline: 0800 807 060 (24 hours)**

**Floodline: 0345 988 1188 / 0845 988 1188 (24 hours)**

## **Natural Resources Wales**

**Call us on: 0800 065 3000 (Monday - Friday, 8am - 6pm)**

**Email: [enquiries@naturalresourceswales.gov.uk](mailto:enquiries@naturalresourceswales.gov.uk)**

**Incident hotline: 0800 807 060 (24 hours)**

**Floodline: 0345 988 1188 (24 hours)**