Dee River Basin District
Flood Risk Management Plan
2015 – 2021

March 2016

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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Published by:

Natural Resources Wales
Cambria house, 29 Newport Road,
Cardiff CF24 0TP

enquiries@naturalresourceswales.gov.uk
http://www.naturalresourceswales.gov.uk

0300 065 3000 (Mon-Fri, 8am - 6pm)

Environment Agency
Horizon house, Deanery Road,
Bristol BS1 5AH

enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

03708 506506

Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Dee River Basin District

Flood Risk Management Plan

December 2015

Foreword

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

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

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

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

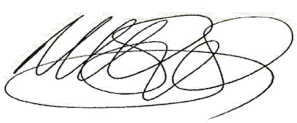
Measures (actions) in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to RMA measures based on current Government policy that gives the highest priority to the areas at highest risk. The funding for flooding is devolved so RMA measures are funded by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

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

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

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

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



Tim Jones

Executive Director

Natural Resources Wales

Mark Sitton-Kent

Director Operations West

Environment Agency

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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, Flood and Rural Affairs) and Welsh Government.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
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.
Natural Resource Management	The taking care of natural resources such as land, water, air, soil, plants and animals with a particular focus on how their management affects the quality of life for both present and future generations.
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
Working with Natural Processes	Taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating function of catchments, rivers, floodplains and coasts. An example of this is using land to temporarily store flood water away from high risk areas.
WG	Welsh Government

PART A

Dee Flood Risk Management Plan

1. What is flood risk and who manages it?

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

Figure 1: What is flood risk?

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

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

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

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

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

Roles and responsibilities

Table 1 and 2 show the RMAs involved in flood risk management in England and Wales their roles and responsibilities.

Table 1: Summary of responsibilities for risk management authorities

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

* Please note RMAs have different responsibilities for reservoirs such as regulation, asset management and flood incident response

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

Table 2: Roles and responsibilities of risk management authorities and others involved in managing flood risk

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

Organisation	Roles and Responsibilities
	the Local Planning Authority.
Community Council (only in Wales)	By agreement with the upper tier Lead Local Flood Authority, the Community Council may do some work to manage flood risk.
Maritime District Council	As District Councils, but also manage coastal erosion. As many coastal defences protect against both erosion and flooding from the sea, these Councils often do both in urban areas.
Riparian Landowner	The owner of land next to a watercourse usually owns the land to the middle of the river (unless property deeds show otherwise). This 'riparian landowner' is responsible for maintaining the watercourse to allow free flow.
Communities	Individuals at risk from flooding, or having flooded, are encouraged to form a Flood Action Group or other Community Group as a focus for understanding the issues, considering improvement options and implementing solutions.
Non- RMA owners of flood defences	Features and structures that have been designated as a flood defence cannot be altered, removed or replaced without the consent of the responsible authority.
Reservoir owners	In addition to their general duty of care for the public under common law, the owners of reservoirs with an above ground capacity of 25,000 cubic metres or more have a legal duty to have their reservoirs supervised and inspected regularly by experts; in order to prevent dam failures and the dangerous flooding that could result. Reservoir owners could fall into any of the above categories listed in the table.

Flooding from river and the sea

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

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

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

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

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

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

Flooding from reservoirs

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

Existing flood management schemes and properties protected

Risk Management Authorities work in partnership with each other and communities to manage flood risk. The Flood Risk Management Plan sets out the current and proposed measures to manage flood risk across the Dee RBD. However, RMAs have been undertaking a range of activities to manage flood risk for many years. Details of these activities can be found in Section 7 **Error! Reference source not found.**. In some parts of the Dee RBD flood management schemes are in place to reduce flood risk. The Environment Agency Flood Map for Planning and NRW Flood Risk Map shows the flood defences that protect against fluvial and tidal floods.

Important flood defences in the Dee catchment include:

- the River Dee flood embankments in Chester
- Sealand main drain flood basin at Clifton Drive, Chester
- Finchetts Gutter outfalls and debris screens at Sealand Road in Chester

2. 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?

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

Why are FRMPs being prepared?

This is the first cycle of implementing the Flood Risk Regulations 2009. As a result of this legislation, 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.

Flood risk and coastal erosion management activities require careful planning to ensure that appropriate, sustainable, options are selected and that they are implemented properly. Actions should be planned effectively, for the long-term, and provide a clear picture of what will be done to manage risk and provide multiple benefits. This may include, for example, linking with other plans such as river basin management plans (RBMPs) and supporting biodiversity, habitat creation or improving water quality. Natural Resources Wales, the Environment Agency and LLFAs are developing FRMPs by drawing existing information together and building on existing Flood and Coastal Erosion Risk Management plans such as: Catchment Flood Management Plans (CFMPs), Shoreline Management Plans (SMPs) and Local Flood Risk Management Strategies (LFRMS) (see Figure 1).

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 What types of flood risk are included in the FRMP?

The 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.

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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

Measures in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to all RMA measures in the same way and is based on current Government policy that gives the highest priority to lives and homes.

What types of flood risk are included in the FRMP?

The 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.

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

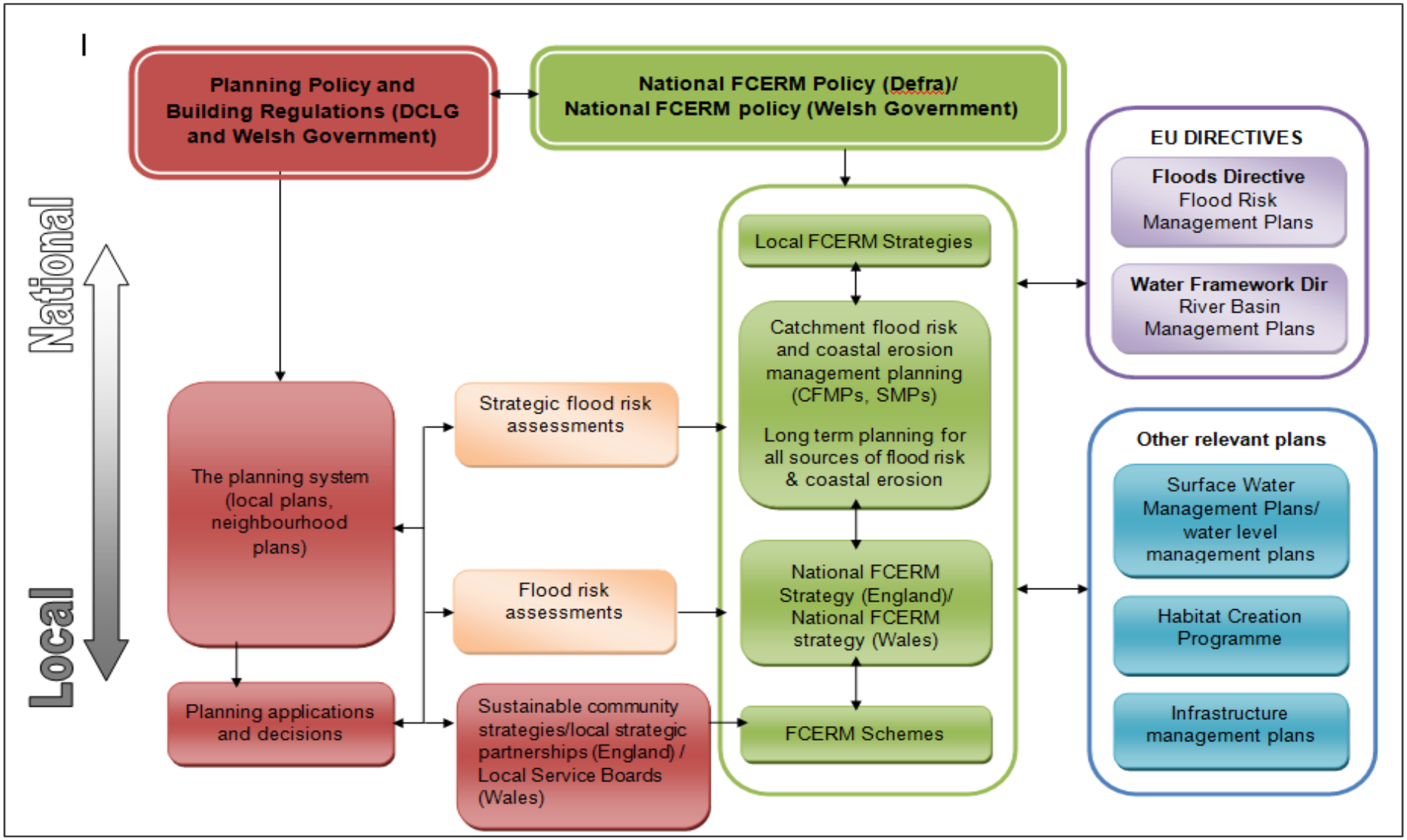

Figure 2: Flood risk management plans and their relationship to other planning initiatives (adapted from the National Flood and Coastal Risk Management Strategy for England)

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.

4. How the plan has been developed

The approach to developing FRMPs

In 2013 the government agreed that the preferred approach to developing FRMPs would be for the Environment Agency and Natural Resources Wales to work in partnership with other RMAs, in particular LLFAs, to pool information to develop an overall plan for managing all sources of flood risk and coastal erosion. 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 What types of flood risk are included in the FRMP?

The 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.

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

and Table).

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

Table 3: 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

Consultation and engagement on this FRMP helped improve, inform and shape the plan. By consulting others we have reached a better final plan.

We consulted on the FRMP from 10 October 2014 to 31 January 2015. As a result of feedback from the consultation we have improved the information on existing flood risk management and made clearer links between the FRMP and river basin management plans. We've also shown more clearly how flood management actions help to improve the environment.

We also sought views on the measures within this final plan during the draft FRMP consultation. These measures are the intention for delivery. However, the majority of these measures are currently unfunded and each will be subject to assessment and justification to secure funding and if appropriate, prioritised on a National basis before delivery.

How the Environment Agency and Natural Resources Wales plan and set objectives

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

This plan covers areas in England where the Environment Agency is the responsible authority for flood risk management (with regard to main rivers, the sea and reservoirs) and areas in Wales where Natural Resources Wales is the responsible authority for flood risk management (with regard to main rivers, sea and reservoirs). Where the 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

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

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

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

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

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

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

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

The scope of the SEA was informed by the consultation with Natural England, Historic England and the MMO as well as with Natural Resources Wales, Scottish Environment Protection Agency, Historic Scotland and Scottish Natural Heritage in January 2014. The SEA took account of the environmental effects of flood risk management measures in the FRMP. The focus was on the combined effects of the programme of protection measures across a catchment or flood risk area, rather than individual measures at specific locations.

Using the same assessment approach for both the RBMP and FRMP allows us to compare the environmental effects directly and consider the interaction between the two plans. The likely positive impacts of the FRMP are identified in the SEA, as well as mitigation required to manage the negative effects and opportunities to deliver greater environmental benefits. Indicators are also set out that indicate the effect of the plan on significant environmental receptors, taking advantage of existing monitoring that is already carried out by the Environment Agency, Natural Resources Wales and others.

A Habitats Regulations assessment has been carried out on the FRMP to consider whether the plan affects designated sites (Special Areas of Conservation, Special Protection Areas and Ramsar sites). Initial assessment suggests that significant effects are not likely.

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 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.

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 forum 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.

Co-ordinating with the RBMP:

- Dee RBMP

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 a forward look of prioritised proposals for managing flood risk. The next review of the FRMP under the Flood Risk Regulations will be completed by 2021.

National flood and coastal erosion risk management strategy for Wales

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

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

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

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

National flood and coastal erosion risk management strategy for England

The national flood and coastal erosion risk management strategy for England (2011) provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion risk in England. The overall aim of the strategy is to ensure the risk of flooding and coastal erosion is properly managed by using the full range of options in a co-ordinated way. It encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to:

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

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

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

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

Measures for managing risk

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

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. RMAs will only use this measure type where flooding has been experienced and a recovery and review action is being undertaken.

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

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

Partnership working

Managing flood and coastal risks and particularly local flood risks requires many organisations to work together in partnership.

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

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) covers an area of approximately 2,200km², 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.

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.

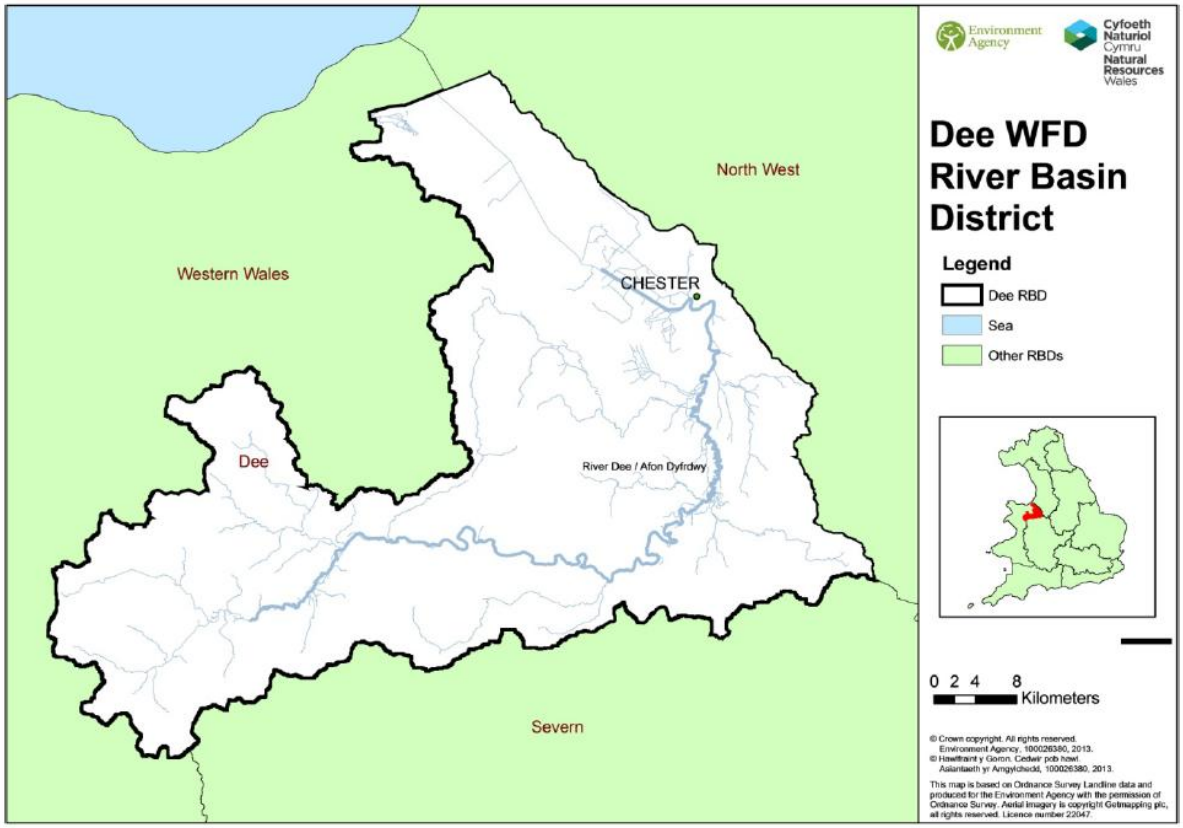
Significant water issues identified for the Dee are; physical modifications, pollution from sewage and waste water, pollution from rural areas and invasive non-native species.

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.

Figure 3: 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 industry and diffuse rural pollution.

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

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

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

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

Floodplains – where hydraulic roughness from woodland cover slows the flow and encourages the deposition of sediment;

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

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

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

Economic activity

The 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 lead 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.

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.

Managing flood risk in less populated areas

The Environment Agency and Natural Resources Wales flood risk management work is focused where each pound of public money spent can provide the greatest amount of economic benefit. River maintenance work and capital improvement schemes tend to have greatest cost-benefit in more populated areas where flood risk is greater to people and property. In sparsely populated areas Environment Agency and Natural Resources Wales work seeks to strike a balance between natural flooding of the flood plain, which attenuates downstream flooding and use of these areas for other purposes, including agriculture and habitat. Internal Drainage Boards are organisations which are jointly funded by landowners and others to manage drainage of land and operation of pumping stations to benefit agricultural productivity.

Managing flood risk in urban areas

Larger settlements have resulted in many man-made structures affecting the river environment, from river channel retaining walls, to weirs and culverts. Culverts beneath roads and properties are particularly common in dense urban areas. These come in all shapes and sizes with those on 'main rivers' generally (but not always) being larger than those on smaller watercourses and surface water drains. These structures inhibit wildlife and vegetation, restrict flows and increase flood risk from blockages. To counter this risk, the Environment Agency, Natural Resources Wales and LLFAs do frequent 'man-entry' inspections (larger culverts) and CCTV surveys (smaller structures) and carries out repairs when necessary. During heavy rainfall they may monitor water levels at structures and send teams to clear debris from culvert inlet screens where safe to do so. Examples of debris are: tree branches, leaves, garden refuse and obstructions such as shopping trolleys, or gravel and boulders in more extreme conditions. Problems with debris at culverts arise on both small and large watercourses. Levels can rise quickly and flooding on some can start in less than two hours from a blockage occurring, making preventative action very difficult.

Historical flooding

Prior to 1800, flooding mainly affected 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 13th 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, Rhydmwyn, 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.

Climate Change

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

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

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

10 times. Increases in the frequency of flooding would affect people's homes and wellbeing, especially for vulnerable groups.

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.

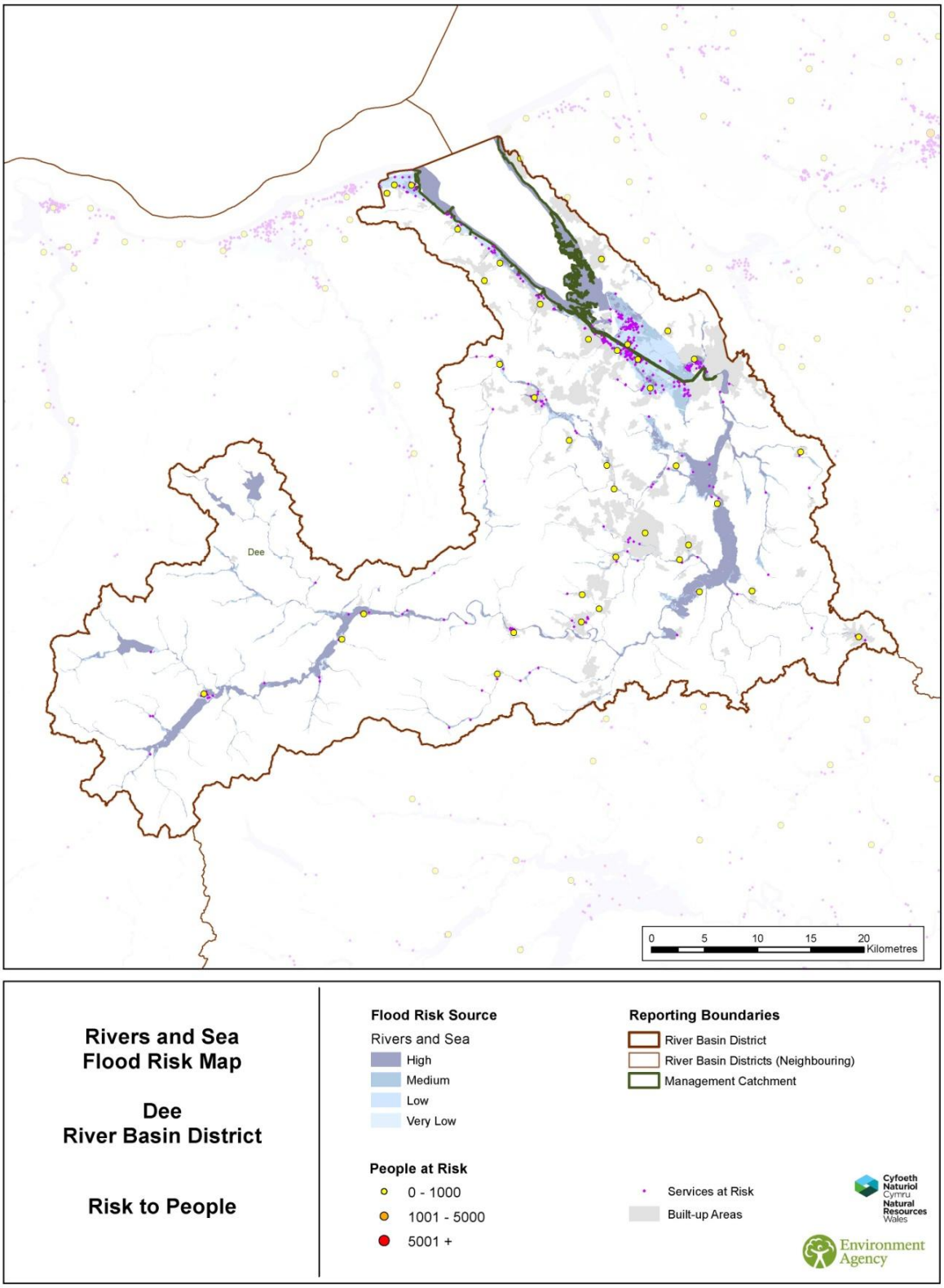
Future increase in flood risk is likely to be concentrated in towns located near the mouth of rivers or where there are tidal influences. This is where the effects of sea level rise and increased river flows will combine, resulting in more frequent, extensive flooding. The most significant increases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

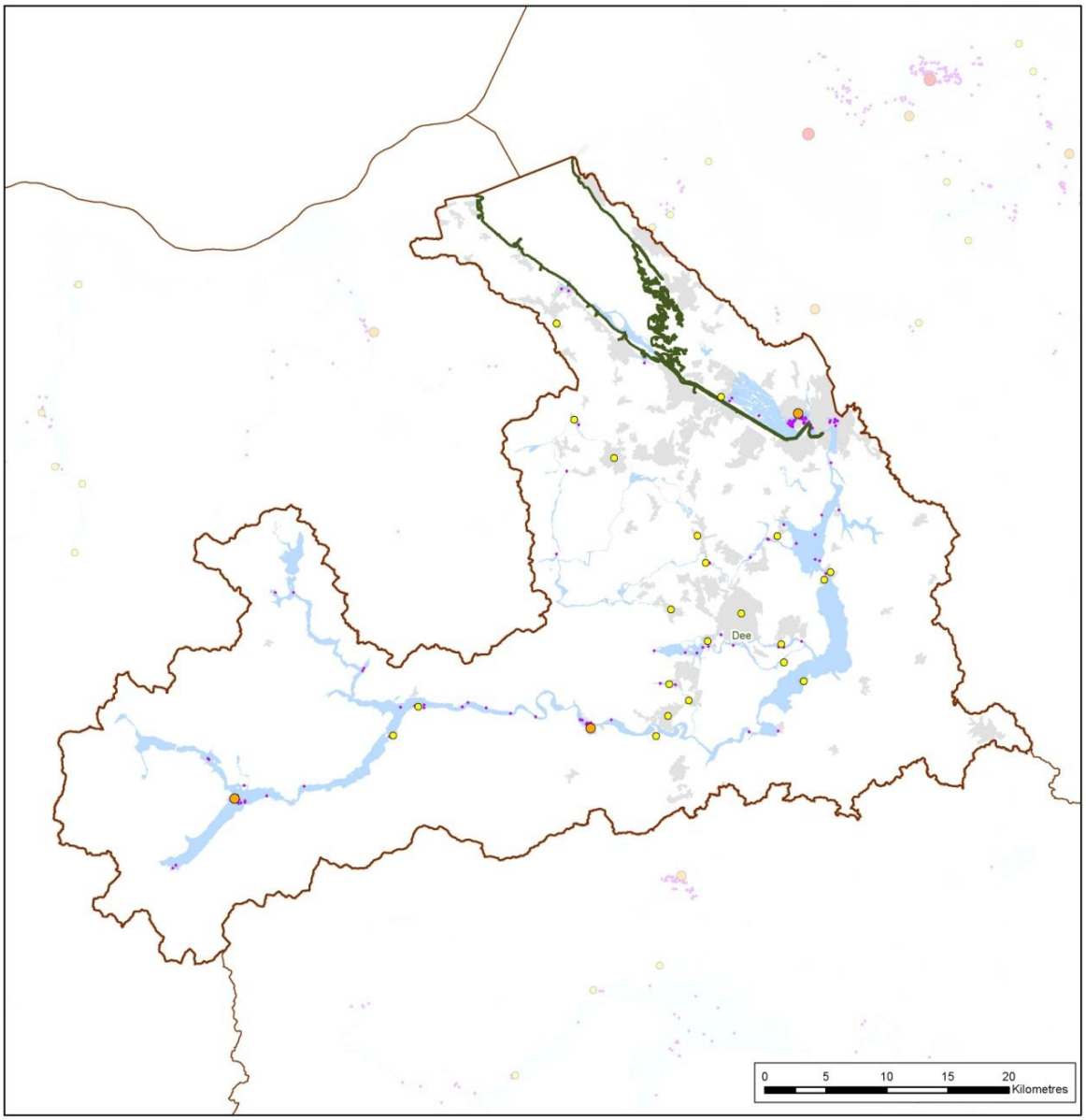
Find out more about flood risk on the Natural Resources Wales and GOV.UK websites.

Flood and coastal erosion risk to people

Map of flooding from rivers and sea:



Map of flooding from reservoirs:



Reservoirs
Flood Risk Map

Dee
River Basin District

Risk to People

Flood Risk Source

Reservoirs

Maximum extent of flooding

Reporting Boundaries

River Basin District

River Basin Districts (Neighbouring)

Management Catchment

People at Risk

0 - 1000

1001 - 5000

5001 +

Services at Risk

Built-up Areas

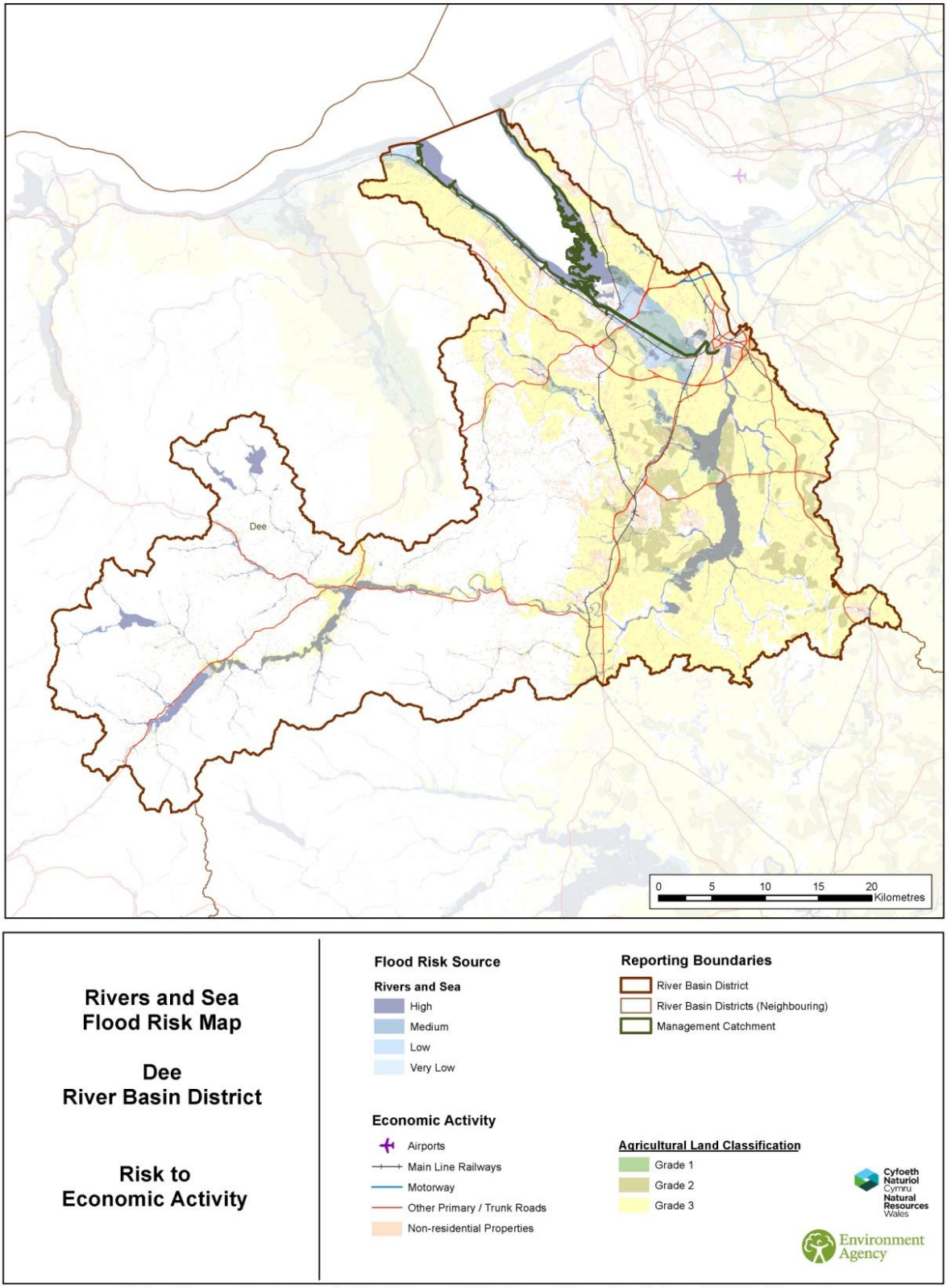
Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Contact Us: Environment Agency - National Customer Contact Centre, PO Box 54, Rotherham, S60 1BY. Telephone: 03708 506 506 (Mon to Fri, 8am to 6pm). Email address: enquiries@environment-agency.gov.uk
Contact Us: Natural Resources Wales - Customer Care Centre, Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP. Telephone: 0300 065 3000 (Mon-Fri, 8am - 6pm). Email address: enquiries@naturalresourceswales.gov.uk

Flood and Coastal Erosion Risk to Economic Activity

Map of flooding from rivers and sea:



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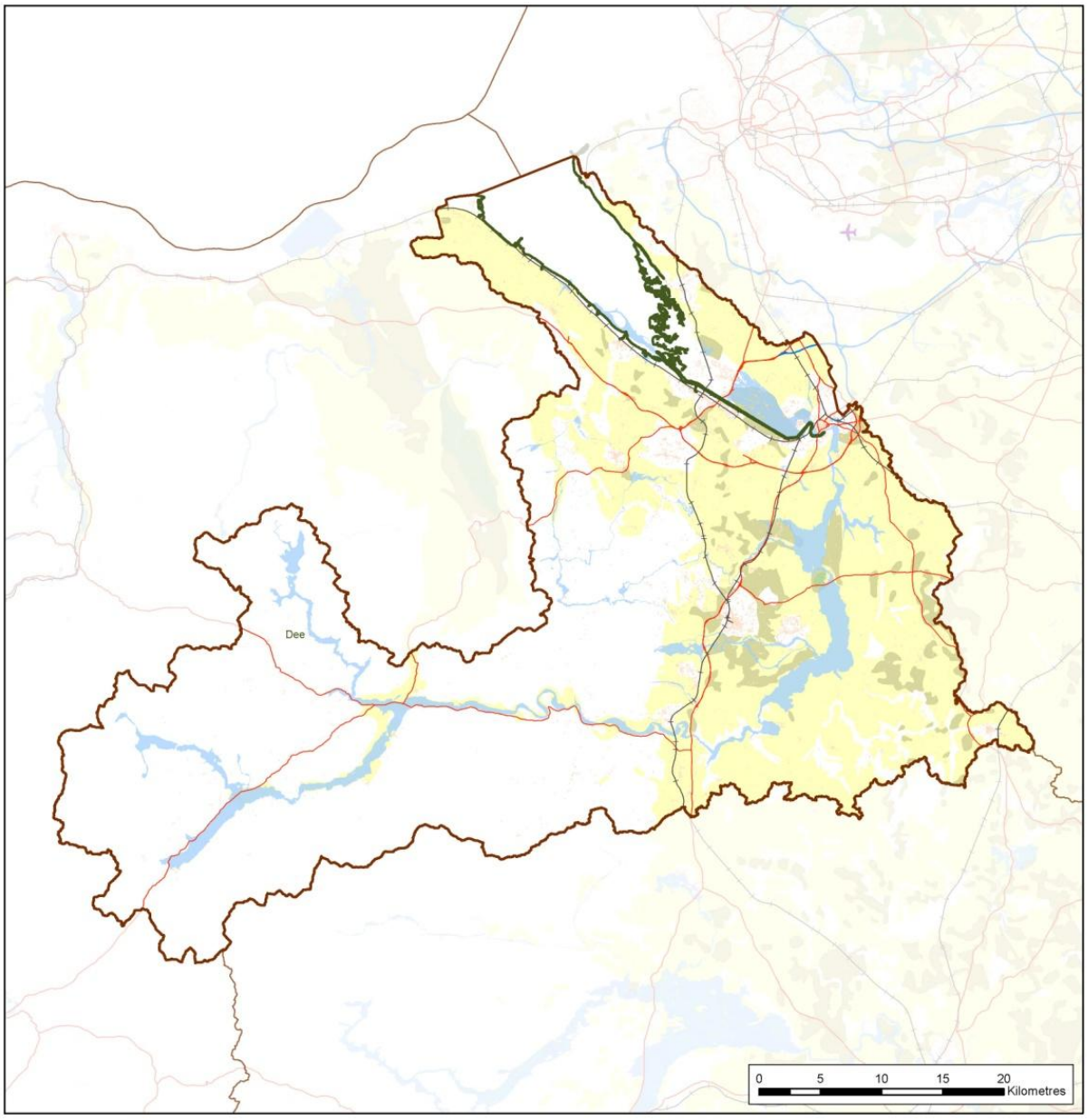

Reservoirs Flood Risk Map

Dee River Basin District

Risk to Economic Activity

Flood Risk Source

Reservoirs

Maximum extent of flooding

Economic Activity

Airports

Main Line Railways

Motorway

Other Primary / Trunk Roads

Non-residential Properties

Reporting Boundaries

River Basin District

River Basin Districts (Neighbouring)

Management Catchment

Agricultural Land Classification

Grade 1

Grade 2

Grade 3

Cyfoeth Naturiol Cymru Natural Resources Wales

Environment Agency

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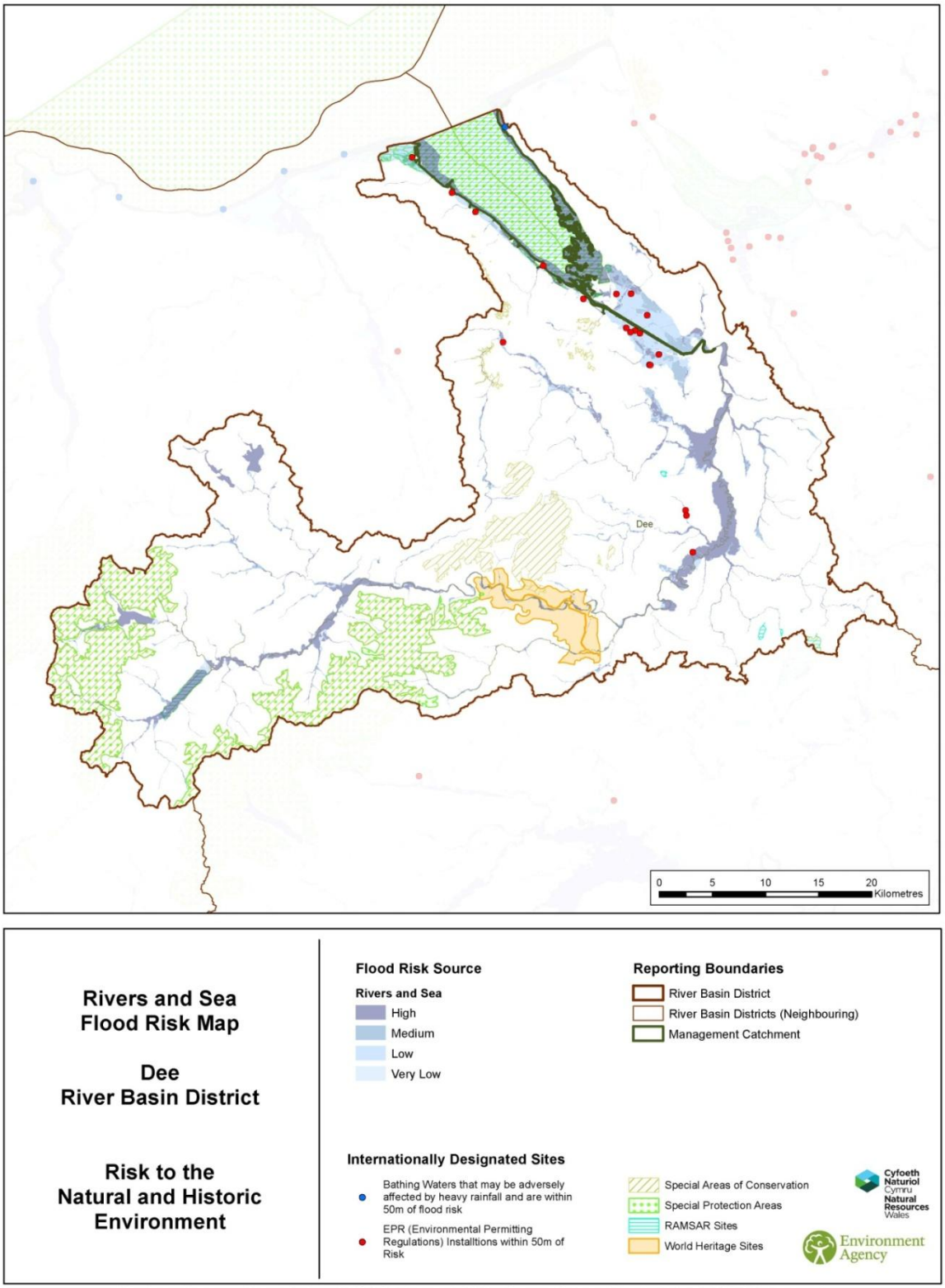
Flood and coastal erosion risk to the natural and historic environment

Map of flooding from rivers and sea:



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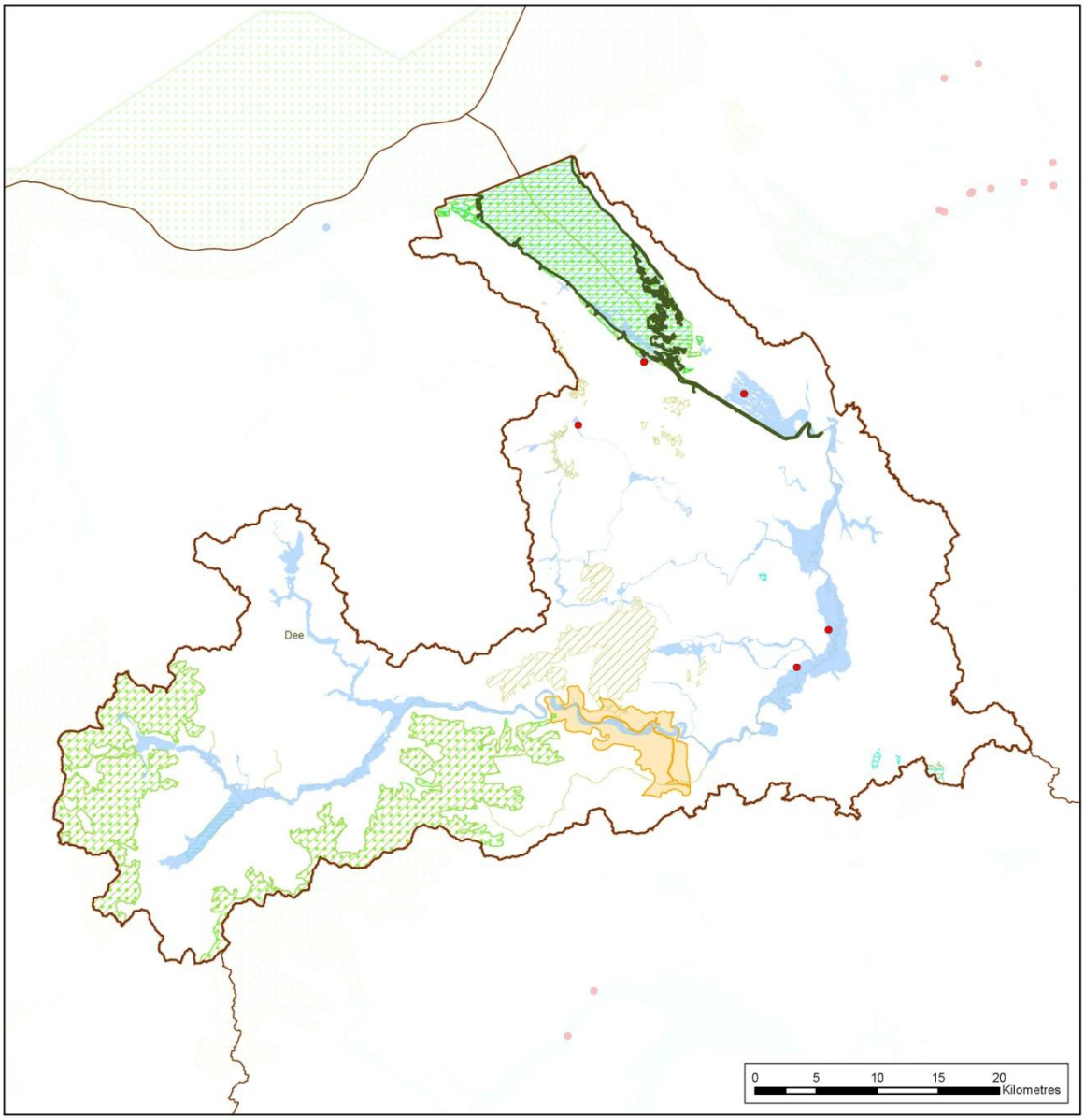
Contact Us: Natural Resources Wales - Customer Care Centre, Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP. Telephone: 0300 065 3000 (Mon-Fri, 8am - 6pm). Email address: enquiries@naturalresourceswales.gov.uk

Map of flooding from reservoirs:



Reservoirs Flood Risk Map

Dee River Basin District

Risk to the Natural and Historic Environment

Flood Risk Source

Reservoirs

Maximum extent of flooding

Reporting Boundaries

River Basin District

River Basin Districts (Neighbouring)

Management Catchment

Internationally Designated Sites

Bathing Waters that may be adversely affected by heavy rainfall and are within 50m of flood risk

EPR (Environmental Permitting Regulations) Installations within 50m of Risk

Special Areas of Conservation

Special Protection Areas

RAMSAR Sites

World Heritage Sites

Cyfoeth Naturiol Cymru Natural Resources Wales

Environment Agency

Contact Us: Environment Agency - National Customer Contact Centre, PO Box 54, Rotherham, S60 1BY. Telephone: 03708 506 506 (Mon to Fri, 8am to 6pm). Email address: enquiries@environment-agency.gov.uk
Contact Us: Natural Resources Wales - Customer Care Centre, Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP. Telephone: 0300 065 3000 (Mon-Fri, 8am - 6pm). Email address: enquiries@naturalresourceswales.gov.uk

Key Statistics

Table 4: 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
Risk to people:					
Number of people in area:	458,100	3300	2500	20,500	150
Number of services:	900	30	10	60	<10
Risk to economic activity:					
Number of non-residential properties:	67,250	1100	1200	4,500	50
Number of airports:	<10	0	0	<10	0
Length of roads (km):	350	<10	<10	14	0
Length of railway (km):	127	<10	<10	20	0
Agricultural land (ha):	86,416	5,777	1,868	2,820	20
Risk to the natural and historic environment:					
Number of EU designated bathing waters within 50m:	<10	<10	0	0	0
Number of EPR installations within 50m:	56	<10	<10	20	0
Area of SAC within area (ha):	29,700	3,200	100	150	0
Area of SPA within area (ha):	23,300	2,150	150	300	0
Area of RAMSAR site within area (ha):	3,250	2,550	100	300	0
Area of World Heritage Site within area (ha):	4,250	200	10	100	10
Area of SSSI within area (ha):	34,250	4,000	195	403	0
Area of Parks and Gardens within area (ha):	3,048	156	50	50	0
Area of Scheduled Ancient Monument within area (ha):	550	10	<10	<10	0
Number of Listed Buildings within area:	4,400	150	50	200	<10
Number of Licensed water abstractions within the area:	200	50	10	<10	0

Table 5: Summary flood risk from reservoirs to people, economic activity and the natural and historic environment across the Dee river basin district.

Reservoirs	Total in RBD	Maximum extent of flooding
Risk to people:		
Number of people in area:	458,100	12,400
Number of services:	900	50
Risk to economic activity:		
Number of non-residential properties:	67,250	3,600
Number of airports:	0	0
Length of roads (km):	350	50
Length of railway (km):	100	<10
Agricultural land (ha):	86,400	8,300
Risk to the natural and historic environment:		
Number of EU designated bathing waters within 50m:	<10	0
Number of EPR installations within 50m:	50	<10
Area of SAC within area (ha):	29,650	1250
Area of SPA within area (ha):	23,350	100
Area of RAMSAR site within area (ha):	3,250	550
Area of World Heritage Site within area (ha):	4,250	450
Area of SSSI within area (ha):	34,250	2,050
Area of Parks and Gardens within area (ha):	3,050	250
Area of Scheduled Ancient Monument within area (ha):	550	50
Number of Listed Buildings within area:	4,400	500
Number of Licensed water abstractions within the area:	200	50

8. Sub-areas in the Dee river basin district

Introduction

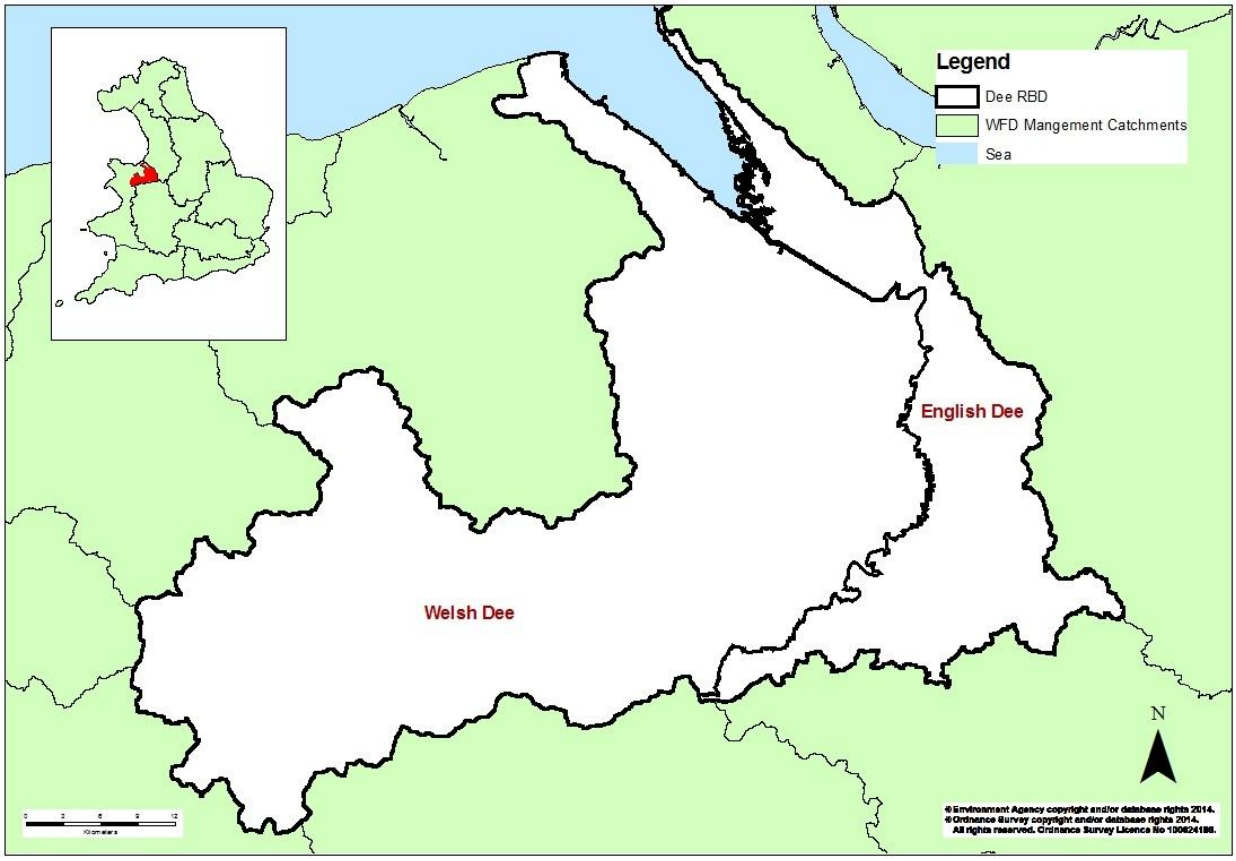
Where possible, this plan has been co-ordinated at RBD scale covering the whole of the Dee RBD. As the Dee RBD covers parts of both England and Wales, there are elements of flood risk management work that are not applicable to the whole RBD and just cover the Welsh section or the English section, due to different administrations. This plan includes two large strategic areas, as shown in Figure 4. 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 4: 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 RMAs contributing have:

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

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.

Rivers and Sea flood risk

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. The proportion of the population at medium or high risk of flooding from rivers and the sea is relatively low, at less than 2%.

Large areas of agricultural land are at risk, including over 5,700 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.

Reservoir flood 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 are predicted, 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.

Surface water flood risk

Lead Local Flood Authorities are responsible for managing the risk of flooding from surface water, defined as rainwater on the ground surface that hasn’t entered a watercourse, drain or sewer. This type of flooding can begin to occur within minutes of intense rain, so it is almost impossible to forecast for. Problems can quickly occur in several places, and although these might be over a small area, a Local Council’s resources can quickly become stretched.

It is good practice to plan for drains and watercourses becoming overwhelmed in a flood, such as by analysing the flow paths that floodwater may take. Once these are known, steps can be taken to ensure they are kept free from obstructions such as buildings and to consider whether roads and open space can be used to safely channel water away. Surface water flooding is a problem across the Dee, whether due to run-off from fields and down roads in rural and semi-rural areas, or from roofs and paved surfaces in built-up areas, sometimes due to insufficient capacity of drains and sewers.

In the long-term, SuDS may relieve some pressures. In the short-term, local councils have identified the places where properties are at greater risk of surface water flooding and will gather more data for some of these before considering a range of measures according to circumstances. Some of this will involve working closely with the Environment Agency, Natural Resources Wales and water companies to jointly understand complex interactions between the drainage, sewer and watercourse systems. It is important to note, though, that laying a bigger drain is often not the solution, as this can simply pass the problem onto the watercourse it discharges into and that could then flood.

Groundwater flood risk

LLFAs are responsible for managing the risk of flooding from Groundwater. Groundwater is naturally stored in the ground below the water table level. When the water table rises and reaches ground level, water starts to emerge on the surface and flooding can happen. This may be because the ground slopes, or because of break in the rock layers. Once on the surface this groundwater may flow or pond. Groundwater flooding is closely linked to geology and is less common in the Dee than in other locations, such as south east England where chalk is quite common.

Sewer flood risk

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

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 6.

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 6: Objectives for the Dee FRMP River Basin District

FRMP Objective Number	FRMP Objective	Social	Environmental	Economic
1	Reduce the risk and impact of flooding on people and communities (from main rivers, reservoirs and the sea).	Y		Y
2	Increase resilience of services, assets and infrastructure to the risk of flooding.	Y		Y
3	Improve understanding of flood risk so that decisions are based upon the best available information.	Y	Y	Y
4	Improve community awareness and resilience to flooding.	Y		Y
5	Provide an effective and sustained response to flood events.	Y		Y
6	Allocate funding and resources for all sources of flooding on a risk basis.	Y	Y	Y
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.	Y	Y	Y
8	Incorporate climate change adaption into all aspects of flood risk management.	Y	Y	Y
9	Seek opportunities to deliver RBMP measures through Flood Risk Management	Y	Y	Y

Measures across the Dee RBD

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

- **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.
  - We seek to work collaboratively with our partners to find innovative approaches to managing flood risk.
- **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.
  - We seek opportunities to undertake Natural Flood Management by using all appropriate tools available, such as Woodland Creation maps.
- **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.

Contributing to broader benefits

This Plan has been produced alongside the Second Cycle Dee River Basin Management Plan. The alignment of planning programmes and study areas has allowed consideration of how the plans interact and how the Environment Agency and Natural Resources Wales can work to deliver multiple benefits in the most efficient way, throughout the six year planning cycle.

Introduction

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

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

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

- Central Government – including Environment Agency, Natural England, Natural Resources Wales, Historic England, Cadw, Sport England, Forestry Commission, Marine Management Organisation
- Local Government and Regulators – including Local Authorities (planning and regeneration, conservation, archaeology, ecology, landscape, public rights of way), Internal Drainage Boards, AONB conservation boards and National Park authorities
- Industry and Business – including Local Enterprise Partnerships, navigation and renewable energy interests
- Non-Government Organisations – including Local Wildlife Trusts, Catchment Partnerships, River Trusts, Local Wildlife Groups, Canals and River Trust, Woodland Trust
- Water Industry – including water companies
- Agriculture and Rural Land Management – including landowners, NFU
- Recreation, Leisure and Amenity – including angling / fishing/ sport clubs/societies, local residents
- Local communities – including parish and town councils and local community groups

In parallel to flood risk management planning, the Environment Agency and Natural Resources Wales work with others to improve the quality of the water environment through River Basin

Management Planning. The Environment Agency and Natural Resources Wales aims to co-ordinate effectively between the FRMP and River Basin Management Plan so that all organisations can do more for the environment.

Other Plans and Partnerships

Table 7 sets out the key themes from a review of the main other plans and strategies that the Dee FRMP would be expected to influence. The purpose of the review is to take account of the objectives of these key documents in the assessment with a view to aligning and ensuring compliance of the plan with other policies and legislation. The plan review can also help to identify where other planning processes and organisations may be able to work with the flood risk management planning process. The following summary of the plan review is based on the Environmental Report for the Dee FRMP.

Table 7 Key influences from the plans review

Category of plan /strategy	Common themes relevant to the FRMP	Key plans
Water and flood risk management	• Protection, improvement, sustainable management and use of the water environment in terms of quantity and quality – for the benefit of the human and natural environment. • Flood risk management measures could place pressure on water bodies and any measure to be implemented would have to be Water Framework Directive compliant. • The update to the Dee River Basin Management Plan has been prepared in parallel the FRMP. In support of integrated planning, the SEA identifies where there is the potential for the two plans to deliver positive effects and areas where there may be potential conflicts and require early consideration to develop mutually beneficial solutions.	• National flood and coastal erosion risk management strategies for England and Wales • Water for people and the environment: Water resources strategy for England and Wales • Water white paper: Water for life • A Water Strategy for Wales • Dee RBMP (draft update) • Catchment flood risk management plans • Shoreline management plans • Fluvial River Dee FRMS • Dee Estuary Flood Risk Management Strategy • Surface water management plans • Water resource management plans • River Restoration Strategies • Nutrient management plans
Biodiversity	• Protection and enhancement of important habitats and species, both from a statutory basis (International and National conservation designations and protected species) and through policy. • Promotion of coherent ecological networks. • Promotion of working with natural processes and sustainable development/management. • Tackling the issue of non-native invasive species • Flood risk management measures could place pressure on habitats and species, and work against natural processes.	• Natural environment white paper: The natural choice: Securing the value of nature • Biodiversity 2020: A strategy for England's wildlife and ecosystem services • Wales Biodiversity Framework • Environment Strategy for Wales • Coastal squeeze: Implications for flood management. The requirements of The European Birds and Habitats Directives. Defra policy guidance. • The invasive and non-native species framework strategy for Great Britain • Wales National Habitat Creation Programme • Green infrastructure strategies • Local biodiversity action plans
Landscape	• Protection of existing sensitive landscapes (such as National Parks and AONBs) • Promotion of actions to improve water	• All Landscapes Matter • AONB and National Park management plans [Mendip Hills,

	quality and water quantity, protect and enhance habitats, and restore the wider landscape character • Flood risk management measures could place pressure on sensitive landscapes, and lead to changes in water quality, quantity and change in habitat type.	Cotswolds, Shropshire Hills, Malvern Hills, Wye Valley and Brecon Beacons] • Local landscape strategies
Climate	• Long term aims for reduction of carbon dioxide emissions including reference to binding targets, and wide-reaching policies across all sectors to deliver reductions. • Requirements to adapt to climate change and associated threats, the need for increased resilience to climate change. • Likely increase in flooding and coastal erosion due to climate change.	• Managing the environment in a changing climate • Climate Change Strategy for Wales • The national flood and coastal erosion risk management strategies for England and Wales
Marine and Coastal	• Sustainable economic growth within the marine environment that balances benefits to society with the needs of local communities and protecting nature conservation. • Coastal flood risk management measures can enable growth • Coastal flood risk management measures would need to be in alignment with planning policies.	• UK Marine Policy Statement • Wales Fisheries Strategy
Cultural heritage	• Sustainable development in relation to historic assets through conservation and enhancement. • The historic environment could be affected by flood risk management measures e.g. through the construction of new flood risk management schemes, implementation of fish/eel passage on flood risk management assets, etc and as such any such measures would need to be appropriately assessed.	• The Government's Statement on the Historic Environment for England • Valuing the Welsh Historic Environment • Heritage at Risk Registers
Resource management	• Promotion of sustainable waste and resource management and the protection and enhancement of the environment.	• National Waste Strategy for Wales • Metal Mines Strategy for Wales • Minerals and Waste Plans
Planning	• Promotion of sustainable growth • Promotion of water-based recreation and tourist opportunities • Flood risk management measures can enable growth. • Flood risk management measures would need to be in alignment with planning policies. • Development activities could place pressure on the water bodies and would need to be appropriately management and assessed to ensure no detrimental effect to the water environment.	• National Planning Policy Framework • Planning Policy Wales • Local Development Plans/ Unitary Development Plans
Forestry and Farming	• Protection, management and enhancement of woods and forests to provide economic, social and environmental benefits e.g. managing flood risk in a sustainable way, and helping to reduce water pollution • Sustainable farming practices that deliver environmental benefits e.g. biodiversity, landscape, cultural heritage, water quality	• Government Forestry and Woodlands Policy • Woodland Strategy for Wales • Wales – A new Strategy for Farming

Links with the Dee River Basin Management Plan

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

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

10. Wales only section

The following section considers the objectives and measures that are 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).

Sustainable flood risk practice in Wales is increasingly focused on working with natural processes to create more flexible and adaptive solutions that provide increased resilience to our changing and uncertain climate. Natural Resources Wales actively seek opportunities to undertake natural flood management by using all appropriate tools available to us, such as the Woodland Creation maps.

By working with natural processes to deliver flood risk management other benefits are provided such as restoring/maintaining soil drainage capacity, creating/restoring habitats, enhancing biodiversity, capturing carbon, reducing sedimentation and improving water quality. This approach has the potential to achieve greater value for money because it enables the development of multi-functional projects which provide a wide range of ecosystem services and benefits to society.

Through the flood risk management planning and river basin management planning process Natural Resources Wales have determined where priority water bodies coincide with communities at risk to identify opportunities to deliver more holistic natural resource management through flood risk management projects and operations.

Where a flooding problem is identified in Wales, the first step is to fully understand the cause to determine what management response might be appropriate. Natural Resources Wales aim to consider non-structural solutions first and implement these where it is possible to do so, such as flood warning and awareness raising so people and communities are able to plan and prepare for flooding.

If the flood risk is at a level that without intervention will pose a serious threat to people and property, Natural Resources Wales, in consultation with the community and environmental experts, will consider solutions to reduce and manage the threat of flooding.

It is through this process of assessing different risk management options that Natural Resources Wales will consider all the options that could reduce the risk of flooding, including how the river interacts with the natural flood plain and options to retain water, amongst all other solutions. Potential options are considered for their technical feasibility and cost amongst many other factors in order to select the preferred option.

If an option is identified as having the potential to retain water close to the point where it has fallen, Natural Resources Wales will aim to work closely with land owners and managers, and communities to develop the solution that will not only slow the flow of water into the watercourse but also can create improved landscape and environment.

The flood risk maps for the Welsh Dee area are shown in Figure 5 and Figure 6.

Flood Risk Maps

Figure 5: Flood Risk from Rivers and the Sea in the Welsh Dee area

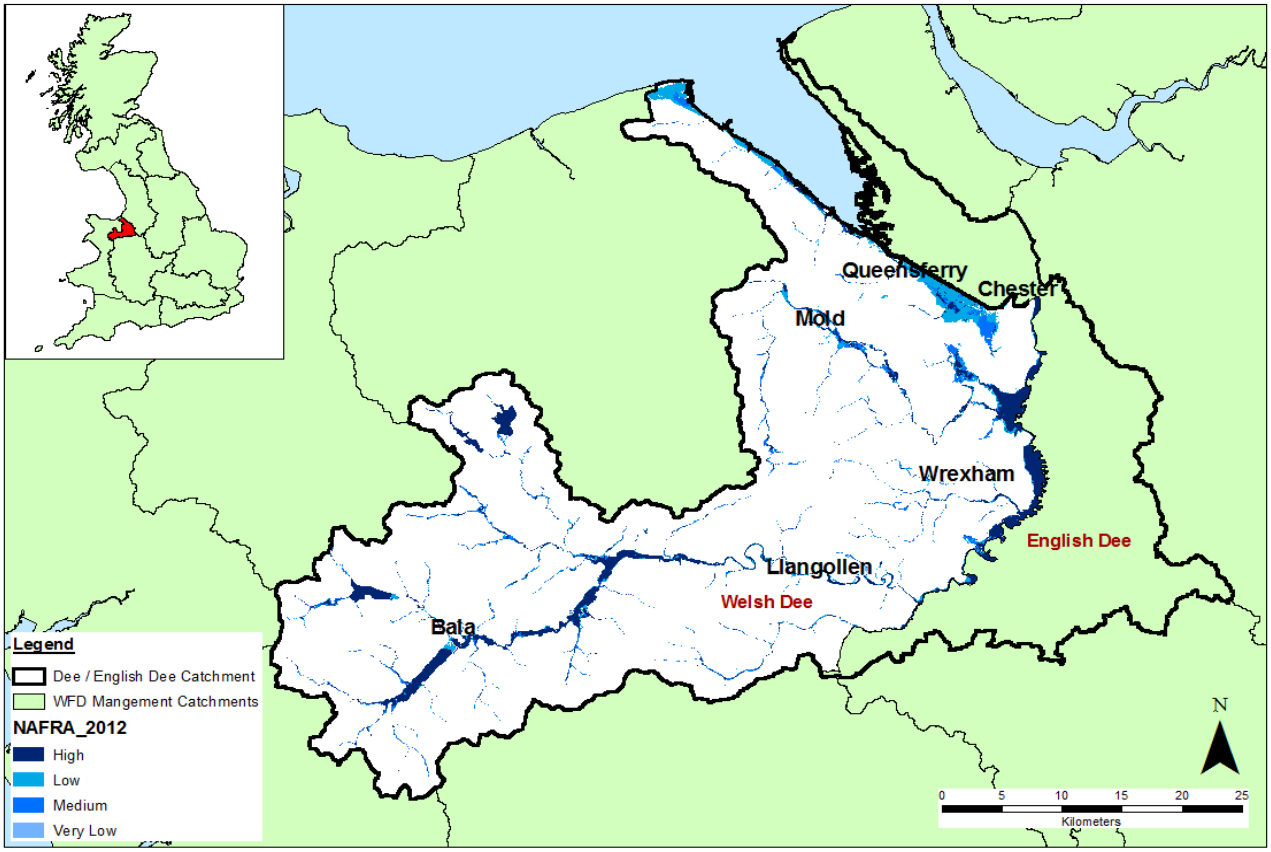
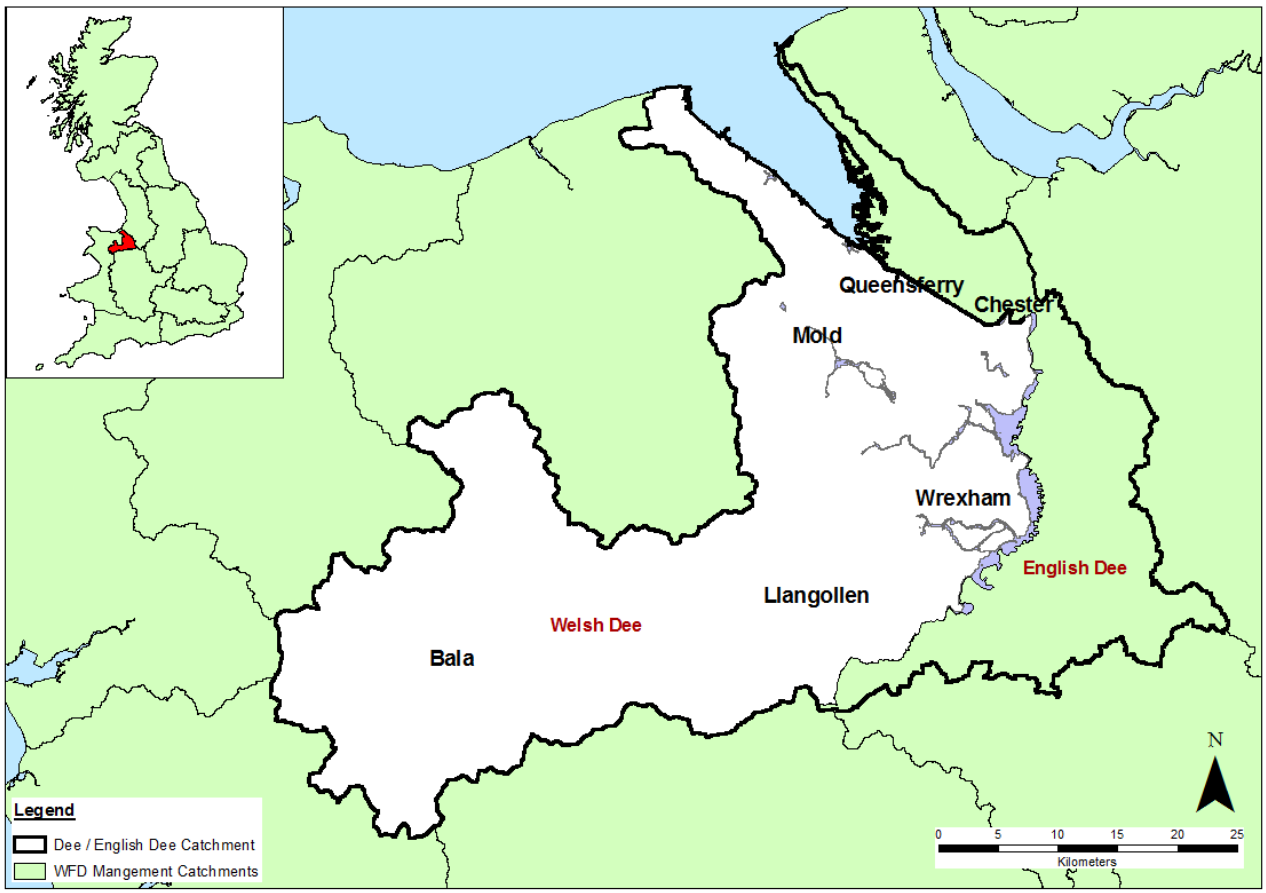


Figure 6: Flood Risk from Reservoirs in the Welsh Dee area



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 Brougton, 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 eight 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 8 provides details on the eight 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 8: 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 current and future risk of flooding.	1, 3	Y		Y
3	Improve understanding of current and future flood risk so that decisions are based upon the best available information.	1, 3	Y	Y	Y
4	Improve community awareness and resilience to current and future flooding.	2	Y		Y
5	Work with others to 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 natural resource management into the delivery of flood risk management.	1, 4	Y	Y	Y
8	Seek opportunities to deliver RBMP measures through Flood Risk Management	1	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 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 7 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 8.

Measure terminology

The following table introduces the terminology used to describe and categorise the measures within this Flood Risk Management Plans.

Priority score	Description
1	Critical - Needs attention - immediately
2	Very High - Needs attention - short term (year 1)
3	High - Needs attention - medium term (year 2 - 3)
4	Medium - Needs attention - medium term (year 4 - 6)
5	Low - Good status - no intervention required for > 6 years
Implementation status	**Description**
Not started	Could mean that: • The technical and/or administrative procedures necessary for starting the construction or building works of a project have not started. • The advisory services are not yet operational and have not provided any advisory session yet. • The research, investigation or study has not started, i.e. contract has not been signed or there has not been any progress. • The administrative file has not been opened and there has not been any administrative action as regards the measure.
On-going	Could mean that: • The administrative procedures necessary for starting the construction or building works have started but are not finalised. • The advisory services are operational and are being used. • The research, investigation or study has been contracted or started and is being developed. • An administrative file has been opened and at least a first administrative action has been taken.
Complete	Could mean that: • The works have been finalised and the facilities are operational. • An advisory service that has been implemented and has been finalised, • The research, investigation or study has been finalised and has been delivered. • The administrative act has been concluded (e.g. the regulation has been adopted, etc.).

Measures across the Welsh Dee area

Across the Welsh Dee area there are 73 measures to manage flood risk including;

Preventing risk: **12 measures**

- We propose to continue with our programme of reviewing and updating hydraulic models in the future, to include communities such as Connah's Quay and Shotton, Gronant, Queensferry and Sandycroft.
- 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 Greenfield, Mold, and Llong.
- We have built new hydraulic models to assess the current and future risk at specific locations, for example Leeswood, Walwen and Wheston.

Preparing for risk: **39 measures**

- We propose to further improve our existing flood warning service, for example at Bretton, Connah's Quay and Shotton, Bagillt, Ffynnongroyw, Flint, Garden City and Deeside, Gronant, Rossett and Burton, 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.
- We are maintaining community plans for specific locations including; Bagillt, Bangor-is-y-coed, Ffynnongroyw, Garden City and Deeside, Queensferry and Sandycroft, Sealand and Talacre.

Protecting from risk: **22 measures**

- We propose to implement alternative risk reduction measures (such as individual property protection at Cefn-Mawr and New Broughton.
- We are maintaining existing defences and carrying out regular inspections to check their integrity at specific locations such as; Bagillt, Bala, Ffrith, Ffynnongroyw, Greenfield, Gronant, Lache, Mold, Sealand and Talacre.
- We have carried out structural assessments on existing structures to ensure they are fit for purpose, for example at Garden City and Deeside.

Recovery and review of risk:

- We will undertake our actions in the Delivery Plan resulting from our Wales Coastal Flooding Review into the winter 2013/14 coastal storms and flood events in Wales.

Integrated natural resource management

Integrated natural resource management is a key element of the Welsh Government's legislative programme. The Well Being and Future Generations Act, the Planning Act and the Environment Bill, together with the Wales National Marine Plan, set out a new statutory framework and process for the integrated management and sustainable use of natural resources in Wales.

This new framework for managing natural resources, will build on the UN ecosystem approach, defined as 'an integrated strategy for the management of natural resources'. The Environment Bill, expected to receive Royal Assent by spring 2016 will legislate for a more joined-up management process, focused on delivering a healthier, more resilient Wales through economic, social and environmental benefits.

This starts by introducing a new prioritisation process - to identify and characterise the key pressures on our natural resources and to explore the opportunities for the sustainable management of these resources within a defined geographical area. By recognising and better understanding the challenges faced, the tools used to safeguard and deliver environmental benefits (of which flood risk management plans are one) can be applied in a more integrated and joined-up way– better reflecting the needs of that place. An integrated approach to natural resource management is currently being trialled across Wales in three catchment areas, the Dyfi, Tawe and Rhondda.

The natural resource management framework is still being developed in Wales but the flood risk management plans reflect the essential elements of the new approach in the following ways:

Be area based.

The flood risk management plans are set at a variety of spatial scales. This enables the focus for managing flood risk to be delivered at the spatial scale most relevant for communities, stakeholders and level of flood risk.

Involve stakeholder engagement throughout.

It is essential that RMAs involve stakeholders, including local authorities, communities, developers and industry, throughout the process of drawing up and implementing the flood risk management plans. This will ensure RMAs are targeting our effort in the right places.

Plan and present at the most appropriate scale.

The Floods Directive requires that RMAs produce and review management plans at the river basin scale. For some management actions, this scale is appropriate. For others, management actions are best considered at the catchment or community scale. RMAs plan our flood risk management work at the scale which is most appropriate to deliver most for communities and stakeholders.

Plan for the long term.

To create a sustainable Wales Natural Resources Wales need to consider the opportunities and constraints Wales will face in the long term. Flood risk management plans consider both short term and long term objectives and measures for the management of flood risk are reviewed every six years.

Plan to deliver multiple benefits.

We need to ensure that future activities deliver multiple, long term benefits for the environment and for the economy and society in Wales. All decision making must therefore reflect the long-term well-being goals for Wales and be underpinned by the principles of sustainable management.

Sustainable flood risk practice in Wales is increasingly focused on how working with natural processes can be used to create more flexible and adaptive solutions that provide increased resilience to a changing and uncertain climate.

Be evidence based.

To develop this flood risk management plan the best available evidence from a range of sources has been used, building on both our knowledge and that of our stakeholders and local communities. Natural Resources Wales will continue to build and improve this evidence base.

People focussed.

The natural resource planning process will need to reflect the principles of co-production and stakeholder engagement. The overarching aim should deliver outcomes that are equitably distributed and focussed on delivering long term benefits for the people of Wales.

By working with others the aim is to:

- Understand all the issues (not just flood risk) and how they interact;
- Understand how the issues are affecting the current local benefits and future sustainability;
- Involve local people, communities, organisations and businesses in making decisions that affect their area by sharing evidence, knowledge and experience;
- Identify which issues to tackle as a priority.

FRM National Measures for RBMP & FRMP

The Dee RBMP sets out National Measures proposed for delivery by Flood Risk Management in Wales. These measures are set out below and demonstrate Natural Resources Wales' commitment to integrated natural resource management through our activities.

1. **Identify opportunities to improve the water environment through existing programmes of work and scheme designs for Flood Risk Management**. Potential synergies and conflicts between RBMP measures and FRMP measures in specific communities at risk have been identified and will be incorporated into the Communities at Risk Register to identify where multiple benefits can be delivered through projects. Those actions that can be delivered within the next 6year planning window are documented in the delivery plans in Section 9.

2. **NRW will seek opportunities and influence others to utilise natural flood risk management measures where appropriate.** FRM will work with the Area Natural Resource Management teams in the development of the Area Based Statements to ensure flood risk is integral in the consideration of Natural Resource Management, including identifying opportunities to deliver Natural Flood Risk Management. FRM will support the work of others to identify opportunities and implement measures to secure flood risk benefits as part of planned programmes of work/projects.

3. **Implement managed realignment and intertidal habitat creation through the National Habitat Creation Programme (NHCP).** Continue with this programme of work, delivering coastal compensation habitat to offset predicted losses brought about through coastal squeeze, as identified in the SMP2's.

4. **In waterbodies designated as heavily modified due to flood and coastal protection, mitigation for NRW owned assets and activities will be reviewed and delivered on a prioritised basis.**

5. **Contribute to the achievement of the WFD objective and favourable conservation status at priority Water Level Management sites.** Continue

working with protected sites colleagues and land owners in the delivery of Water Level Management Plans.

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6. Contribute to research and development to identify best practice for managing hydromorphological pressures in the water environment

Flood risk management is one of the top ten reasons a waterbody fails to meet the objective set under the WFD in Wales. This is why it is important to ensure that where action is needed to manage the risk of flooding, an option is selected that at least maintains the ecological status or potential of a water body, and also seeks opportunities for improvement.

Figure 7: Summary of measures in the Wales side of the RBD

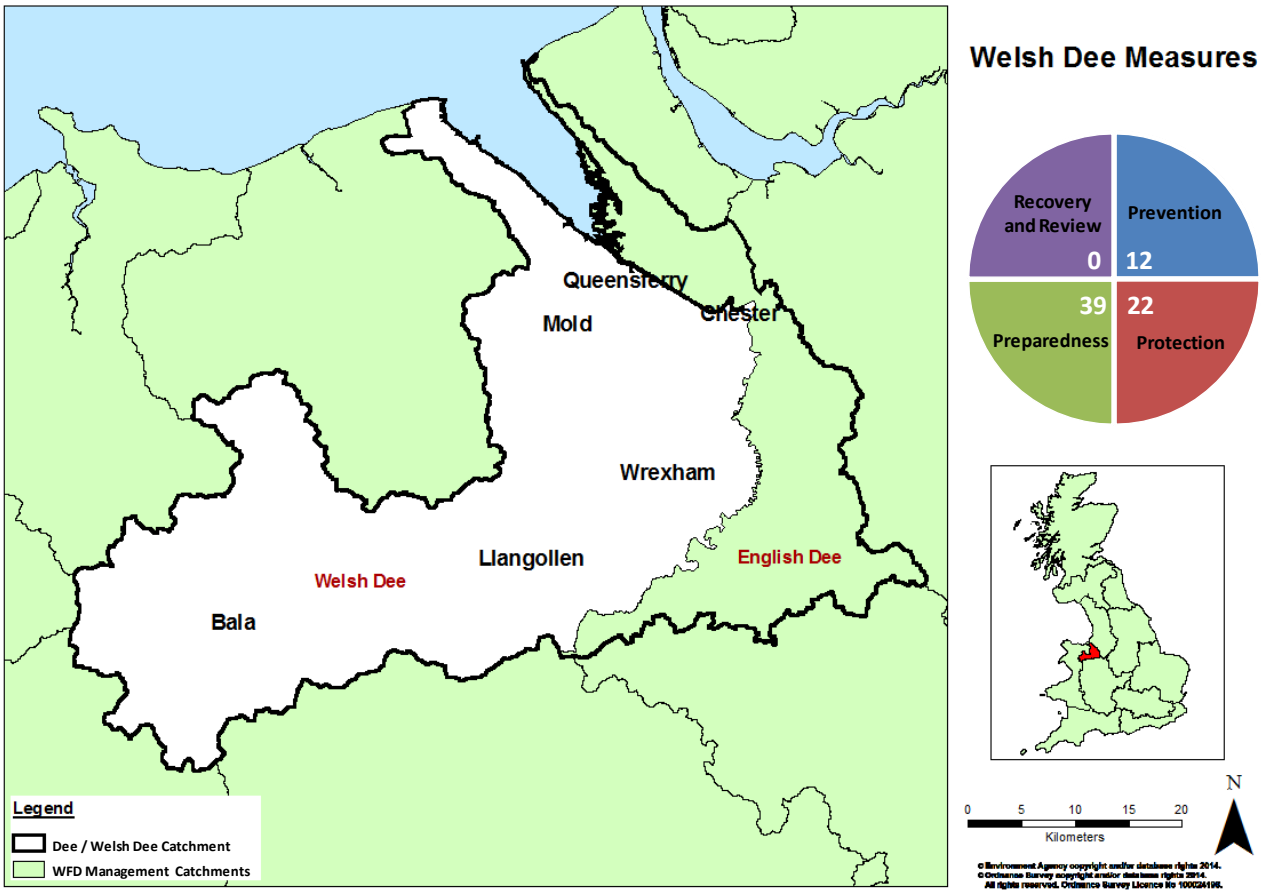


Table 9: Wales only measures

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).

This table provides a list of measures Natural Resources Wales intend to undertake within this catchment over the coming years, subject to resourcing, economic assessment and funding justification.

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	Ongoing
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Bala	Main River	Develop scheme appraisal for flood alleviation scheme	M3 - Protection	1, 2, 8	High	Ongoing
Bangor-is-y-coed	Main River	Design and construction of flood alleviation scheme	M3 - Protection	1, 2, 8	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	Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2, 8	Medium	Not Started
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started
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, 8	Medium	Not Started
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
		Derive hydrology	M2 - Prevention	1, 2, 3	Very High	Not Started
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Ffrith	Main River	Investigate feasibility for new flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Medium	Ongoing
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started
Ffynnongroyw	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Flint	Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2, 8	High	Not Started
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, 8	Very High	Complete
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started
		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
		Raise flood awareness within the community	M4 - Preparedness	1, 4, 5	High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
		Review or update hydraulic model	M2 - Prevention	1, 2, 3	High	Ongoing
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
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Medium	Not Started
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	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
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Leeswood	Main River	Build hydraulic model	M2 - Prevention	1, 2, 3	High	Completed
		Improve existing flood forecasting model	M4 - Preparedness	1, 2, 4	Medium	Ongoing
		Review / update hydrology	M2 - Prevention	1, 2, 3	Very High	Complete
Llong	Main River	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Medium	Ongoing
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started
Mold	Main River	Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
		Review / update hydrology	M2 - Prevention	1, 2, 3	Very High	Ongoing
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started

Location	Source	Measure Name	Measure	Link to FRMP objective	Priority	Measure Status
New Broughton	Main River	Implement alternative risk reduction measures	M3 - Protection	1, 2, 8	Medium	Not Started
New Broughton	Main River	Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started
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, 8	Medium	Not Started
Queensferry and Sandycroft	Main River / Sea	Carry out structural assessment on existing structures to ensure they are fit for purpose	M3 - Protection	1, 2, 8	High	Not Started
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	Very High	Not Started
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Review / update hydrology	M2 - Prevention	1, 2, 3	Medium	Not Started
		Review or update hydraulic model	M2 - Prevention	1, 2, 3	Medium	Not Started
		Undertake hydrometric surveys	M4 - Preparedness	1, 2, 4	High	Not Started
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
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
		Undertake hydrometry and telemetry improvements	M4 - Preparedness	1, 2, 4	Very High	Complete
Sealand Basin Wales	Main River / Sea	Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Talacre	Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	Very High	Not Started
		Improve existing flood warning service	M4 - Preparedness	1, 2, 4	High	Not Started
		Maintain completed community flood plan	M4 - Preparedness	1, 4, 5	Very High	Ongoing
		Maintain existing defences and inspection regime	M3 - Protection	1, 2, 8	Very High	Ongoing
Walwen and Wheston	Sea	Build hydraulic model	M2 - Prevention	1, 2, 3	Medium	Complete
		Review / update hydrology	M2 - Prevention	1, 2, 3	Medium	Complete
		Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2, 8	High	Not Started
Wrexham	Main River	Undertake initial assessment and feasibility work for reducing flood risk	M3 - Protection	1, 2, 8	Medium	Not Started

11. England only section

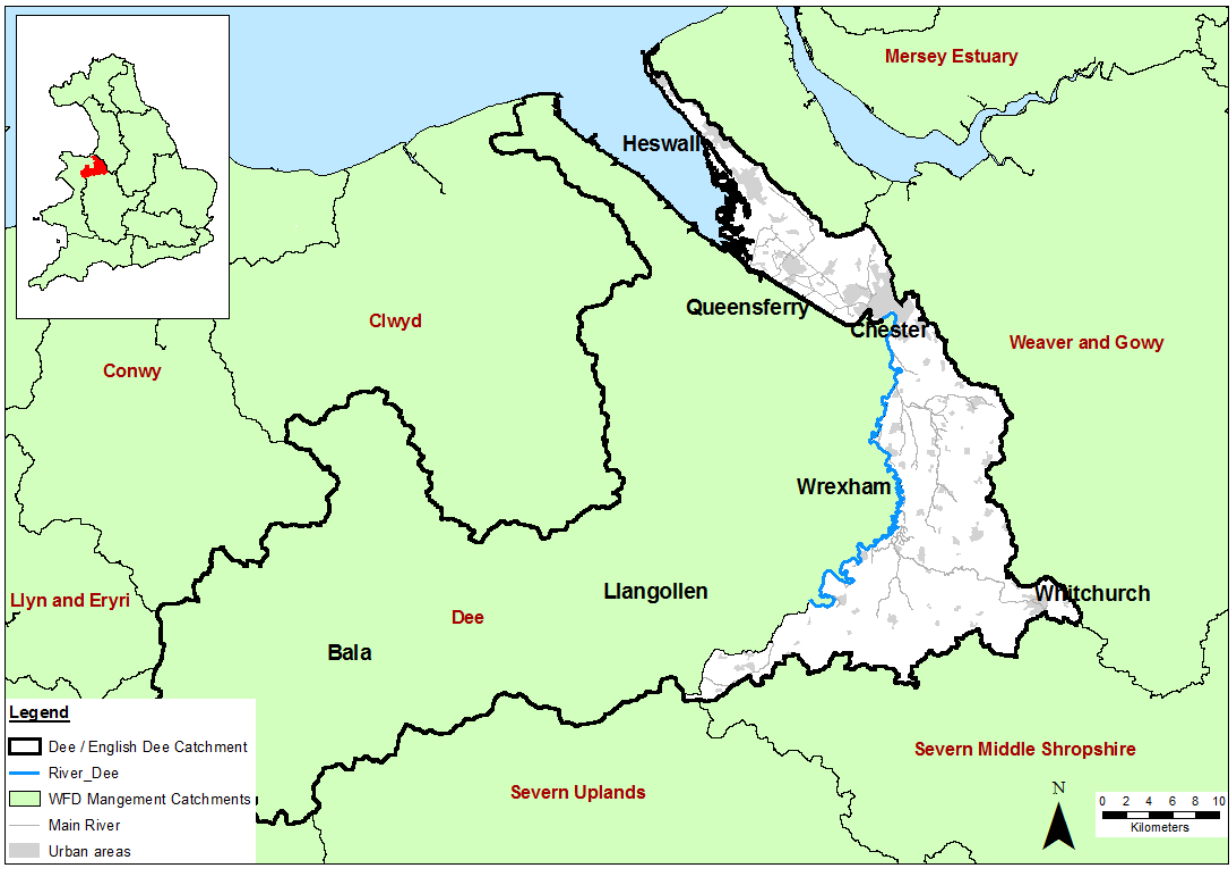
The following section considers the objectives and measures that are only applicable to the England only side of the RBD (these will include objectives and measures that are applicable at a scale that is larger than a single catchment but not applicable across the border in the RBD). The flood risk maps for the Welsh Dee area are shown in Figure 9 and Figure 10.

The English Dee area covers 500km² 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, altering arable farming practices on steeper sloping ground where appropriate could increase infiltration and water retention and hence reduce run-off rates. Wetlands outside the flood plain in the lower catchment could 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 8: 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, United Utilities 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 The Environment Agency will also work closely with the Regional Flood and Coastal Committee, and Natural England.

Broader benefits and Natural Flood Management

Natural flood management and 'slowing the flow' techniques such as restoration of peat moorland, woodland creation, wetlands and ponds, encourage greater infiltration of water into the ground and/or hold water back. This reduces peak flows in minor watercourses and across the surface of undeveloped land. The Environment Agency will work with many other organisations and within partnerships to consider the application of these methods and to develop a programme of them alongside more traditional solutions, such as building raised flood defences. Programmes will include the 6 year program of Environment Agency and Lead Local Flood Authority projects. This more natural approach can reduce sediment volumes entering rivers, filter out contaminants and enhance habitats.

Natural flood management can be used as a stand-alone solution for protecting small clusters of property and providing a small measure of climate change resilience. It may be especially appropriate where small communities suffer frequent flooding - measures may be less effective in larger floods when they could be overwhelmed and when land may be more saturated, but even then they could reduce the peak flow slightly. In addition, natural flood management it could be combined with property level protection measures to isolated properties, or with raised defences in the case of larger communities at risk of flooding. Similar techniques may be applied in or on the fringe of urban areas where they may be referred to as green infrastructure, or sustainable drainage systems.

Measures to satisfy Water Framework Directive objectives will be located upstream or along stretches of water with poor water quality or habitats. Locations where these coincide may require input from more stakeholders to work in collaboration, perhaps using funding from multiple sources. These are likely to provide greater benefit for a given investment and so have a high priority.

Sustainable Urban Drainage Systems (SuDS) include green roofs, ponds, swales, porous pavements and soakaways. When applied to developments they have an important role in delivering multiple benefits. SuDS attenuate and filter run-off to reduce flood risk and improve water quality. They also conserve and benefit biodiversity and help with climate change adaptation (eg. urban heat island effect).

Consequently, in the context of planning for flood risk, the Environment Agency encourages Local Planning Authorities to adopt a Green Infrastructure approach and SuDS form a significant aspect of this. It should be planned and managed in a similar way to critical infrastructure, because it is a climate change adaptation response that will help build a community's overall resilience – reduced flood risk, increased shading, drought tolerance and protection of urban ecosystems.

The following table summarises the WFD outcomes expected to be delivered through flood risk management programmes by the end of the cycle 2 of the RBMP by 2021:

Table 10: RBMP outcomes related to Environment Agency flood risk management programmes by 2021

Type of FCERM programme actions	No of actions	Hectares of water dependent habitat created or improved to help meet the objectives of WFD	Hectares of intertidal habitat created to help meet the objectives of WFD for protected areas	Kilometres of rivers protected under EU Habitats/Birds Directive improved to help meet the objectives of WFD
FCERM actions in Site Improvement Plans of water dependent sites designated under the EU Habitats and Birds Directives that will deliver a WFD outcome.	3	4	0	187
FCERM actions addressing remedies and threats to water dependent sites designated under the Wildlife & Countryside Act 1981 (SSSIs) that will deliver a WFD outcome.	1	18	0	0
FCERM actions addressing requirements for consent of flood works such as planning, EIA, HRA etc.	2	21	0	0
FCERM actions that deliver WFD outcomes from works that contribute to the Eel Regulations.	4	No of eel barrier easements or removal = 4		
Total	**10**	**43**	**0**	**187**

Links to Dee RBD Designated Site Plans (from .GOV UK)

The FRMP aims to contribute to the specific plans of designated conservation sites and these are set out as proposed actions in specific plans and related to FCERM and the relevant Risk Management Authorities. These include actions in the Dee RBD Site Improvement Plans for the following European designated sites:

Dee RBD Natura 2000 sites with Site Improvement Plans
Brown Moss
Chew Valley Lake
Fens Pool
Lyppard Grange Ponds
River Clun
River Wye
Dee Estuary Mor Hafren
Walmore Common
West Midlands Mosses
Wye Valley Woodlands/Coetiroedd Dyffryn Gwy

These plans have been developed by Natural England, in conjunction with NRW for sites that cross the border such as the River Wye (SAC) and Dee Estuary SAC/SPA/Ramsar site. For every European site in Wales (apart from cross-border sites) NRW are leading on the development of Prioritised Improvement Plan (PIPs). These are currently subject to consultation and include the River Usk.

There is strong evidence that woodland measures can reduce flood flows, particularly but not only within smaller catchments. Trees help reduce flood risk in a number of ways:

- greater water use by trees compared to other vegetation types reduces run-off and also creates greater capacity for woodland soils to absorb rainfall during flood events;
- higher infiltration rates of forest soils resulting from the extensive rooting systems of trees reduces run-off to watercourses and aids interception of overland flow from adjacent land;
- Floodplain and riparian woodland can slow down flood flows, increase temporary storage and thereby delay the transfer of flood water downstream;
- soils under woodland are generally protected from erosion risk, reducing delivery of sediment to watercourses.

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

The 2011 'Woodland for Water' report detailed the evidence behind these conclusions. As a result opportunity mapping to be used to identify where in the country to target woodland measures to help reduce flood risk. Priority locations fall into three categories:

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

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

Development planning and control

Risk management authorities (RMAs) work together to avoid inappropriate development of the floodplain. The National Planning Policy Framework (NPPF) sets out government policy on new developments, which must be applied by local planning authorities when making land use planning decisions. The Environment Agency is a statutory consultee for planning applications except for minor developments in areas at risk of flooding from rivers and the sea and large developments where flooding from rivers and the sea is very unlikely. RMAs work in partnership to advise developers on planning consultations in high risk areas. The final decision for development in the floodplain is made by the local planning authorities. Permitting decisions on development is an opportunity to integrate SuDS, Sustainable Urban Drainage Systems, that mimic the natural drainage of the land and reduce surface water run-off.

Maintenance

In England the Environment Agency and other RMAs carry out maintenance work in line with government policy to provide the greatest benefits to people and property at risk of flooding within the available funding. Maintenance work to maintain channels, assets and structures is carried out under the Environment Agency's permissive powers to ensure that assets are fit for purpose. A

risk-based approach to assess the need and justification for works and investment is directed towards those activities that will contribute most to reducing flood risk per pound of funding.

Maintenance activities are divided into four main areas:

- operation (inspecting and operating assets);
- conveyance (improving the flow of water in a channel);
- structures (maintaining structures and assets);
- Mechanical, Electrical, Instrumentation, Control and Automation (carrying out minor repairs and replacements to pumps and tidal barriers).

The Environment Agency extract a national picture of maintenance needs from System Asset Management Plans (SAMPs) these systems are ranked based on their cost/benefit ratio. The Environment Agency annual maintenance programme includes a range of activities that are prioritised and timetabled using information from asset inspections, maintenance standards, characteristics of the assets, levels of flood risk and from legal and statutory obligations.

Six year investment programme

In December 2014 the government set out a 6 year plan for investment in flood and coastal erosion risk management (2015/16 to 2020/21). The latest published figures show the current funding profile of each year. Each year RMAs are invited to submit details of proposed FCERM capital works to the Environment Agency. These proposals are combined with Environment Agency proposed schemes to form a programme of work. Investment in FCERM is prioritised according to government policy, and in line with the government's National FCERM Strategy and HM Treasury Green Book on economic appraisal. Government policy gives the highest priority to lives and homes and all FCERM projects should at least have a benefit cost ratio greater than 1:1. All FCERM schemes are prioritised against a consistent set of criteria applied to all risk management authorities (RMAs). This ensures a fair distribution of funding based on agreed priorities, principles and needs. Measures in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to all RMA measures in the same way and is based on current Government policy that gives the highest priority to lives and homes.

The published programme can be found here. Measures from the 6 year investment programme are included in the FRMP. In subsequent years the FRMP will inform which proposed FCRM capital works are submitted to the investment programme.

Long term investment scenarios

The Environment Agency's long-term investment scenarios study published in December 2014, presents a new analysis of the costs and risks of flood and coastal erosion risk management in England. The study sets out the link between national investment in flood and coastal erosion risk management, and the outcomes in terms of economic risk and numbers of properties at risk. The study found that the annual economic 'optimum' investment need over the next 10 years is broadly in line with current expenditure (about £750 million, including public and third party contributions). The study shows that over the next 50 years optimal investment in FCERM is expected to rise by 10-20% (in present day terms). A key finding of the study is that even if average annual investment is sustained at an optimal level there will still be significant numbers of properties at high and medium flood risk in 50 years time meaning new and innovative approaches will be needed. LTIS estimates that, by 2021, the six year programme could reduce overall flood risk by up to 5% on the assumption that planned capital, maintenance and incident management activities are maintained.

Coastal Erosion & Shoreline Management Plans

The Environment Agency has the coastal Strategic Overview in England. The coastal overview joins up coastal management activities to ensure flooding and erosion risk is managed effectively. The overview encourages authorities to work together in partnership to achieve effective management of coastal flooding and erosion risks.

Work to tackle coastal erosion is the responsibility of district or unitary councils. Local authorities have operational powers relating to managing coastal erosion under the Coast Protection Act 1949 and the Floods and Water Management Act 2010. Local Authorities lead on coastal risk management activities and undertake works on sea flooding and coastal erosion where they are best placed to do so. This is undertaken in collaboration with the Environment Agency.

Shoreline Management plans are non-statutory, high level planning documents. They are large scale assessments of the risk associated with coastal processes, and a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. They set the strategic direction for how the coast is wanted to be managed over the next 100 years. SMPs identify the most sustainable approaches to managing coastal erosion and flooding risks in the short, medium, and long term.

During the development of Shoreline Management Plans, a range of partners and the public were extensively consulted and involved in the decision making processes.

This FRMP also draws some coastal erosion information from the Shoreline Management Plan 2 (SMP2), however, the full Shoreline Management Plan has not been included in this FRMP. The SMP measures included in this FRMP are those that are most relevant for sea flooding and flood risk issues. You can access further information and the full SMPs here: https://www.gov.uk/government/publications/shoreline-management-plans-smps/shoreline-management-plans-smps.

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

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

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

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

Flood Risk Maps

Figure 9: Flood Risk from Rivers and the Sea in the English Dee area

Figure 10: 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.

Supporting Communities that Remain at Risk is an Environment Agency project to pre -plan for the use of temporary defences. This project is a great opportunity to have prepared plans and equipment for more communities to maximise the use of the extra time flood forecasting investment has bought us in helping to protect them.

There is key environmental interest as the River Dee is designated as SSSI and SAC and therefore the Environment Agency 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 the 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.

During December 2015, Storms Desmond, Eva and Frank brought record breaking levels of rainfall and significant flooding to some parts of the England. On 5 and 6 December the highest ever river flows were registered in several large catchments including the Eden, Lune and Tyne. On 25 and

26 December further record river levels were registered for many large rivers draining the Pennines. The Met Office confirmed that December 2015 was the wettest on record in parts of the UK, including Cumbria which experienced more than two and a half times expected monthly rainfall.

Across the country over 19,000 properties were flooded, with thousands more affected by loss of power supply and travel disruption. Existing flood defences played an essential part in protecting thousands of homes during December with 12,500 benefitting during Storm Desmond and 10,900 during Storm Eva. Support to affected communities, business and the agricultural sector is in place, along with a programme of inspections and repairs to damaged defences.

Following the December 2015 floods, Defra announced a National Flood Resilience Review, to assess how the country can be better protected from future flooding and increasingly extreme weather events. The review is looking at climate modelling, infrastructure, resilience and future investment strategy. Government is also working to strengthen or establish partnerships in the areas most flood affected to encourage a more integrated approach to managing risk across the whole catchment. These Partnerships are considering improvements to flood defences, upstream options to help slow the flow and surface water runoff, and how planning and design of urban areas can help reduce flood risk. They are also aiming to build stronger links between local residents, community groups and flood management planning and decision making. The resulting actions from the Local Flood Partnerships in Cumbria and Yorkshire will complement the measures in the relevant FRMPs and the learning from this approach will be shared across the country. In England, the Government is investing £2.3bn on 1,500 flood defence schemes between 2015-2021. Investment in flood risk management infrastructure not only reduces the risks of flooding but also supports growth by helping to create new jobs, bringing confidence to areas previously affected by floods and creating and restoring habitats.

Objectives

The objectives in the Dee Flood Risk Management Plan are aligned with the second cycle River Basin Management Plan. They state the main ways in which work is directed to make a difference and reduce flood risk. They cover people, the economy and the environment. The objectives are split into the 3 categories to help demonstrate the balance of objectives across the plans but the categories aren't assigned a weighting in the FRMP. Objectives are used to plan and prioritise investment programmes to target investment in the most at risk communities. Prioritisation is then done at an England wide level and takes into account the risk but also considers other factors such as; cost benefits, the level of investment to date and other aspects such as the potential for external funding opportunities.

<u>Social</u>

1. Minimise impact to people and property and to critical infrastructure and services from rivers, the sea, surface water, groundwater, reservoirs & sewers
2. The water environment shall be enjoyed by people and provide opportunities for recreational amenity
3. Promote the consideration of environmental benefits to people (ecosystem services) as part of work to manage flood risk

<u>Economic</u>

4. Minimise flood risk impact to the local economy so that business is resilient and sustainable growth is supported

<u>Environmental</u>

5. Promote an integrated approach to water management
6. Work with river, estuarine and coastal processes to conserve and enhance natural hydro-morphology (sediment movement and physical features) and water quality
7. Promote natural flood risk management and protection of soils

8. Deliver a clean and safe water environment with benefits for the wider environment. The water environment will have diverse flora and fauna which benefits from natural flood management techniques, 'green infrastructure' and improved ecological connectivity
9. Support climate change adaptation by making space for water, both inland and at the coast
10. Conserve built and natural heritage wherever possible

Measures across the English Dee area

Across the English Dee area there are 21 measures to manage flood risk. Measures in FRMPs do not all have secured funding and are not guaranteed to be implemented. Money is allocated to all RMA measures in the same way and is based on current Government policy that gives the highest priority to lives and homes.

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

Preparing for risk:

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

Protecting from risk:

- 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.
- Identify where working with natural processes/natural flood management can help to reduce flood and coastal erosion risk and help catchments both adapt and become more resilient to the impacts of Climate Change
- Dee Lock Flood Risk Management scheme
- Inform the owners/operators of the storm water pumping stations and associated infrastructure of their flood risks now and in the future.
- Incorporate Climate Change allowances into flood risk management works
- Identify where working with natural processes/natural flood management can help to reduce flood and coastal erosion risk and help catchments both adapt and become more resilient to the impacts of Climate Change

Table 11: England only measures

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5831	Whitchurch	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 | Environment Agency	Statutory FRMP	FRMP
ACT5852	Malpas	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 | Environment Agency	Statutory FRMP	FRMP
ACT5853	Tattenhall	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 | Environment Agency	Statutory FRMP	FRMP
ACT5854	Middle Dee	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 | Environment Agency	Statutory FRMP	FRMP

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5855	Shocklach	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 | Environment Agency	Statutory FRMP	FRMP
ACT5856	Farndon	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 | Environment Agency	Statutory FRMP	FRMP
ACT5857	Almere	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 | Environment Agency	Statutory FRMP	FRMP

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5858	Aldford	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 | Environment Agency	Statutory FRMP	FRMP
ACT5859	Eccleston	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 | Environment Agency	Statutory FRMP	FRMP
ACT5860	Lower Kinnerton	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 | Environment Agency	Statutory FRMP	FRMP

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5861	Lower Dee	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 | Environment Agency	Statutory FRMP	FRMP
ACT5862	Neston	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 | Environment Agency	Statutory FRMP	FRMP
ACT5863	West Kirby	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 | Environment Agency	Statutory FRMP	FRMP

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5864	Heswall	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 | Environment Agency	Statutory FRMP	FRMP
ACT5865	Chester	DEE07.002	Inform the owners/operators of the stormwater 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 | Environment Agency	Statutory FRMP	FRMP
ACT5866	Chester	DEE07.003	Encourage the owners and operators of stormwater 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 | Environment Agency	Statutory FRMP	FRMP
ACT5867	Chester	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 | Environment Agency	Statutory FRMP	FRMP

Measure ID	Place	Measure Name	Measure Details	Source of flood risk or coastal erosion									Category of objective			Category of Measures	Timing	Priority	Measure Owner	Statutory or voluntary measure	Plan Type
				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*	*Source plan measure originates from*
ACT5868	Chester	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 | Environment Agency	Statutory FRMP	FRMP
ACT6057	Dee Locks, Chester	DEE07.015	Dee Locks Flood risk Management scheme - Improve the stanbdard of protection for Dee Locks gates to bring it in line with the adjacent flood embankments along the lower Dee.	N	N	N	N	N	N	N	N	N	N	N	Y	M3 - Protection	2015 - 2021	High	Environment Agency | Environment Agency	Statutory FRMP	FRMP
ACT7020	NW and Dee RBD wide	NWRBD.001	Incorporate Climate Change allowances into flood risk management works	N	N	N	N	N	N	N	N	N	Y	N	N	M3 - Protection	2015 - 2021	Moderate	Environment Agency | Environment Agency | LLFAs	Non statutory FRMP	FRMP
ACT7022	NW and Dee RBD wide	NWRBD.002	Identify where working with natural processes/natural flood management can help to reduce flood and coastal erosion risk and help catchments both adapt and become more resilient to the impacts of Climate Change	N	N	N	N	N	N	N	N	N	Y	N	N	M3 - Protection	2015 - 2021	Moderate	Environment Agency | Environment Agency	Non statutory FRMP	FRMP

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 the Environment Agency 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, RMAs 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 are happening 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.

Annex 1 - Sources of information for the draft FRMP

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

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.

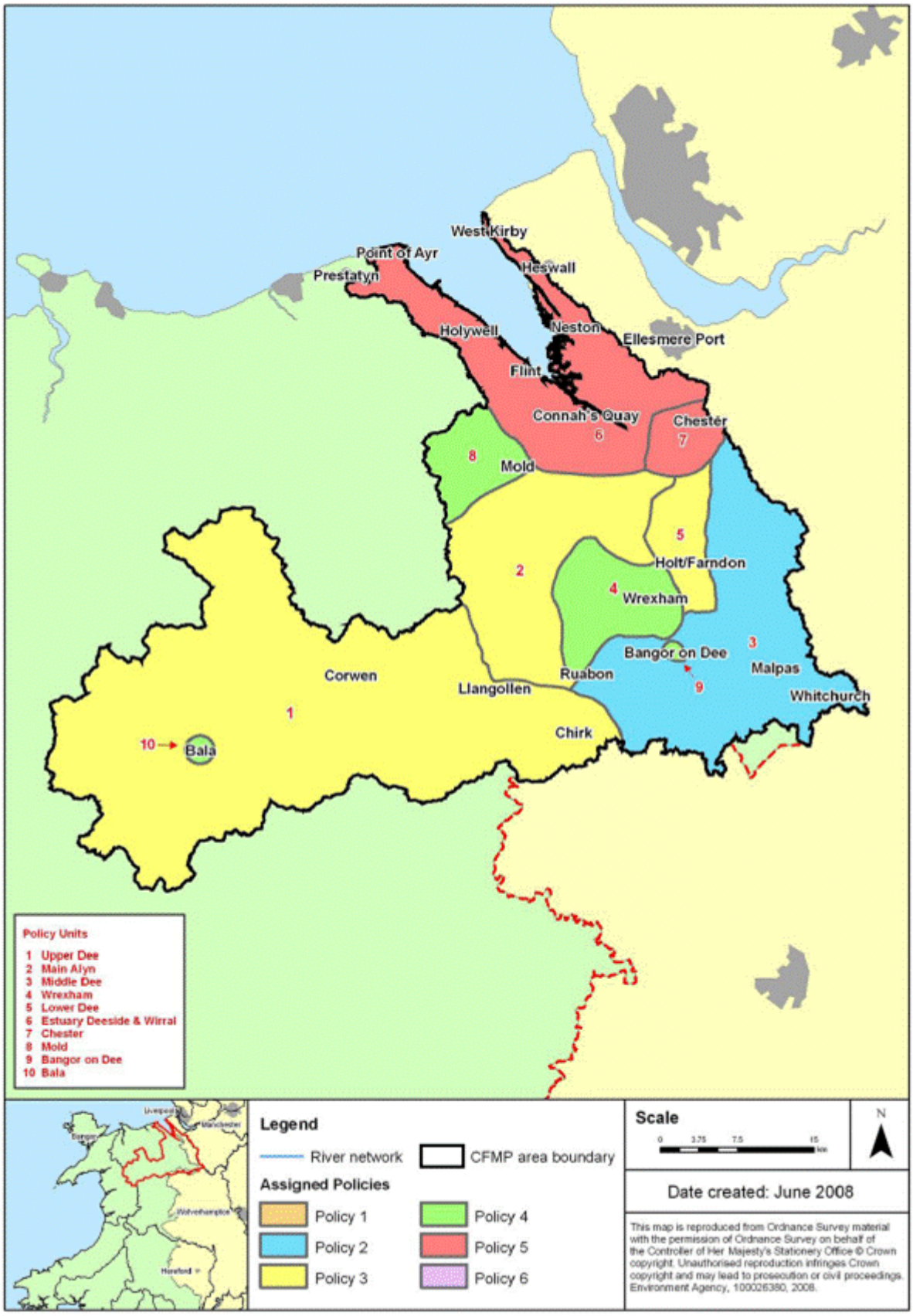
The six pre-defined policies that were adopted are illustrated in Figure 11 and can be described as:

- 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 the 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 11: 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 the 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.

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