# Dee River Basin District Flood Risk Management Plan (English Catchments) 2021 to 2027

December 2022

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





We are the Environment Agency. We protect and improve the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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# Foreword


More than 160,000 people in England live in the Dee River Basin District, which spans the England and Wales border and includes Chester, Neston, Heswall, West Kirby and Whitchurch.

Over 3,000 people who live in the English portion of the Dee River Basin District are at risk of flooding from rivers and the sea**,** and around 11,000 people at risk of flooding from surface water. Surface water is the main source of flooding in the English Dee, with flooding also occurring from rivers, the sea and sewers.

Whilst there has been limited flooding in the Dee River Basin District in recent years, the floods of 2021 did have some significant impacts on:

- communities
- businesses
- infrastructure
- rural areas
- the environment

With a rapidly changing climate, the need to plan together to improve the overall resilience of our local places is more important than ever before.

Partnerships are key. The more we plan together, the more we can deliver together for local people, places and our environment.

Over the last two years we have worked together with Lead Local Flood Authorities and other partners to develop these Flood Risk Management Plans (FRMPs). This has been a challenging time because of winter flooding and the impacts of coronavirus which have served as a reminder about how precious the environment around us is for our health and wellbeing, and of the importance of protecting and enhancing it.

FRMPs are an important contribution towards delivering the ambitions of the ‘National Flood and Coastal Erosion Risk Management Strategy for England’ and the government’s 25 Year Environment Plan. They focus on the more significant areas of flooding and describe the risk of flooding both now and in the future. They will help to:

- identify actions that will reduce the likelihood and consequences of flooding
- refresh plans to improve resilience whilst informing the delivery of existing flood programmes
- work in partnership to explore wider resilience measures – including nature-based solutions for flood and water
- set longer term, adaptive approaches to help improve our nation’s resilience

To support these plans, we have developed the Flood Plan Explorer which is a new, online, map-based tool. It will make plans more accessible and show all the proposed actions in a visual format. It will also help people to see what is planned, where and when. The aim is to stimulate even more opportunities for collaboration and co-operation in local places.

I am pleased we have this opportunity to share the Dee FRMP and I encourage you all to get involved and to have your say.

Sue Longstone, Operations Director for (North) Environment Agency.

# Contents

# Introduction to the FRMP

You should read this Flood Risk Management Plan (FRMP) with Part A: National Overview of Flood Risk Management in England for Second Cycle FRMPs. Part A is a high-level overview of the FRMP and flood risk management in England.

You can find all the FRMP documents for the Dee River Basin District on GOV.UK. The plan is supported by the:

- Dee River Basin District Second Cycle Flood Risk Management Plan Habitats Regulations Assessment – a report on the findings of the habitats regulations assessment (HRA)
- Dee River Basin District Second Cycle Flood Risk Management Plan Habitats Regulations Assessment non-technical summary – a summary of the findings in the full HRA report
- Dee River Basin District Statement of Environmental Particulars (SOEP) – a report on the potential impacts on people and the environment when implementing the measures in the FRMP
- Annex 1 spreadsheet – a list containing the implementation status of each measure published in the first FRMP cycle

You can use Flood Plan Explorer, a new, interactive mapping tool that displays information about the measures included within this plan.

## Developing the FRMP

The second cycle Flood Risk Management Plan (FRMP) is a plan to manage significant flood risks within the English Catchments of the Dee River Basin District (RBD). Nationally the primary focus of FRMPs is on areas that have been designated as being at particular risk of flooding from either rivers and sea or surface water. These areas are called Flood Risk Areas (FRA). In England FRAs were designated nationally in 2017 and 2018 following a nationally consistent approach. Producing the plan for these areas is a requirement of the Flood Risk Regulations (2009). More information on the background to FRMPs, the Flood Risk Regulations and how FRAs were identified is in Part A National Overview of Flood Risk Management in England for Second Cycle FRMPs.

The Dee RBD is partly in England and partly in Wales. The first cycle Dee FRMP covered the whole RBD. This second cycle FRMP covers the part of the RBD that is in England. Natural Resources Wales (NRW) will be producing a separate FRMP to cover the whole of Wales.

The Lache FRA is in North Wales close to the English border in a shared river catchment. The Environment Agency work together with Natural Resources Wales (NRW) to manage flood risk in this area.

Flooding can cause significant impacts on communities outside of designated Flood Risk Areas. The Environment Agency and other Risk Management Authorities (RMAs) will continue to plan for and manage the risk of flooding to all communities and places. This is regardless of whether they are in a FRA or not. For example, RMAs will support communities to prepare for, respond to and recovery from flooding. They will also warn and inform people of the risk as well as plan and implement works to maintain or improve their resilience to flooding.

Although there are no FRAs in the English catchments of the Dee RBD there are communities that are at risk of and have experienced flooding. The draft plan for the Dee RBD has therefore been developed to include measures that apply to all or specific areas of the RBD. This allows us to target actions where needed across the RBD and helps us to provide appropriate support to all our communities that are at risk of flooding. This is like how the first cycle of FRMPs were developed. The first cycle of FRMPs covered the period 2015 to 2021.

The Environment Agency and other RMAs, in particular Lead Local Flood Authorities (LLFAs) worked together to develop the first cycle FRMP. This was in order to create a plan to manage the risk from all sources of flooding. The second cycle FRMP will build on this approach. The ambition is that the FRMP is a strategic, place-based plan which shows what is happening in flood risk management across the RBD. It is closely aligned with the:

- Government's 25 year environment plan
- National Flood and Coastal Erosion Risk Management Strategy for England (FCERM strategy)

The second cycle FRMP will encourage closer ways of working between RMAs that will help to achieve its revised objectives and measures. These revised objectives and measures align with the ambitions of the FCERM strategy. They also support achieving wider environmental and growth ambitions of society. The FRMP is also aligned with the draft River Basin Management Plan for the Dee RBD. Together, these plans set the strategic goals and approaches to managing water and flood risk within the RBD.

## Contributors to the FRMP

The Environment Agency has worked with LLFAs and other RMAs to develop the FRMP. The Environment Agency and those LLFAs with a surface water FRA within their administrative area must produce a FRMP.

There are no FRAs within the English catchments of the Dee RBD.

RMAs without FRAs have contributed to the FRMP. This is to show what is happening to manage the risk of flooding across the English catchments of the Dee RBD.

This second cycle FRMP for the English catchments Dee RBD identifies some measures that are applicable across all the English catchments of the Dee RBD and some that apply to parts of the RBD.

The second cycle FRMP measures for the English catchments of the Dee RBD cover all sources of flood risk and have been developed with contributions from other RMAs as listed below. These RMAs do not have FRAs and have therefore volunteered to be part of the FRMP development. Whilst the ambition of the plan is to be a strategic place-based plan that covers all sources of flood risk, there may be places and flood risk management activities that are not included. This is due to the strategic nature of the second cycle FRMP and does not change anything planned for those places. All RMAs across the Dee RBD will continue to plan for and manage the risk of flooding as appropriate. You can find information about national-level measures that the Environment Agency and LLFAs carry out as part of their routine day to day work in the interactive mapping tool – Flood Plan Explorer.

Developing the FRMP has been impacted by the extraordinary events of the past few years. Despite these challenges, the Environment Agency and RMA partners have set out measures for FRAs, ensuring that the requirements of the 'Flood Risk Regulations 2009' are met. Where we have been able to do so in the time available, we have taken a place-based approach when developing these measures for FRAs. For the rest of the RBD we have:

- included relevant place-based measures from the first cycle FRMP that have not been completed - either individually or aggregated
- included new measures - mostly reflecting where we already had plans to work in the period 2021-2027, several of which have been developed using a strategic place-based approach
- included water and biodiversity objectives wherever possible in measures

We have engaged with Natural Resources Wales and Welsh Water during the development of the second cycle FRMP. We have identified the measures in which they would like to be involved.

Our ambition for the period 2021-2027 is to continue to drive catchment-based delivery in the Dee RBD that offers multiple benefits to communities and the environment. This catchment-based approach is a key part of the Environment Agency's ambition to meet net zero carbon, along with low carbon innovation and carbon offsetting. It is also integral to achieving the Environment Agency's biodiversity net gain targets which support the ambitions of the government's '25 Year Environment Plan'.

Working in partnership is the most effective way to address the issues of flooding and climate change and to deliver multiple benefits. During the period 2021-2027 the Environment Agency and RMA partners will continue to work together to produce strategic plans such as the:

- evolving drainage and wastewater management plans - led by water companies
- review of the local flood risk management strategies - led by LLFAs
- review of the 'North West Shoreline Management Plan' - led by the relevant Coastal Groups

The Environment Agency and many other RMAs work with partners in the River Basin District including:

- catchment partnerships
- landscape partnerships
- catchment based groups
- non-government organisations
- Flood Action Groups
- Coastal Groups
- other active community organisations

We value the contribution these partners make, including in:

- linking people and groups
- bringing in local knowledge, data and expertise
- developing and delivery of projects

We intend to continue developing and strengthening our working with others to identify, develop and deliver solutions that will increase resilience to flooding and climate change and aid nature recovery in the River Basin District. The FRMPs are not intended to cover the detail of this partnership working.

## Other RMAs that have contributed to the FRMP

1. Welsh Water
2. Natural Resources Wales
3. North West Coastal Group
4. Cheshire West and Chester Council
5. Wirral Council
6. Cumbria County Council
7. Regional Flood Coastal Committee
8. Cumbria Strategic Flood Partnership
9. Cheshire Mid-Mersey Strategic Flood Partnership

In preparing the FRMP, RMAs reviewed the first cycle FRMP objectives and measures together with existing and evolving national and local plans and strategies. For this FRMP, relevant plans and strategies include the:

- National Flood and Coastal Erosion Risk Management Strategy for England
- Dee River Basin Management Plan (RBMP)
- Local Flood Risk Management Strategies as hosted on the Flood Hub
- Welsh Water draft drainage and wastewater management plan
- North West Shoreline Management Plan (Great Ormes Head to Scotland - North West England and North Wales)
- The National Planning Policy Framework (NPPF)

For the second cycle of FRMPs, there is nationally consistent set of objectives which are closely linked to the:

- Flood Risk Regulations 2009
- National Flood and Coastal Erosion Risk Management (FCERM) Strategy and Roadmap
- 25 Year Environment Plan
- The full list of these objectives is in the Part A National Overview of Flood Risk Management in England for Second Cycle FRMPs

In drawing the objectives and measures together, RMAs have:

- revisited the priorities
- ensured there is a shared understanding of the main flood risks and how best to manage them

# The Dee RBD

## Overview of the Dee RBD

The Dee River Basin District (RBD) spans the England and Wales border but lies mainly within Wales. This Flood Risk Management Plan (FRMP) covers the English portion of the Dee RBD only. You can find out more about the flood risk management planning process in Wales by visiting the Natural Resources Wales website.

In England the Dee RBD covers an area of 416 $km^2$, which is split between two discrete areas. The smaller southern area (65 km2) extends eastward from Selattyn to Welshampton and includes:

- Weston Rhyn
- Chirk Bank
- Moors Bank
- Castle Dingle
- Gadlas

The larger north-eastern area (351 $km^2$) extends from near Whitchurch to West Kirby on the Wirral coast and includes:

- Tilston
- Aldford
- Chester
- Neston
- Heswall

The English Welsh border broadly follows the line of the River Dee along much of its length.

The Dee RBD encompasses a range of landscapes including Welsh mountains and steep sided wooded valleys, the plains of Cheshire and the mudflats in the estuary. It has a rich diversity of wildlife and habitats, supporting many species of global and national importance. The Dee is a migratory salmon river with internationally important pearl mussel populations. The estuary also supports globally important bird populations.

Around 89% of the river basin district is rural, with most land being used for agriculture. Over 160,000 people live in the English Dee RBD. The main urban and sub-urban areas are in the north of the RBD, including:

- Chester
- Neston
- Heswall
- West Kirby
- Whitchurch

There are no FRAs within the English portion of the Dee RBD.

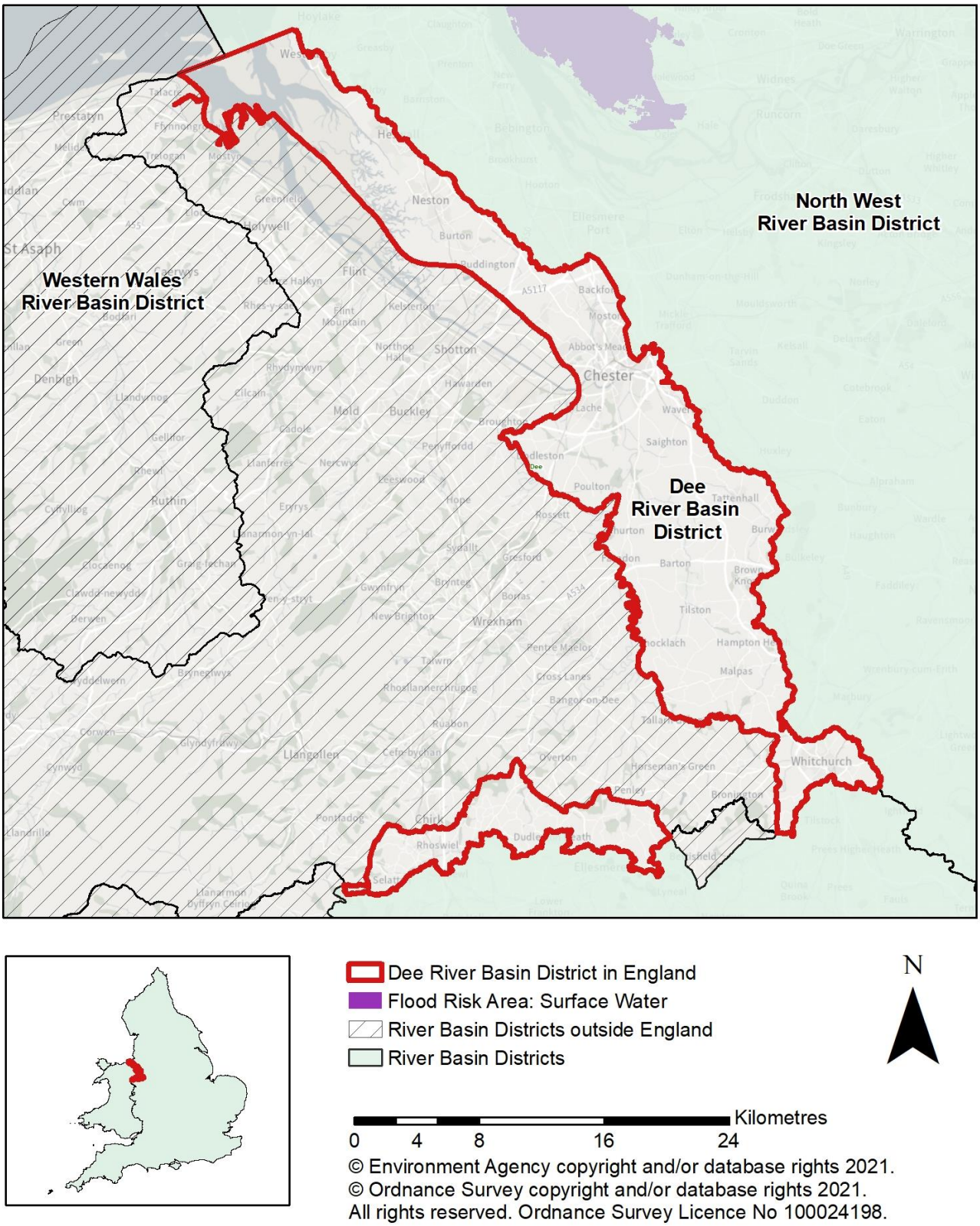


**Figure 1: Map showing the surface water flood risk areas close to the Dee River Basin District**

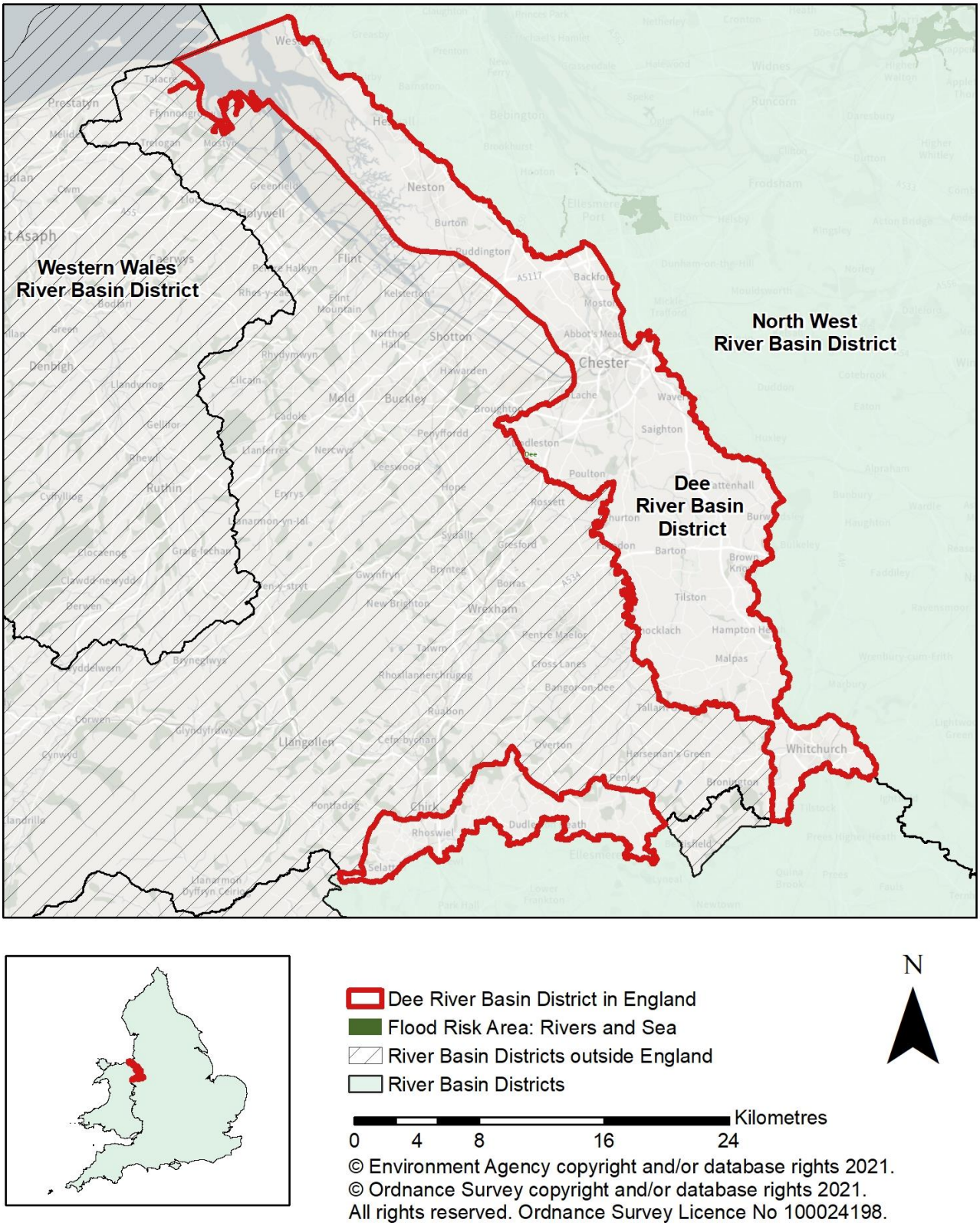


**Figure 2: Map showing the rivers and sea flood risk areas close to the Dee River Basin District**

For further information about the Dee RBD, please read the accompanying Strategic Environmental Assessment (SEA) report. This includes information on topics such as the landscape, geology and cultural heritage of the Dee RBD.

# The main flood risk issues and changes in the Dee RBD

In the English catchments of the Dee River Basin District (RBD) around 3,000 people are estimated to live in areas at risk of flooding. Only 168 of these live in areas considered to be high risk of flooding. High risk is defined as up to a 1 in 30 chance of flooding in any given year.

A further 367 people are estimated to live in areas at moderate risk of flooding. Moderate risk is defined as between a 1 in 30 and 1 in 100 chance of flooding in any given year.

Flooding in the English Dee arises from multiple sources. These are principally river flooding, coastal or tidal flooding, surface water flooding and sewer flooding. There is also some risk of flooding from groundwater, reservoirs and canals.

Risk Management Authorities (RMAs) work together to help reduce the risk of flooding across the River Basin District and to help communities respond and recover during and after flooding.

Risks of flooding from different sources are managed by different Risk Management Authorities. Further information is available at Flood and coastal erosion: Risk Management Authorities.

## River flood risk

River flooding occurs when the volume of water in a river channel is too great to be contained and it overspills on to surrounding land. This is often a result of prolonged or heavy rainfall, where waterlogging of the surrounding land prevents rainfall from draining into the ground. The risk and consequence of flooding from rivers is influenced by a range of factors including:

1. The topography of the surrounding land.
2. The permeability of the underlying geology.
3. The proximity of communities to natural flood plains.

The English portion of the Dee RBD has mainly broad meandering slower flowing rivers on lowland plains closer to the coast. Floodplains are generally wide, with flooding affecting large areas of agricultural land and urban areas including Chester. The inflows into the river Dee are regulated in Wales by several reservoirs for water supply. The River Dee at Chester responds slowly to heavy rainfall, taking up to 3 or 4 days to peak following a rainfall event.

Tidal river flooding can also be a significant source of flooding in the English portion of the Dee RBD. 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.

Over time the rivers have been modified to serve a variety of purposes, including:

- reservoir dams for flood storage
- weirs for power supply or navigation
- realignment, river walls, bridges and land raising for industrial or housing development
- flood plain drainage and realignment to improve agriculture

Managing the risk of flooding from rivers can involve a variety of different actives, including:

- estimating the level of flood risk on the river network both now and into the future
- supporting businesses and communities to understand the risk the face, to be prepared to respond to and recover from flooding
- providing a flood warning service to alert people that flooding could occur
- keeping river channels free from obstructions
- planning, designing and constructing works with communities to reduce the risk of flooding
- operating, inspecting, maintaining and repairing flood risk management assets
- advising planning authorities and developers on the siting and nature of development

Flood risk from rivers is estimated by the Environment Agency using computer models that are calibrated and validated using locally collected rainfall, river level and river flow data. These models are also used to predict how this risk could increase because of climate change. This information is used not only to inform Flood and Coastal Erosion Risk Management (FCRM) investment and activity but also to inform the public, businesses, developers and planning authorities. 87% of the main river network in the northwest of England has been modelled, 5676km, 21% of which has been updated since 2015.

The Environment Agency works with Natural Resources Wales to manage flood risk in the Dee RBD. We do take different approaches, but we share data and regularly liaise on the planning and delivery of FRM services to ensure that flood risk is managed appropriately. For example, we work together to forecast and warn for floods as they pass through the catchment.

The Environment Agency works with RMAs to plan and undertake activities that increase the resilience of communities to flooding. These activities include helping communities to respond to and recover from flooding.

The Environment Agency operate a Flood Warning Service to alert and warn communities at risk of flooding when there is an increased likelihood of this happening. The warnings

are informed by river level forecasts based on computer models and real time of rainfall and river level measurements. There are 8 flood warning areas in the English portion of the Dee RBD that enable specific warnings to be provided to properties at risk of flooding. Public awareness campaigns are run regularly to promote the flood warning service to increase the uptake by people and businesses. In the northwest of England the average uptake is 72%. More generic flood alerts are also issued that cover all locations at risk of flooding.

Rivers in the northwest take many forms ranging from a fully natural state through to being heavily modified through the construction of river channel assets. These include river walls, weirs and culverts amongst others. Natural processes that see the transportation and deposition of sediment within the channel that can have implications for flood risk. Similarly, the growth of vegetation in and adjacent to the river channel can obstruct flows or provide materials that contribute to the formation blockages downstream. In urban areas other materials, for example shopping trolley and garden waste, can also contribute to such blockage risks.

The northwest of England has over 3,000 culverts on main river alone. These can be particularly susceptible to blockage and are often fitted with debris screens to prevent woody debris and other detritus being washed into the culvert. These screens are cleared periodically and in advance and during high flow events. Significant resources are needed to clear blockages during flooding incidents. Where culverts are no longer required the Environment Agency liaise with land owners and Local Planning Authorities to seek their removal.

The Environment Agency undertake routine river channel inspection and vegetation management activities, prioritised on locations with the greatest susceptibility to flooding from this. Periodic sustainable maintenance activity can also be undertaken by RMAs to manage river shoals or siltation where there are flood risk implications. RMAs will also work with owners of river channel assets in poor condition that will increase flood risk if they fail, to remedy the situation.

The Environment Agency is an accredited asset management organisation and considers assets over their whole life from their inception through to their decommissioning or demolition.

New flood risk management works on rivers are delivered by the RMAs in line with government policy and funding criteria. They can take many forms ranging from flood defence walls or embankments to river pumping stations or upstream flood storage.

Many thousands of properties in the northwest of England benefit from existing flood risk management schemes. These include the river Dee embankments and the Finchett’s Gutter flood storage reservoir which reduce the flood risk to the Sealand area of Chester.

Staggs Brook culvert in Whitchurch was refurbished in 2019 benefitting 35 properties. Flood risk management assets are regularly inspected and maintained. Defects identified

are repaired and any more significant issues could lead to assets being replacement or upgrade.

The Environment Agency and LLFAs provide advice to Local Planning Authorities (LPAs) about proposed development within areas considered to be at risk of flooding. The Environment Agency responded to over 1100 planning applications in the northwest of England during the year. The Environment Agency and LLFAs also work closely with combined authorities and LPAs to ensure flood risk is properly accounted for in their long-term strategic plans for the area.

## Coastal and tidal flood risk and Coastal Erosion Risk

The English portion of the Dee RBD has 7.3 km of coastline, along the Wirral Peninsula. This is generally low-lying with vast intertidal mudflats, with some wide sandy beaches and lengths of boulder clay cliffs.

Communities on the Wirral can be at risk of flooding, particularly when high tides coincide with large waves and a storm surge.

Because of a generally soft sedimentary coast and a large tidal range of around 10 metres the coastline is highly dynamic. This is illustrated by the constant moving and reshaping of the tidal flats and channels in the estuary and the erosion of unprotected cliffs.

There are many people and properties behind sea and tidal defences, which reduce the risk of them being affected by flooding. Defences can be over topped by an extreme flood event or failure. Such events could pose a major hazard to people and property due to possible sudden inundation. To guard against this, defences are regularly inspected and maintained and replaced when they can no longer provide the necessary protection.

In December 2013 West Kirby suffered from tidal flooding. A flood risk management scheme to upgrade existing defences is due to be delivered soon that will protect some 70 properties in the town.

The Environment Agency has a Strategic Overview of the coast 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 flooding from the sea and coastal erosion.

Coastal and tidal flood risk and coastal erosion is managed via the North West Shoreline Management Plan published in 2010 (SMP2). This provides a broad scale assessment of the risk associated with coastal processes to people and the developed, historic and natural environment. It also provides a policy framework for managing these risks in a sustainable manner into the future. The implementation of the plan is overseen by the North West Coastal Group. This group is made up of Risk Management Authorities with powers for coast protection or flood risk. It includes the Environment Agency and relevant Lead Local Flood Authorities.

Some of the River Basin District measures included in this Flood Risk Management Plan (FRMP) reflect actions in the SMP2. The SMP measures included in this FRMP are those that are most relevant to flooding from the sea.

## Surface water flood risk

Surface water flooding can occur anywhere across the Dee river Basin District. It can occur suddenly within minutes of intense rain and affect small, localised areas. It can have several contributory factors which include:

- storm intensity and duration
- ground topography, permeability and saturation
- inadequacy of drainage systems including insufficient capacity, damage or blockage
- high river levels that impede drainage into them

Forecasting surface water flooding is difficult, particularly in summer months when dynamic thunderstorm conditions arise.

Surface water flood risk is extensive in the lower Dee catchments upstream of Aldford that affect mainly farmland. Areas in Chester, Neston and West Kirby are also considered to be at risk.

Managing surface water flood risk for new development plays a key role in managing the risks of surface water flooding. Lead Local Flood Authorities (LLFAs) provide local planning authorities with comments on surface water management for new development. Many LLFAs have developed specific strategies to manage surface water flood risk, and further information is available on the Flood Hub.

In the long-term, Sustainable Drainage Systems (SuDS) may relieve some pressures, and local councils encourage the use of sustainable drainage in new developments. SuDS are usually above ground and can limit site run-off and filter out some silt and contaminants. Discharge of surface water to sewer is generally only acceptable if preferable approaches such as infiltration, attenuation or discharge to watercourse are impractical.

## Groundwater and sewer flood risk

Groundwater is naturally stored in the ground below the water table level. Where the water table reaches ground level, water starts to emerge onto the surface and flooding can happen. Once on the surface this groundwater may flow or pond. Groundwater flooding is closely linked to ground conditions and is not as widespread an issue in the Dee RBD as it is in other parts of England.

Sewers can flood because of hydraulic incapacity, that is sewers are not big enough for the flows that now enter them. They can also flood from other causes including sewer collapse, sewer blockage, loss of power supply to a pumping station, or a failure of mechanical or electrical plant.

To help minimise sewer flood risk Welsh Water undertake substantial programmes of sewer improvement works, maintenance activities, property level flood protection and raising public awareness. They also take action to mitigate damage during sewer flooding incidents and are involved in recovery work so that communities can return to normality.

Groundwater and sewer flooding has occurred in some areas of the Dee RBD and caused road flooding and some property flooding. These are localised issues and flood risk from these sources is low at the RBD scale.

## Canal flood risk

The Shropshire Union Canal passes through Chester in the north and the Llangollen Canal passes through Whitchurch and near Weston Rhyn in the south part of the RBD. Both canals are owned, maintained and operated by the Canal and River Trust.

Reservoirs supply water to canals at intervals along their length to compensate for minor water losses from leakage, evaporation and the operation of canal locks. Surface water run-off from areas near to canals also drains into them. Overflow weirs at intervals along canal banks maintain a constant water level and these outfall into watercourses passing nearby or underneath.

Canals can alleviate flood risk due to the large storage volume represented by a small level increase along several kilometres of waterbody. They can also move water artificially within or between a catchment and delay the timing of flood peaks.

However, canals constitute linear impoundments of significant bodies of water between locks and temporary closure points. Flood risk can arise if a canal embankment, that is above the level of nearby property, breaches or a culvert beneath the canal collapses.

Flooding can also arise when high inflow from tributary watercourses exceeds the capacity of the canal or navigable waterway and water overspills the banks. The nature of canal flooding, although relatively rare, means that it can be serious and happens without warning.

The Canal and River Trust is not a designated Risk Management Authority within the Flood and Water Management Act, 2010. They do have responsibilities for managing their infrastructure to minimise risk to others, including during incidents.

## Reservoir flood risk

The River Dee is highly regulated by controlled releases from reservoirs in the upper catchment. The main reservoirs in the RBD are:

1. Bala (Llyn Tegid).
2. Llyn Celyn.
3. Llyn Brenig.
4. Alwen reservoir.

These reservoirs are all in Wales. However downstream areas within the English section of the RBD could be flooded if a large reservoir were to fail.

Few catastrophic reservoir failures have occurred in the UK and there has been no loss of life due to dam disasters here since 1925.

Nearby communities located downstream of a reservoir benefit from the delay and attenuation of storm flows as they pass through the reservoir. In recent years consideration has been given to understanding the potential viability of increasing the storage capacity of some reservoirs to increase this benefit. Using reservoirs for more than a single purpose, however, creates several complex issues. The Environment Agency is working to resolve these with other responsible national organisations and reservoir owners and operators.

## Land management and flooding

How our land is managed is important to the sustainable management of flood risk as it increases as a result of climate change. The Environment Agency, LLFAs and other RMAs work with Local Planning Authorities (LPAs) to influence their strategic development plans so they fully account for flood risk. We engage with property and landowners to help them improve their resilience to flooding and contribute to the resilience of their communities. This can include the reduction of impermeable surfaces and the introduction of vegetated buffer strips adjacent to watercourses to trap soil runoff.

The Environment Agency work with LLFAs, Local Flood Partnerships, Rivers Trusts and community groups to reduce flood risk by using Natural Flood Management (NFM) techniques. The aim of these techniques is to reduce, slow and store runoff, particularly in minor watercourses and upper catchments to reduce the risk of downstream flooding. The techniques include:

- soft-stopping small channels with large woody debris to slow the flow
- creating space for a river to adopt a more natural channel profile with increased flood capacity

- tree or bankside vegetation planting, which can reduce erosion and downstream sedimentation risk

NFM approaches are typically easy and cost-effective to install and maintain and can bring additional benefit to water quality and biodiversity. NFM can help address the increased risk from climate change as well as form an important component of major Flood Risk Management (FRM) schemes.

In recent years at Tattenhall the Environment Agency has reconnected the natural flood plain on Keys Brook. It is continuing to work with Mersey Rivers Trust to deliver further NFM measures and environmental improvements here.

## Managing flood risk in rural areas

Rural areas face specific challenges in relation to flood risk management. Agriculture and horticulture are economically significant land uses that are vulnerable to extreme weather and climate change. Significant flooding, particularly on land used for arable farming and horticulture can have potential to affect food production.

Investment in flood risk management is prioritised according to government policy, the 'National Flood and Coastal Erosion Risk Management Strategy' (FCERM) and HM Treasury Green Book on economic appraisal.

Flood and Coastal Risk Management (FCRM) Resources are currently targeted where flood risk to people and property is highest. In rural areas where the flood hazard to people and flood damage to property is low the Environment Agency may reduce its flood risk management activities on some watercourses. The Environment Agency is in contact with affected landowners about this, to look at the options and strike the right balance.

The Government are introducing Environmental Land Management Schemes to support the rural economy. These are aimed at achieving the goals of the '25 Year Environment Plan' and a commitment to net zero emissions by 2050. The Environment Agency are working with other organisation to understand how such support can be used to complement FCRM activity, such as NFM techniques. The Environment Agency will continue to work with farmers and other land managers maximise the flood risk benefit of this opportunity.

## Managing flood risk in urban areas

Development in larger settlements has resulted in many man-made structures affecting the river environment, including river channel retaining walls, weirs and culverts. These structures are as prevalent in towns and suburbs including Chester.

Effective flood risk management requires the holistic management of culverted systems. However, culverts and other assets within a system may have multiple owners and the existence and location of culverted watercourses is not always known. This can present serious challenges for new development or if collapses and blockages occur.

Risk Management Authorities work to both reduce current day flood risk and meet future challenges of increasing risk due to climate change.

The Environment Agency encourages Local Planning Authorities to adopt a Green Infrastructure approach in the context of planning for flood risk. It should be planned and managed in a similar way to critical infrastructure. It should set out the climate change adaptation response that builds a community's overall resilience to climate change. A Green Infrastructure strategy, as with other approaches to natural flood risk management, should be developed with consideration of broad scale ecological connectivity.

Sustainable Drainage Systems (SuDS) form a significant aspect of this. These are typically swales, ditches or ponds that temporarily store water that either infiltrates the ground or is subsequently released at an acceptable rate into the drainage system. These water environments can make a significant improvement to the local environment and public amenity. They can also be formed of buried tanks located for example under car parks.

## History of flooding

This section of the FRMP provides a summary of significant flood events and their consequences since the first cycle FRMP in 2015. Significant is defined as an event which affected more than 20 residential properties. The first cycle FRMP for the Dee (English Catchments) RBD contains information on historic flood events and their consequences before this date.

More detailed information on why flood records and evidence are important and how they are used is in Part A National Overview of Flood Risk Management in England for second cycle FRMPs. In the Dee RBD there have been few floods between 2015 and 2021. The only significant flooding within the RBD occurred in January 2021 because of Storm Christoph.

**Table 1: Historical flood events from all sources since 2015. Number of properties rounded to the nearest 10**

| Date of flood | Location and approximate number of properties affected shown in brackets | Source of flood water |
|---|---|---|
| **January 2021** | Tattenhall (20), Farndon (10) | main river, surface water |

# Climate change and the Dee RBD

This section sets out what we know are likely to be the implications of climate change in the Dee RBD. We use allowances for different climate scenarios over different periods of time, over the coming century.

A percentile describes the proportion of possible scenarios that fall below an allowance level. The:

- central allowance is based on the 50th percentile
- higher central allowance is based on the 70th percentile
- upper end allowance is based on the 95th percentile

An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it's exceeded by 30%. At the 95th percentile it's exceeded by 5%. The 'H++' allowance is an extreme climate change scenario which applies up to the year 2100 for sea level rise.

## Coastal flood risk

As sea levels rise, it means coastal flooding will become more frequent. This is because higher water levels will be seen more often. Predicting coastal flooding is complicated because it's a combination of:

- a still water level
- a surge component
- wave conditions

Future changes in sea levels are primarily accounted for by increases to the mean sea level. Changes in storminess and wave conditions are not as well understood or are not likely to change significantly. Future changes in wave conditions are thought to be heavily variable by geographical area and are an area of further research. Table 2 sets out how we expect mean sea levels to rise along the coastline by 2125. As the Dee RBD does not have its own sea level rise allowances, the North West RBD allowances are applied.

**Table 2: Cumulative mean sea level rises between 2000 and 2125 (metres) for the North West River Basin District***

| Allowance | Sea level rise |
|---|---|
| Extreme (H++) | 1.90m** |
| Upper end | 1.41m |
| Higher central | 1.01m |

* Data source: flood risk assessments: climate change allowances

** This applies up to the year 2100.

## Fluvial (river) flood risk

Rainfall intensity is expected to increase in the future, which will cause river flows to increase. Flood risk assessments: climate change allowances sets out how much we expect peak river flows might increase by 2125 for management catchments. A 'Management Catchment' is a designated river catchment designated under the Water Framework Directive (The Water Environment (Water Framework Directive) Regulations 2017); this subdivides river catchment areas for easier management within the River Basin District.

As river flows increase, it means that fluvial flooding will become more frequent. This is because higher river flows will be seen more often.

The Dee RBD is covered by one management catchment and therefore the same climate change increases apply across the RBD.

## Surface water flood risk

In winter, more rainfall and wet days are projected. In summer less rainfall and fewer wet days are projected. For all seasons, rainfall intensity is projected to increase.

Intense rainfall can cause surface water flooding, particularly when the ground is already wet or following a prolonged dry spell. This is when clay soils can form an impermeable crust. As rainfall intensity increases, it means that surface water flooding will become more frequent, because higher rainfall totals will be seen more often.

Flood risk assessments: climate change allowances set out how much we expect rainfall intensity might increase by 2125 for management catchments in the RBD.

## How our understanding of the impact of climate change on flood risk might change

Our climate changes naturally over time, alongside human influence since the industrial revolution, due to the emission of greenhouse gases. As well as climate change, there are other factors that can affect how severe a flood is. This includes how wet the ground already is when heavy rain starts to fall. This means that it's difficult to be sure about how much more likely a certain size of flood will be in the future.

Traditional methods used to estimate the likelihood and size of floods assume stationarity of extreme events. This means that flooding in the past is assumed to represent the behaviour of future flooding.

Due to recent large-scale flood events on our rivers and coasts, many hydrologists are now considering non-stationarity. This recognises statistically significant changes over time.

We're working with universities to actively research what this might mean for future increases in flood risk. This means that our understanding of how likely extreme floods will be in the future, and what contributes to this, is likely to change.

More information on climate change considerations in the FRMPs is in 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans'.

# Progress review of implementing the first cycle FRMP

This section assesses the achievements and what has happened across the Dee River Basin District (RBD) since the first cycle Flood Risk Management Plan (FRMP) was produced in 2015. It describes how the first cycle FRMP was reviewed.

It reports on the status of the measures and a summary of progress made towards achieving the objectives in the first cycle FRMPs. It gives reasons if progress has not been made.

## How we assessed progress

The Flood Risk Regulations 2009 (FRR) require that the Environment Agency and Lead Local Flood Authorities (LLFAs) review the first cycle FRMP. The FRRs state that this review must:

- include an assessment of the progress made towards implementing the measures
- include a statement of the reasons why any measures proposed in the previous flood risk management plan have not been implemented

The Environment Agency and LLFAs followed these steps to complete the review within the Dee RBD:

1. The status of each measure was reviewed and assigned an implementation status as of 31 March 2021.
2. For measures assigned an implementation status of not started or superseded reasons were given why they have not been progressed.
3. Additional measures were identified that have been implemented since 2015 which have made a material difference to achieving the first cycle FRMP objectives.
4. Assessed how well the measures have contributed towards achieving the first cycle FRMP objectives.

The review of first cycle FRMPs is presented in this section by:

- summary statistics to show an overview of measure implementation
- a selection of case studies to demonstrate what has been achieved since 2015
- a summary of additional measures implemented since 2015
- an overview of how well first cycle FRMP objectives have been met

## Summary of progress of implementing the measures since 2015

Table 3Table 3 shows a summary of the implementation status of all the measures in the Dee RBD since 2015, as of 31 March 2021. Chart 1 also shows this in more detail.

**Table 3: Implementation status of measures for the Dee RBD**

| Progress | Number of measures |
|---|---|
| **Ongoing** | 21 |
| **Ongoing construction** | 0 |
| **Completed** | 1 |
| **Superseded** | 0 |
| **Not started - proposed** | 0 |
| **Not started - agreed** | 0 |

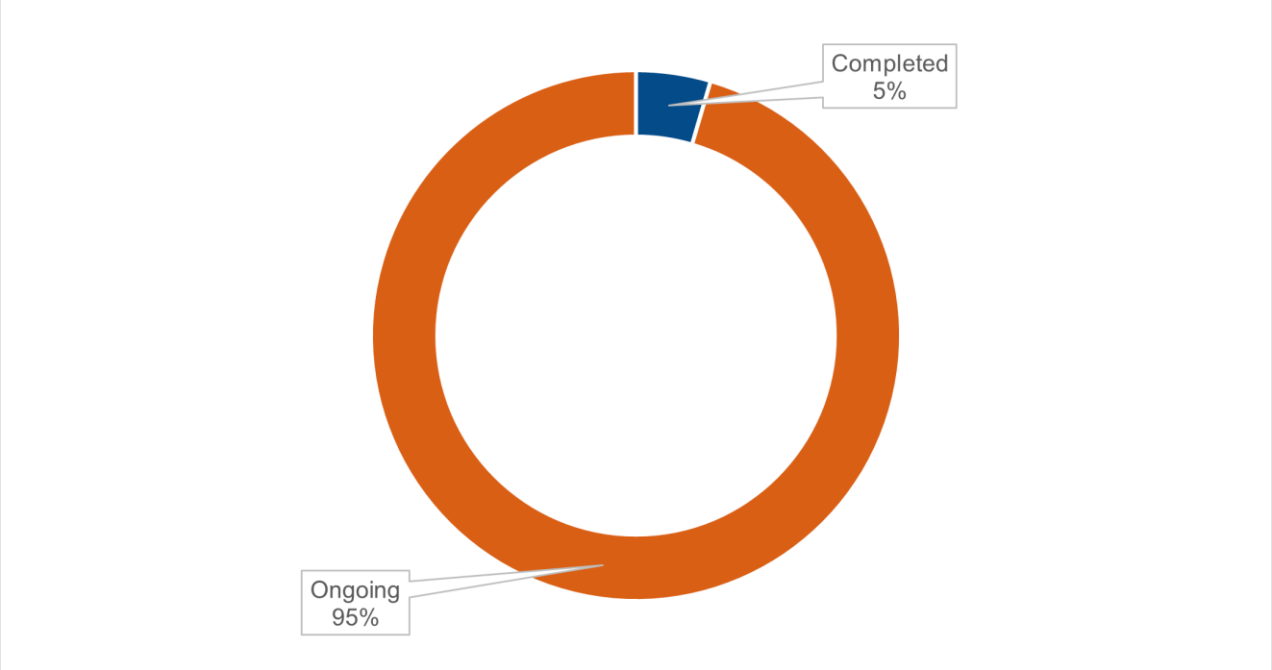


**Chart 1: Implementation status of measures for the Dee RBD**

Chart 1 entitled ‘Implementation status of measures for the Dee RBD’ shows the proportion of measures by implementation status. It shows that 5% of the measures

published in the first cycle FRMP have been completed. This equates to a single measure. None of the measures are ongoing in construction.

The remaining 95% of the measures are ongoing. These measures include day to day activities which have been carried out by risk management authorities in 2015-2021.

These measures have contributed towards achieving the objectives of the first cycle FRMP and almost half have made a substantial contribution. These ongoing activities will be continuing in the period 2021-2027 and have been included in the national level & River Basin District Wide Measures. These measures can be found in the interactive mapping tool – Flood Plan Explorer.

## How these measures were implemented and the main outcomes achieved

The Flood Risk Regulations (FRR) state that the FRMP must include measures relating to the following areas:

- prevention of flooding
- the protection of individuals, communities, and the environment against the consequences of flooding
- arrangements for forecasting and warning

In order to meet the requirements of the FRR, measures included in the first cycle FRMP were grouped into themed approaches:

- preventing flooding
- protecting against flooding
- preparing for flooding
- recovery and review following flooding

### Prevention of flooding

4.8% of ongoing measures have contributed to the prevention of flooding. For example, there was a measure to produce local community flood plans for key communities and then identify and undertake further actions to help prevent flooding.

One of these actions resulted in the Environment Agency undertaking work to reconnect the natural flood plain on Mill Brook, Tattenhall in 2016. Working with the Tattenhall Wildlife Group it also built 2 leaky dams to slow the flow. These works have helped prevent flooding by reducing the downstream flood risk. They also created 1.5ha of priority reedbed and wet grassland habitats.

**Figure 3: Mill Brook, Tattenhall before (left) and after construction (right)**

## Protection from flooding

100% of completed measures and 19% of ongoing measures have helped to protect individuals, communities, and the environment against the consequences of flooding. For example, in Chester there was a measure to improve the Dee Locks gates at the Shropshire union Canal and bring it in line with adjacent flood embankments.

**Figure 4: Demountable flood barrier at Dee Locks, Chester**

This measure was delivered by the Dee Locks Flood Risk Management Scheme.

This scheme was carried out in partnership with the Canal and River Trust and Cheshire West and Chester. It addressed a gap in the River Dee tidal flood defences around Dee Lock, where the Shropshire Union canal connects to the River Dee. As water levels rose in the river water would overtop the canal lock gates and flow into the Dee Lock basin. Some 95 properties were at risk during a flood event with a 0.5% chance of happening in any one year.

The scheme was designed to reduce flood risk to these properties and maintain boat access through Dee Lock. A demountable defence was put in place.

Special stop logs were formed to bridge the gap and allow easy and safe deployment. In advance of forecast flood events the stop logs are inserted to form a continual defence. Due to the size and weight of the stop logs, a third-party contractor undertakes removal which involves a full lane closure of on Sealand Road.

One occasion when the stop logs were used was prior to the September 2017 high tides.

## Preparing for and recovering from flooding

76% of ongoing measures have helped to prepare people for flooding. For example, The Flood Hub has been developed and launched to help people prepare for and recover from flooding.

It is a dedicated website which supports our communities to manage flood and coastal risk. It was developed by Newground on behalf of the North West RFCC and the Risk Management Authorities. It has been designed to be a one stop shop for flood information and resources to support householders, businesses and communities in becoming more flood resilient. It pulls together multiple sources of guidance to produce a hub of information that gives an overview of flood resilience and its many related topics.

In the last year, the Flood Hub has been visited over 115,000 times by some 42,500 users, who downloaded almost 10,000 resources. It provides an invaluable facility to support our community engagement work and direct members of the public to who want to learn more about flooding.

The Knowledge Hub contains a variety of downloadable flood risk information and guidance document. The Your Local Area pages provide information on community groups, flood works and events on an easy to use interactive map. The Flood Risk Management Scheme pages is where Risk Management Authorities can share up-to-date information and progress reports on proposed and ongoing flood schemes.

## Ongoing measures that have contributed to managing flood risk

In addition to the completed measures, the first cycle FRMP also included ongoing measures that reflect the day-to-day activities undertaken by RMAs which contribute to managing flood risk. These measures have continued throughout the period 2015-21. For example:

- RMAs have operated and maintained flood risk assets to help protect individuals, communities, and the environment
- the Environment Agency issued flood warnings between 2015 and 2021, which warned and informed the public of the risk of flooding

Also, day to day activities carried out in 2015-2021 that have contributed to preventing flooding include:

- flood risk activity permits
- consultee in the planning process
- modelling programme
- publishing of updates to flood risk mapping
- monitoring of the Northwest Regional Coastal Monitoring Programme
- repairing and refurbishing flood risk management assets
- routine maintenance of flood risk management assets
- reservoir management and regulation
- capital schemes
- incident response including:
- monitoring and operating defences
- erecting demountable and temporary barriers
- clearing debris from watercourses to allow water to flow freely

Day to day activities carried out in 2015-2021 that have helped people to prepare for flooding include:

- maintenance and improvement of river recording gauges used to warn and inform
- improvements to flood forecasting
- continued maintenance and improvement of the Environment Agency's flood warning service
- monitoring rainfall and river levels during flood events to inform partners' emergency response decision making
- issuing forecasts and warnings for river flooding to many thousands of people including during winter floods of 2015/16 and 2019/20
- working with partners to provide media and stakeholder briefings during flood events to keep the public informed

In addition to the measures in the first cycle FRMP, the following day to day activities carried out in 2015-2021 have aided communities to recover from flooding:

- capital investment projects to repair flood risk management assets damaged during flooding
- Environment Agency staff have visited communities during flooding
- RMAs work together to hold site visits and drop in events with communities and businesses affected by flooding
- RMAs work together during and after flooding to help communities recover
- RMAs work together to review flooding incidents to help further improve our response

All RMAs will continue to carry out day to day activities to manage the risk of flooding during the second cycle FRMP period 2021-2027.

## Additional measures implemented since 2015

No formal additional measures were identified for the English catchments of the Dee RBD over the first cycle FRMPs plan period. However, ongoing activities undertaken by RMAs between 2015 and 2021 have helped to further reduce flood risk to residential properties. For example, Cheshire West undertook measures to reduce the risk of flooding from surface water in various rural locations across Cheshire. Improve capacity of surface water drainage and re-routed flows.

## How well these measures have achieved the first cycle FRMPs objectives

The FRR require the FRMP to include details of objectives for the purpose of managing flood risk and measures to set out how the objectives will be achieved. The first cycle FRMPs objectives were grouped into categories: social, economic, and environmental. Information on these objectives for the Dee River Basin District FRMP1 can be found in Part B of the FRMP1.

Overall, the measures included in the first cycle FRMPs have successfully achieved the objectives set out across all of categories, delivering improvements to the social, economic and environmental well-being of the Dee River Basin district. The completed measure has contributed to achieving the objective in both the social and economic categories. Outcomes delivered by on-going measures have contributed towards achieving both these and the environment category.

The completed measure of constructing defences at Dee Locks in Chester has reduced the risk of flooding to a community of 95 properties and improved the social and economic resilience to flooding. Through delivering these works we were also able to raise wider community awareness of flood risk and agree a sustainable incident response between different RMAs and other stakeholders.

The completed measure didn't contribute to achieving environmental objectives. Other on-going measures and other work undertaken as part of our routine activities have enabled the environmental objectives to be met. For example, the work undertaken at Tattenhall to reconnect the floodplain of Mill Brook has created valuable water habitat improving the local biodiversity and river ecology.

In addition to the completed measures, ongoing measures that reflect day to day activities undertaken by RMAs in the period 2015-2021 have contributed to achieving the first cycle FRMPs objectives. For example:

1. Developing, reviewing and updating local community flood response plans at several places in Cheshire, Shropshire and on the Wirral.
2. Maintaining the multi-agency response flood plans that cover the English Dee.
3. Encourage our partners to develop and maintain a long-term investment plan to manage all sources of flood risk in Chester.

4. Encourage owners and operators of stormwater pumping stations and associate infrastructure to develop and implement a plan improve their flood resilience as appropriate.

These activities will continue to be carried out during the second cycle FRMP period 2021-2027.

# Second cycle summary of flood risk for the Dee RBD

This section shows a summary of flood risk in the RBD from:

- Rivers and sea
- Surface water

The data in tables 4 to 9 has been calculated from data available in December 2019. This data considers the presence and condition of defences. The risk is presented in flood risk likelihood categories. These indicate the chance of flooding in any given year:

- high risk means that each year an area has a chance of flooding of greater than 3.3%
- medium risk means that each year an area has a chance of flooding between 1% and 3.3%
- low risk means that each year an area has a chance of flooding of between 0.1% and 1%
- very low risk means that each year an area has a chance of flooding of less than 0.1%

Table 4 summarises the risk of flooding from rivers and sea to people in the RBD.

**Table 4: Summary of river and sea flood risk to people in the Dee RBD**

| Risk to people | Total in RBD | High risk | Medium risk | Low risk | Very low risk |
|---|---|---|---|---|---|
| Number of people in RBD | 163,205 | 168 | 367 | 1,780 | 768 |
| Number of services | 1,038 | 9 | 6 | 42 | 5 |

There are 163,205 people in the RBD. Of these:

- 1.9% are in areas at risk of flooding from rivers and the sea
- 0.1% are in areas at high risk of flooding

There are 1,038 services in the RBD. Of these:

- 6% are in areas at risk of flooding from rivers and the sea
- 0.9% are in areas at high risk

Table 5 summarises the risk of flooding from rivers and the sea to the economic activity in the RBD.

**Table 5: Summary of river and sea flood risk to economic activity in the Dee RBD**

| Risk to economic activity | Total in RBD | High risk | Medium risk | Low risk | Very low risk |
|---|---|---|---|---|---|
| Number of non-residential properties | 5,669 | 13 | 53 | 271 | 6 |
| Number of airports | 0 | 0 | 0 | 0 | 0 |
| Length of road (kilometres (km)) | 108 | <1 | 2 | <1 | <1 |
| Length of railway (km) | 43 | <1 | <1 | <1 | <1 |
| Agricultural land (hectares (ha)) | 33,166 | 918 | 750 | 275 | 44 |

There are 5,669 non-residential properties in the RBD. Of these:

- 6% are in areas at risk of flooding from rivers and the sea
- 0.2% are in areas at high risk of flooding

There are no airports in the RBD.

There are 108 km of roads in the RBD. Of these:

- 2.5% are in areas at risk of flooding from rivers and the sea
- 0.3% are in areas at high risk of flooding

There are 43 km of railways in the RBD. Of these:

- 2% are in areas at risk of flooding from rivers and the sea
- 0.5% are in areas at high risk of flooding

There are 33,166 hectares of agricultural land in the RBD. Of these:

- 6% are in areas at risk of flooding from rivers and the sea
- 2.8% are in areas at high risk of flooding

Table 6 summarises the risk of flooding from rivers and the sea to the natural and historic environment in the RBD.

**Table 6: Summary of river and sea flood risk to the natural and historic environment in the Dee RBD**

| Risk to the natural and historic environment | Total in RBD | High risk | Medium risk | Low risk | Very low risk |
|---|---|---|---|---|---|
| Number of EU designated bathing waters within 50 metres (m) | 0 | 0 | 0 | 0 | 0 |
| Number of Environmental Permitting Regulations (EPR) installations within 50m | 8 | 0 | 0 | 1 | 0 |
| Area of Special Area of Conservation (SAC) within area (ha) | 6,101 | 1,822 | 3 | 2 | <1 |
| Area of Special Protection Area (SPA) within area (ha) | 7,159 | 1,687 | <1 | 26 | <1 |
| Area of Ramsar site within area (ha) | 7,169 | 1,688 | <1 | 27 | 2 |
| Area of World Heritage Site within area (ha) | 292 | 11 | 0 | 0 | 0 |
| Area of Site of Special Scientific Interest (SSSI) within area (ha) | 6,479 | 1,946 | 71 | 21 | 2 |
| Area of parks and gardens within area (ha) | 580 | 89 | 25 | 10 | <1 |
| Area of scheduled ancient monument within area (ha) | 140 | <1 | 5 | <1 | <1 |
| Number of listed buildings within area | 1,666 | 15 | 32 | 15 | 0 |
| Number of licensed water abstractions within the area | 60 | 8 | 3 | 2 | 1 |

It should be noted that some of the environmentally designated sites at risk within the RBD are reliant to some degree on flooding. It is needed to maintain their interest features.

There are no EU designated bathing waters in this RBD.

There are 8 Environmental Permitting Regulations (EPR) installations in the RBD. Of these:

- 12.5% are in areas at risk of river and sea flooding
- 0% are in areas at high risk of flooding

There are 6,101 hectares of Special Area of Conservation (SAC) in the RBD. Of these:

- 30% are in areas at risk of flooding from rivers and the sea
- 30% are in areas at high risk of flooding

There are 7,159 hectares of Special Protection Area (SPA) in the RBD. Of these:

- 24% are in areas at risk of flooding from rivers and the sea
- 24% are in areas at high risk of flooding

There are 7,169 hectares of Ramsar sites in the RBD. Of these:

- 24% are in areas at risk of flooding from rivers and the sea
- 24% are in areas at high risk of flooding

There are 292 hectares of World Heritage Site in the RBD. Of these:

- 3.6% are in areas at risk of flooding from rivers and the sea
- 3.6% are in areas at high risk of flooding

There are 6,479 hectares of Site of Special Scientific Interest (SSSI) in the RBD. Of these:

- 31.5% are in areas at risk of flooding from rivers and the sea
- 30% are in areas at high risk of flooding

There are 580 hectares of parks and gardens in the RBD. Of these:

- 21.3% are in areas at risk of flooding from rivers and the sea
- 15.3% are in areas at high risk of flooding

There are 140 hectares of scheduled ancient monument in the RBD. Of these:

- 4.2% are in areas at risk of flooding from rivers and the sea
- 0.2% are in areas at high risk of flooding

There are 1,666 listed buildings in the RBD. Of these:

- 3.7% are in areas at risk of flooding from rivers and the sea
- 0.9% are in areas at high risk of flooding

There are 60 licensed water abstractions in the RBD. Of these:

- 23.3% are in areas at risk of flooding from rivers and the sea
- 13.3% are in areas at high risk of flooding

Table 7 summarises the risk of flooding from surface water to people in the RBD.

**Table 7: Summary of surface water flood risk to people in the Dee RBD**

| Risk to people | Total in RBD | High risk | Medium risk | Low risk |
|---|---|---|---|---|
| Number of people in RBD | 163,205 | 531 | 1,524 | 8,824 |
| Number of services | 1,038 | 8 | 4 | 56 |

Of the 163,205 people in the RBD:

- 6.7% are in areas at risk of flooding from surface water
- 0.3% are in areas at high risk of flooding

Of the 1,038 services in the RBD:

- 6.6% are in areas at risk of flooding from surface water
- 0.8% are in areas at high risk

Table 8 summarises the risk of flooding from surface water to economic activity in the RBD.

**Table 8: Summary of surface water flood risk to economic activity in the Dee RBD**

| Risk to economic activity | Total in RBD | High risk | Medium risk | Low risk |
|---|---|---|---|---|
| Number of non-residential properties | 5,669 | 34 | 50 | 430 |
| Number of airports | 0 | 0 | 0 | 0 |
| Length of road (kilometres (km)) | 108 | 3 | 3 | 13 |
| Length of railway (km) | 43 | 4 | 6 | 8 |
| Agricultural land (hectares (ha)) | 33,166 | 611 | 417 | 1,644 |

Of the 5,669 non-residential properties in the RBD:

- 9% are in areas at risk of flooding from surface water
- 0.6% are in areas at high risk of flooding

The are no airports in the RBD.

Of the 108 km of roads in the RBD:

- 18% are in areas at risk of flooding from surface water

- 3% are in areas at high risk of flooding

Of the 43 km of railways in the RBD:

- 44.5% are in areas at risk of flooding from surface water
- 9.8% are in areas at high risk of flooding

Of the 33,166 hectares of agricultural land in the RBD:

- 8% are in areas at risk of flooding from surface water
- 1.8% are in areas at high risk of flooding

Table 9 summarises the risk of flooding from surface water to the natural and historic environment in the RBD.

**Table 9: Summary of surface water flood risk to the natural and historic environment in the Dee RBD**

| Risk to the natural and historic environment | Total in RBD | High risk | Medium risk | Low risk |
|---|---|---|---|---|
| Number of EU designated bathing waters within 50 metres (m) | 0 | 0 | 0 | 0 |
| Number of Environmental Permitting Regulations (EPR) installations within 50m | 8 | 0 | 2 | 4 |
| Area of Special Area of Conservation (SAC) within area (ha) | 6,101 | 36 | 19 | 79 |
| Area of Special Protection Area (SPA) within area (ha) | 7,159 | 2 | 7 | 53 |
| Area of Ramsar site within area (ha) | 7,169 | 2 | 7 | 53 |
| Area of World Heritage Site within area (ha) | 292 | 4 | 1 | 5 |
| Area of Site of Special Scientific Interest (SSSI) within area (ha) | 6,479 | 44 | 25 | 102 |
| Area of parks and gardens within area (ha) | 580 | 7 | 7 | 35 |
| Area of scheduled ancient monument within area (ha) | 140 | 2 | 1 | 4 |

| Risk to the natural and historic environment | Total in RBD | High risk | Medium risk | Low risk |
|---|---|---|---|---|
| Number of listed buildings within area | 1,666 | 9 | 9 | 34 |
| Number of licensed water abstractions within the area | 60 | 3 | 3 | 7 |

It should be noted that some of the environmentally designated sites at risk within the RBD are reliant to some degree on flooding. It is needed to maintain their interest features.

There are no EU designated bathing waters in this RBD.

Of the 8 Environmental Permitting Regulations (EPR) installations in the RBD:

- 75% are in areas at risk of surface water flooding
- 0% are in areas at high risk of flooding

Of the 6,101 hectares of Special Area of Conservation (SAC) in the RBD:

- 2.2% are in areas at risk of flooding from surface water
- 0.6% are in areas at high risk of flooding

Of the 7,159 hectares of Special Protection Area (SPA) in the RBD:

- 0.8% are in areas at risk of flooding from surface water
- 0% are in areas at high risk of flooding

Of the 7,169 hectares of Ramsar sites in the RBD:

- 0.8% are in areas at risk of flooding from surface water
- 0% are in areas at high risk of flooding

Of the 292 hectares of World Heritage Site in the RBD:

- 3.5% are in areas at risk of flooding from surface water
- 1.2% are in areas at high risk of flooding

Of the 6,479 hectares of Site of Special Scientific Interest (SSSI) in the RBD:

- 2.6% are in areas at risk of flooding from surface water
- 0.7% are in areas at high risk of flooding

Of the 580 hectares of parks and gardens in the RBD:

- 8.5% are in areas at risk of flooding from surface water
- 1.2% are in areas at high risk of flooding

Of the 140 hectares of scheduled ancient monument in the RBD:

- 5% are in areas at risk of flooding from surface water

- 1.2% are in areas at high risk of flooding

Of the 1,666 listed buildings in the RBD:

- 3.1% are in areas at risk of flooding from surface water
- 17.3% are in areas at high risk of flooding

Of the 60 licensed water abstractions in the RBD:

- 21.7% are in areas at risk of flooding from surface water
- 5% are in areas at high risk of flooding

# Second cycle objectives and measures

A full list of the objectives are in the Part A National Overview of Flood Risk Management in England for second cycle Flood Risk Management Plans (FRMPs).

In developing the FRMP, the Risk Management Authorities (RMAs) have:

- drawn conclusions from the hazard and risk maps and other sources of information - this helps us all to understand the risks or opportunities
- taken account of the likely impact of climate change on the occurrence of floods
- selected appropriate objectives from the national list to reduce the adverse consequences of flooding for human health, economic activity and the environment (including cultural heritage), and reduce the likelihood of flooding
- identified the likely approach (the measures) to achieve these objectives using the categories: preparing**,** preventing**,** protecting and recovery and review

In determining the proposed measures for the FRMP, the RMAs considered several different factors. The main ones are outlined in the Part A National Overview of Flood Risk Management in England for second cycle FRMPs.

Measures that have been included in the second cycle are strategic. The FRMP is not intended to cover all detail of the measure. Further, the level of the detail that is included may vary depending on whether the measure is at the planning or implementation stage. Not all measures have secured funding and so they are not guaranteed to be implemented.

## Finding the second cycle measures

For this second cycle of flood risk management planning, the Environment Agency has developed a new interactive mapping tool called Flood Plan Explorer. You can use flood plan explorer to discover information about all the measures proposed as part of this plan. This information mainly includes:

- where the measure is
- a description of the measure and what it is aiming to achieve
- which objectives the measure will help to achieve
- who is responsible for implementing the measure
- when the measure is planned to be implemented

You can find more information on how to use Flood Plan Explorer within the tool itself. This will be updated with additional instructions over time.

## National level objectives and measures

There are several measures which are applicable to every Flood Risk Area (FRA) in England. The Environment Agency will seek to implement these national-level measures

as part of its routine day to day work as a risk management authority. The Environment Agency is responsible for the national-level measures that apply to every FRA for main rivers and the sea.

Lead Local Flood Authorities (LLFAs) are responsible for the national-level measures that apply to every FRA for surface water. Some of these measures are statutory (the work is required by law) and others are optional. LLFAs implement their day-to-day work in different ways depending on local priorities and resources. You should look at LLFA websites and their local flood risk management strategies for more information on how they carry out their day-to-day work.

You can find information about each of these measures in the interactive mapping tool - Flood Plan Explorer.

## Flood Risk Area objectives and measures

There are no Flood Risk Areas within the English part of the Dee RBD. The Lache FRA is located in North Wales close to the English border in the shared river catchment of the Balderton Brook and wider River Dee. The Environment Agency work together with Natural Resources Wales to manage flood risk in this area. You can find a measure in Flood Plan Explorer that sets out how we will continue to do this over the plan period.

## RBD level objectives and measures

Measures have been developed which apply specifically to the English part of the Dee River Basin District (RBD) or apply to areas within the RBD. These measures have been developed in addition to measures which cover other spatial scales. You can find information about each of these measures in the interactive mapping tool - Flood Plan Explorer.

To set overall objectives for the management of flood risk and to develop a plan to achieve them involved stepping back from day-to-day operations. It also involved considering in what direction flood risk management is headed and what its priorities should be, to determine the approach to take.

The River Basin District measures were developed and refined at a series of workshops by an extended group of practitioners and stakeholders. The workshops were focussed on long-term ambitions as set out in the Flood and Coastal Erosion Risk Management (FCERM) strategy for England, on different themes that reflected the Flood Risk Management Plan (FRMP) Objectives. The themes were:

1. flood resilient places
2. adaptive pathways
3. environmental enhancement
4. growth and development
5. infrastructure resilience
6. ready to respond and recovery

Flood risk within the English Dee River Basin District continues to be from a variety of sources including rivers, the sea, surface water, ordinary watercourses, reservoirs and sewers. The information from the hazard and risk maps was considered by experienced practitioners and recognised experts from different RMAs and stakeholders in the Dee RBD. This consideration also captured their knowledge of the practical challenges that exist within the flood risk management community in the Dee RBD. They concluded that strategy River Basin District measures would be beneficial in directing Flood Risk Management (FRM) activity in the Dee RBD over the next 6 years.

# Links between the FRMP and the draft RBMP

In parallel to flood risk management planning, the Environment Agency works with others to protect and improve the quality of the water environment. It does this through river basin management. The Environment Agency aims to co-ordinate the Flood Risk Management Plans (FRMPs) and the River Basin Management Plans (RBMPs) so that all organisations can do more for the environment. By developing the plans together, ways to achieve objectives for flood and drought risk management, and the water environment including water quality and biodiversity, can be joined together wherever possible.

This is particularly important in order to achieve the main aim of the Water Environment (Water Framework Directive (WFD) England and Wales) Regulations 2017. The main aim of these regulations is to establish a framework for the protection of inland surface waters, estuaries, coastal waters and groundwater. You can find more information about this in the Dee RBMP.

In a consultation in 2019/20, the Environment Agency sought views on the:

- challenges that our waters face
- choices and changes we all need to make to help tackle those challenges

Further information on the responses received can be found in the Challenges and Choices consultation summary report.

The Environment Agency has worked with LLFAs and other RMAs to develop joint measures to reduce flood risk and improve the wider water environment. Aligning measures also helps to simplify the delivery of outcomes and make it more efficient.

By visiting the Dee RBMP, you can find out more information on the objectives and measures for the Dee RBMP.

# How we will monitor implementation of the FRMP

For the duration of the second cycle (2021 to 2027), the Environment Agency will work with Lead Local Flood Authorities (LLFAs) and other Risk Management Authorities (RMAs) to monitor progress in achieving all the measures set out in the Flood Risk Management Plan (FRMP). This is a summary of the steps we will follow:

1. The implementation status of each measure in the FRMP will be reviewed and updated every year. This will be done by the authority responsible for implementing the measure.
2. This updated information will be collated by the Environment Agency and analysed to identify any trends in the data. This will allow the identification of possible common interventions which may help measure delivery.

3. Summary statistics will be produced to show how much progress has been made in that year.
4. These statistics and other key messages will be included in the annual report produced under section 18 of the Flood and Water Management Act (2010). This report is published each year and submitted to the relevant regional flood and coastal committee for review. It will also be available online to the public.
5. The updated status of each measure will also be viewable in flood plan explorer.
6. At the end of the 6 year planning cycle, the FRMP will be reviewed and a summary of implementation progress over the duration of the planning cycle will be included. This is a requirement of the Flood Risk Regulations (2009).

# List of abbreviations

This list of abbreviations is intended as a reference tool. It includes the main abbreviations and terms used in the second cycle flood risk management plans.

| Short form | Long form |
|---|---|
| AONB | Area of Outstanding Natural Beauty |
| CaBA | Catchment Based Approach |
| CDE | Catchment Data Explorer |
| Defra | Department for Environment, Food and Rural Affairs |
| DWMP | Drainage and Wastewater Management Plan |
| EIA | Environmental Impact Assessment |
| ELMS | Environmental Land Management Scheme |
| EPR | Environmental Permitting Regulations |
| FAG | Flood Action Group |
| FCERM | Flood and coastal erosion risk management |
| FPE | Flood Plan Explorer |
| FRA | Flood Risk Area (as identified under the Flood Risk Regulations 2009) |
| FRM | Flood Risk Management |
| FRMP | Flood Risk Management Plan |
| FRR | Flood Risk Regulations 2009 |
| FWMA | Flood and Water Management Act 2010 |
| HRA | Habitats Regulations Assessment |

| Short form | Long form |
|---|---|
| IDB | Internal Drainage Board |
| LEP | Local Enterprise Partnership |
| LFRMS | Local Flood Risk Management Strategy |
| LLFA | Lead Local Flood Authority |
| LPA | Local Planning Authority |
| MHCLG | Ministry of Housing, Communities and Local Government |
| MMO | Marine Management Organisation |
| NaFRA | National Flood Risk Assessment |
| NFM | Natural Flood Management |
| NNR | National Nature Reserve |
| NPPF | National Planning Policy Framework |
| NRW | Natural Resources Wales |
| PFRA | Preliminary Flood Risk Assessment |
| RBD | River Basin District |
| RBMP | River Basin Management Plan |
| RFCC | Regional Flood and Coastal Committee |
| RMA | Risk Management Authority |
| RoFSW | Risk of Flooding from Surface Water |
| SAC | Special Area of Conservation |
| SEA | Strategic Environmental Assessment |

| Short form | Long form |
|---|---|
| SEPA | Scottish Environment Protection Agency |
| SMP | Shoreline Management Plan |
| SPA | Special Protection Area |
| SSSI | Site of Special Scientific Interest |
| SuDS | Sustainable Drainage Systems |
| SWMP | Surface Water Management Plan |
| UKCP18 | UK Climate Projections 2018 |
| WFD | Water Framework Directive |

# Glossary

This glossary is intended as a reference tool. It includes the main terms used in the second cycle flood risk management plans and a short description of what they are.

**25 Year Environment Plan**

A plan produced by government which sets out goals for improving the environment, within a generation and leaving it in a better state. It details how government will work with communities and businesses to do this over the next 25 years.

**Catchment**

The area from which precipitation contributes to the flow from a borehole spring, river or lake. For rivers and lakes this includes tributaries (a river or stream flowing into a large river or lake) and the areas they drain.

**Coastal erosion**

The loss of land due to the effects of waves and, in the case of coastal cliffs, slope processes (such as high groundwater levels). This may include cliff instability, where coastal processes result in landslides or rock falls.

**Flood Risk Area**

Areas identified through the PFRA process where the risk of flooding is significant nationally for people, the economy or the environment (including cultural heritage).

**Flood Risk Management Plan**

A statutory plan prepared by the Environment Agency and LLFAs under the Flood Risk Regulations 2009. The plans are reviewed and updated every 6 years. The current plans cover the period 2021 to 2027.

**Flood Risk and Hazard Mapping**

Maps prepared under the Flood Risk Regulations 2009 to show potential risks and impacts of flooding in identified Flood Risk Areas. They are reviewed and updated every 6 years. The current maps use data and risk assessment data available in December 2019.

**Flood Plan Explorer**

A new, online, map-based tool which displays all of the measures proposed as part of the second cycle of flood risk management plans in England.

**Fluvial flooding**

Flooding from/of rivers.

**Groundwater flooding**

Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable layers are particularly susceptible.

**Internal Drainage Board**

A public body that manages water levels in areas known as internal drainage districts.

**Internal Drainage District**

Areas where there are special drainage needs, managed by internal drainage boards.

**Lead Local Flood Authority**

These are County, Unitary or Metropolitan Boroughs that are responsible for managing flooding from surface water, smaller watercourses and groundwater. There are 152 in England.

**Local Flood Risk Management Strategy**

Statutory strategies produced by Lead Local Flood Authorities under the Flood and Water Management Act 2010.

**Main river**

A watercourse shown as such on the main river map. They are usually the larger rivers and streams, and for which the Environment Agency has responsibilities and powers.

**Management catchment**

An amalgamation of a number of river water body catchments that provide a management unit.

**National Flood and Coastal Erosion Risk Management Strategy**

A statutory strategy prepared under the Flood and Water Management Act 2010, by the Environment Agency for England.

**Ordinary watercourse**

A watercourse that does not form part of a main river and is not shown on the main river map. LLFAs, district councils and internal drainage boards may carry out flood risk management work on ordinary watercourses.

**Preliminary Flood Risk Assessment**

The first stage in the six-year planning cycle to deliver the Flood Risk Regulations. The latest PFRAs were reviewed in 2017 for local sources of flood risk and 2018 for main rivers, the sea and reservoirs.

**Preparedness measure**

A measure (action) which aims to prepare people for flooding. Examples include flood forecasting and warning, flood emergency response planning and improving public preparedness for flooding.

**Prevention measure**

A measure (action) which aims to avoid putting people or the environment at risk of flooding. Examples include watercourse regulation, flood risk modelling and mapping and development planning and control.

**Protection measure**

A measure (action) which aims to better protect people from the risk of flooding. Examples include building flood defences, nature based solutions and asset maintenance.

**Recovery and review measure**

A measure (action) which aims to use learning from flood incidents. Examples include reviewing lessons learnt from flood response, supporting communities businesses and the environment to recover from flooding.

**Reservoirs**

A natural or artificial lake where water is collected and stored until needed. Reservoir owners and operators (‘undertakers’) must meet certain requirements under the Reservoir Act 1975.

**River Basin District**

Large river catchments in England. They cover an entire river system, including river, lake, groundwater, estuarine and coastal water bodies.

**River Basin Management Plan**

Statutory plans developed by the Environment Agency which set out how organisations, stakeholders and communities will work together to improve the water environment.

**River flooding**

Occurs when water levels in a channel overwhelms the capacity of the channel.

**Services**

Services include schools, hospitals, nursing/care/retirement homes, police stations, fire and ambulance stations, prisons, sewerage treatment works and electricity installations.

**Sewer flooding**

Flooding as a result of overloading of the sewerage system due to limited system capacity or failure of sewer asset.

**Strategic Area**

A locally defined area included in the Flood Risk Management Plans. They are areas with a similar geography or strategic ambition where it is important to consider flood risk management across administrative boundaries and river catchments.

**Surface water flooding**

Occurs when intense rainfall overwhelms local drainage capacities.

**Tidal flooding**

The temporary inundation of coastal areas during exceptionally high tides or storm surges.

**Tide locking**

Occurs when the level of the incoming high tide stops the river water from flowing out to sea. This can increase the risk of river flooding.

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