South East River Basin District Draft Flood Risk Management Plan 2021 to 2027

October 2021

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

Brighton & Hove City Council

East Sussex County Council

Environment Agency

Kent County Council

Portsmouth City Council

Southampton City Council

West Sussex County Council

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.

Published by:

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

www.gov.uk/environment-agency

Further copies of this report are available from our publications catalogue: http://www.gov.uk/government/publications or our National Customer Contact Centre: 03708 506 506

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Foreword

The South East River Basin District (RBD) covers 10,200 square kilometres. It extends from Hampshire in the west to Kent in the east, encompassing the Isle of Wight and large parts of East and West Sussex. Over 3.9 million people live in this largely rural area, most of which reside in the densely populated coastal zone.

There are more than 240,000 people at risk of flooding from rivers and the sea, and over 370,000 people at risk of flooding from surface water in the South East RBD. Some people live in areas that are at risk from more than one of these sources. This is particularly the case in the low-lying coastal areas. Groundwater flooding is also a major source of flood risk and frequently occurs at the same time as river and surface water flooding.

The combined effects of flooding from multiple sources present complex challenges for all Risk Management Authorities. Flooding can be unpredictable and dynamic, and the impacts can be devastating. In England, for every person who suffers flooding, around 16 others are affected by a loss of services, such as transport and power. 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. In the South East RBD, we have been working to develop a more integrated approach to managing flood and water across our river catchments. Working closely with our partners, we're moving towards planning that's more strategic and place-based.

Over the last 2 years we have worked in partnership with Lead Local Flood Authorities and other partners to develop these Flood Risk Management Plans. This has been a challenging time with winter flooding and the impacts of coronavirus. These tests have served as a reminder, reinforcing how precious the environment around us is for our health and wellbeing, and the importance of protecting and enhancing it.

The Flood Risk Management Plans mark an important contribution towards helping to deliver 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 now and in the future. These plans will help us:

- identify actions that'll reduce the likelihood and consequences of flooding

- update 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. This new, online, map-based tool will make plans more accessible and show the measures in a visual format. It'll also help you to see what's planned, where and when, and hopefully lead to further collaboration across all we do.

I'm pleased we have this opportunity to share this Flood Risk Management Plan, and I encourage you all to get involved and have your say.

Catherine Wright, Director Operations South and East, Environment Agency

Contents

Introduction to the draft FRMP

You should read this draft Flood Risk Management Plan (FRMP) with the:

- draft 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans' – a high level overview of the FRMPs and flood risk management in England
- 'South East River Basin District Second Cycle Flood Risk Management Plan –Strategic Environmental Assessment: environmental report' – a report on the findings of the strategic environmental assessment (SEA)
- 'South East River Basin District Second Cycle Flood Risk Management Plan Strategic Environmental Assessment: non-technical summary'– a summary of the SEA and its findings
- 'Flood Plan Explorer' – a new, interactive mapping tool that displays information about the measures included within this plan
- 'Second Cycle Flood Risk Management Plans – Abbreviations and Glossary' – a reference tool for the main terms used in the FRMP

Approach to the draft FRMP

The draft second cycle Flood Risk Management Plan (FRMP) is a plan to manage significant flood risks in the Flood Risk Areas (FRAs) identified within the South East River Basin District (RBD). Producing the plan for these areas is a requirement of the Flood Risk Regulations (2009). There are areas at risk of flooding outside of these FRAs. The Environment Agency and other Risk Management Authorities (RMAs) will continue to plan for and manage the risk of flooding to all communities. This is regardless of whether they're in an FRA or not. For example, RMAs carry out flood risk management interventions such as warning and informing and capital investment and maintenance programmes.

This draft plan focusses on what is planned in FRAs during the second cycle. It also shows what has happened across the RBD since the first cycle 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 to create a plan to manage the risk from all sources of flooding. The second cycle FRMP will build on this approach, focussing on the areas with the highest risk of flooding. The FRMP is a strategic plan that's 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’ll 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 draft FRMP is also aligned with the draft River Basin Management Plan for the South East RBD. Together, these plans set the strategic goals and approaches to managing water and flood risk within the RBD. More information on the background to FRMPs, the Flood Risk Regulations and how FRAs were identified is in draft ‘Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans’.

Contributors to the draft FRMP

The Environment Agency has worked with LLFAs and other RMAs to develop the draft FRMP. The Environment Agency and those LLFAs with a surface water FRA within their administrative area must produce a FRMP. These FRAs are listed in the following section and in Table 1 respectively.

This second cycle draft FRMP for the South East RBD identifies strategic measures for FRAs. These measures have been developed with contributions from other RMAs as listed in ‘Other RMAs that have contributed to the draft FRMP’ section. Hampshire County Council and the Isle of Wight Council have not been asked to contribute to measures in this draft FRMP. This is because none of the FRAs in the South East RBD are in their areas. However, all RMAs across the South East RBD will continue to plan for and manage the risk of flooding both within and outside of FRAs. 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.

Environment Agency Flood Risk Areas for main rivers and the sea

- Canterbury
- Eastbourne and Pevensey Bay
- Hastings
- Herne Bay
- Hythe
- Portsmouth
- Southampton
- Whitstable

The Whitstable FRA spans both the South East and Thames RBDs, but is described solely within this draft plan for the South East.

LLFAs with surface water FRAs within their administrative boundary

Table 1: LLFA FRAs

Flood Risk Area name	LLFA name(s)
City of Brighton and Hove	Brighton and Hove City Council
Eastbourne	East Sussex County Council
Hastings	East Sussex County Council
Worthing	West Sussex County Council

Other RMAs that have contributed to the draft FRMP

1. Adur and Worthing Councils
2. Canterbury City Council
3. Eastbourne Borough Council
4. Fareham Borough Council
5. Folkestone and Hythe District Council
6. Kent County Council
7. Portsmouth City Council
8. Southampton City Council
9. Southern Water

Developing the draft FRMP

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

- ‘National Flood and Coastal Erosion Risk Management Strategy for England’
- ‘draft South East River Basin Management Plan’
- ‘Portsmouth Local Flood Risk Management Strategy’
- ‘Southampton Local Flood Risk Management Strategy’

- ‘Brighton and Hove Local Flood Risk Management Strategy’
- ‘East Sussex Local Flood Risk Management Strategy’
- ‘West Sussex Local Flood Risk Management Strategy’
- ‘Kent Local Flood Risk Management Strategy’
- evolving ‘Southern Water Drainage and Wastewater Management Plans’
- ‘Isle of Grain to South Foreland Shoreline Management Plan’
- ‘South Foreland to Beachy Head Shoreline Management Plan’
- ‘Beachy Head to Selsey Bill (South Downs) Shoreline Management Plan’
- ‘Selsey Bill to Hurst Split (North Solent) Shoreline Management Plan’
- ‘Portsea Island Coastal Strategy Study’
- ‘River Hamble to Portchester Coastal Strategy’
- ‘Portchester Castle to Emsworth Coastal Strategy’
- ‘Folkestone to Cliff End Coastal Strategy’
- ‘Brighton and Hove Surface Water Management Plan’
- ‘Hastings Surface Water Management Plan’
- ‘Eastbourne Surface Water Management Plan’
- ‘Portsmouth Surface Water Management Plan’

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

- Flood Risk Regulations 2009
- FCERM strategy
- ‘25 Year Environment Plan’

The full list of these objectives is in the draft ‘Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans’.

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 South East RBD

Overview of the South East RBD

The South East River Basin District (RBD) is one of 10 RBDs across England and Wales, covering over 10,200 square kilometres. It extends from Hampshire in the west to Kent in the east. The RBD also includes East and West Sussex, the Isle of Wight and very small parts of Wiltshire and Surrey.

The South East RBD is predominantly rural, with most of the inhabitants living in the densely populated coastal zone. In particular, in the low-lying coastal plain of Hampshire and West Sussex. In total, over 3.9 million people live in the South East RBD, which is densely populated and includes the major urban centres of:

- Southampton
- Portsmouth
- Ashford
- Brighton and Hove

The management catchments that make up the RBD include many interconnected:

- rivers
- lakes
- groundwater bodies
- estuarine waters
- coastal waters

These range from the chalk streams of the Test and Itchen catchments to the modified rivers of the Rother catchment, and comprise:

- The New Forest
- Isle of Wight
- Test and Itchen
- East Hampshire
- Arun and Western Streams
- Adur and Ouse
- Cuckmere and Pevensey Levels
- Rother

- Stour

The location of these management catchments can be seen in Flood Plan Explorer, the interactive mapping tool.

Around 65% of the RBD is used for farming, including:

- livestock
- arable
- horticultural businesses

Important sectors contributing to the economy of the district include:

- technology
- manufacturing
- tourism
- financial services
- construction

The South East RBD has a diverse and high-quality landscape with a higher proportion (35%) of land under national landscape designation than any other UK RBD. Large areas are designated for their iconic landscapes such as the New Forest and the South Downs National Parks. Many areas are protected for nature conservation, for example the Solent Estuary. The South East RBD has a rich heritage with many listed buildings and structures, which are often located close to rivers, lakes and the coast.

The coastline of the RBD is varied with alternating coastal lowlands and chalk and sandstone cliffs. The lowlands include the natural harbours of Portsmouth, Langstone, Chichester and Pagham. Most of the open coast features natural and managed shingle (sand and flint gravel) beaches. There are 2 locations with sand dunes at East Head and Camber, and some sand beaches around the Isle of Thanet. The Victorian legacy on the coast consists of numerous sea-side resorts with associated infrastructure like groynes, sea walls and piers.

The Isle of Wight is a unique feature within the RBD and even with its relatively small coastline has all of the wider catchment features. This includes the iconic Needles on the west of the island, the marshes at Bembridge and the sandy beaches at Sandown and Ryde.

The South East RBD has a rich diversity of wildlife and habitats, supporting many species of global and national importance. These include:

- migratory salmon rivers

- native white clawed crayfish
- estuaries and coastal waters important for shellfish, wintering wildfowl, breeding gulls and terns

The South East RBD shares a border with 3 other RBDs, as follows:

- the South West
- Thames
- Anglian (estuarine/coastal boundary only)

Within the South East RBD there are:

- 8 Flood Risk Areas (FRAs) for significant risk of flooding from main rivers and the sea (Figure 1)
- 4 FRAs for significant risk of flooding from surface water (Figure 2)

Each of these FRAs are discussed in more detail in the ‘Second cycle objectives and measures’ section.

For further information about the South East RBD, please read the accompanying Strategic Environmental Assessment Environmental Report. This includes information on topics such as the landscape, geology and cultural heritage of the South East RBD.

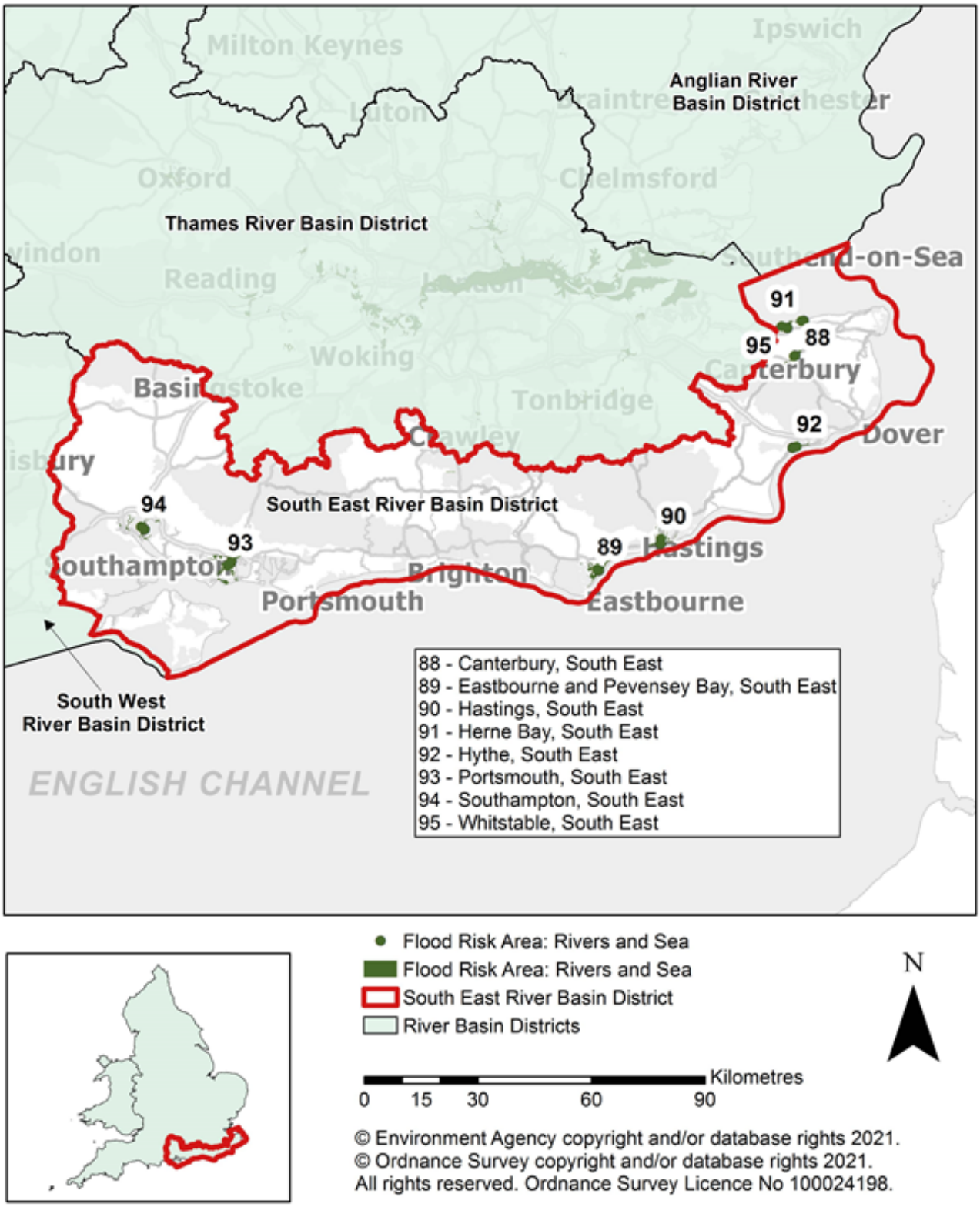


Figure 1: Rivers and Sea Flood Risk Areas in the South East RBD.

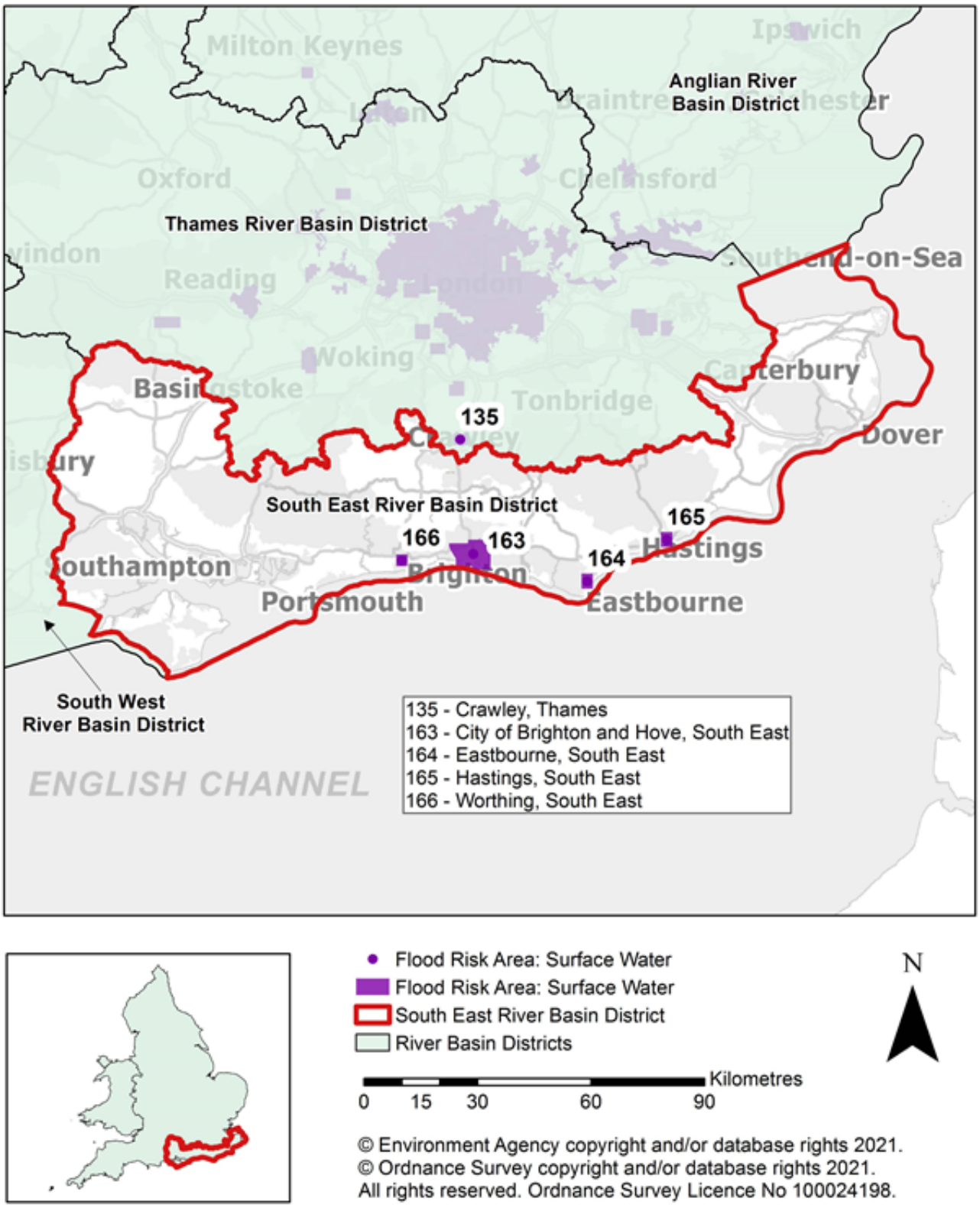


Figure 2: Surface Water Flood Risk Areas in the South East RBD.

The main flood risk issues and changes in the South East RBD

River and tidal flood risk

The majority of the South East River Basin District (RBD) drains into the English Channel, except for the Stour catchment which drains into the North Sea. Flood risk from rivers varies across the South East RBD with differences in:

- local geology
- topography
- level of urbanisation
- land use

The influence of the tide can have a significant impact on rivers that drain to the sea. ‘Tide-locking’ occurs when rivers are prevented from flowing into the sea by the incoming high tide. This is a particular issue in low-lying areas such as:

- Bognor Regis
- Eastbourne
- Pett Levels
- Pevensey Levels
- Romney Marsh
- Ryde

In some of these locations, pumps or storage areas within the watercourses can be used to reduce the effects of ‘tide-locking’. Even inland towns and settlements, such as Lewes and Arundel, are at risk of tidal flooding, particularly when river levels are already high.

Within the RBD, there are several rivers which react very quickly to heavy rainfall. These are typically situated in steep valleys where the topography combines with impermeable geology, such as clay. Impacts are more significant where these watercourses are located in urban areas, such as the:

- Hollington Stream in Hastings
- Scrasebridge Stream in Haywards Heath
- River Dour at Dover

Some of the catchments still retain much of their natural character, whereas others have been significantly modified over time because of industry, navigation and agriculture. Flood risk is increased where the watercourses have been artificially straightened or constricted, such as through culverting. Where the catchments retain their natural rural floodplain, the floodplains provide vital natural flood storage.

The 8 Flood Risk Areas identified as being at risk of flooding from rivers and sea in this second cycle Flood Risk Management Plan (FRMP) are all new. They were not identified in the first cycle FRMP. River flooding is the main source of flood risk in the Canterbury FRA, it's not at risk from the sea. The remaining 7 FRAs are at risk from both rivers and the sea, with tide-locking of rivers being a particular issue in many of these locations.

Coastal flooding and erosion

Coastal flooding and erosion are major issues in the South East RBD as a large percentage of the population live in coastal areas. The coastline is vulnerable to tidal surges moving along the English Channel and down from the North Sea. When coupled with high tides, low-lying areas are at risk of flooding.

The coastline of the South East has variable topography and geology. It's a dynamic and continually changing environment, and includes:

- low sandy cliffs of the New Forest
- marshlands and sheltered harbours of the Solent
- exposed shingle beaches of West Sussex, East Sussex and Kent
- high chalk cliffs of the Isle of Wight, East Sussex and Kent

Most coasts and beaches tend to erode due to waves attacking the shore. The rate of erosion is influenced by changes in wave energy and sediment supply. Coastal erosion across the RBD is likely to accelerate with sea level rise. Cliff tops are also vulnerable to retreat or landslides, particularly during wet periods. Coastal erosion affects many places across the RBD, with the rate being dependant on location and geology. Examples of where natural cliff retreat is occurring include:

- Hordle Cliff
- Isle of Wight
- Telscombe Cliffs
- Birling Gap
- Seven Sisters Country Park
- Fairlight
- East Kent coastline around Dover

Coastal erosion risk management is closely linked to managing flood risk from the sea, for example in the Eastbourne and Pevensey Bay Rivers and Sea FRA. The effects of climate change and sea level rise put beaches, cliffs and defences protecting people and property under constant threat. Defending against this is costly and often complex due to the dynamic nature of the coastline.

The management of shingle beaches is an essential part of flood and coastal erosion risk management across West Sussex, East Sussex and Kent. Many coastal defence schemes involve solutions such as beach recharge and beach recycling to replace shingle lost as a result of storms or longshore drift.

Coastal protection can also be provided by hard, artificial defences such as concrete and steel sheet piled walls. These remain the most effective solution in some locations. Coastal defences often consist of a combination of hard defences and beach management, such as in the Whitstable Rivers and Sea FRA. When located further inland, earth embankments can provide coastal protection. The UK's largest realignment of open coast at Medmerry comprises 7km of embankments, located inland of a newly created intertidal area, protecting almost 350 properties.

Most of the urban areas along the south east coast have coastal defences in place. Over time, the effectiveness of these defences will reduce due to sea level rise and decisions will need to be made about their long-term sustainability.

The South East Regional Coastal Monitoring Programme began in 2002. The following organisations work together to provide a cost-effective method of monitoring the English coastline:

- local councils
- the Environment Agency
- the Channel Coast Observatory

The information gathered is essential for coastal managers to provide sustainable long-term protection from the sea.

The 2 regional Coastal Groups that operate within the South East RBD are:

- the Southern Coastal Group, covering the coast from Portland Bill in Dorset to Selsey Bill in West Sussex, including the Isle of Wight
- the South East Coastal Group, covering the coast from Selsey Bill in West Sussex to Isle of Grain in North Kent

The Coastal Groups are technical groups that bring together local authorities, the Environment Agency and other maritime operating organisations. The Coastal Groups support the delivery of plans, strategies and schemes by:

- providing co-ordination
- facilitating communication
- providing advice and guidance to member organisations

The following Shoreline Management Plans (SMPs) cover the South East RBD:

- ‘Isle of Grain to South Foreland SMP’
- ‘South Foreland to Beachy Head SMP’
- ‘Beachy Head to Selsey Bill (South Downs) SMP’
- ‘Selsey Bill to Hurst Spit (North Solent) SMP’
- ‘Isle of Wight SMP’
- ‘Hurst spit to Durlston Head (Poole and Christchurch Bays) SMP’

SMPs provide a large-scale, high-level assessment of the risks associated with coastal evolution including the added pressures from sea level rise. They present a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner.

The framework allows coastal Risk Management Authorities (RMAs) and the Environment Agency to plan for coastal adaptation and influence decisions on:

- investment
- development
- infrastructure

They’re a vital tool in providing the evidence for:

- resilience building
- local engagement
- consultation
- adaptation

Since 2019, the Environment Agency has been working with Coastal Groups to update the SMPs. This process, known as the ‘SMP Refresh’, will be completed by 2023. One of the improvements will be the development of SMP Explorer, an online tool to make the plans more accessible.

Flood risk and coastal erosion management measures can have an impact on wetland and coastal environments and their conservation interest. As sea levels rise, intertidal habitat in front of a flood defence can get squeezed and erode. The Regional Habitat Compensation Programme is a strategic programme run by the Environment Agency. It

seeks to replace habitats that are lost due to coastal squeeze or tidal inundation effects that arise from the management of coastal defences. The ‘Medmerry Managed Realignment Scheme’ is an example of a completed habitat scheme from this programme in the RBD.

As well as being at risk of flooding from rivers, the following second cycle FRAs are identified as being at significant risk of flooding from the sea:

- Eastbourne and Pevensey Bay
- Hastings
- Herne Bay
- Hythe
- Portsmouth
- Southampton
- Whitstable

These FRAs are all new, they were not identified in the first cycle FRMP.

Surface water flood risk

Surface water is defined as rainwater on the ground surface that hasn’t entered a watercourse, drain or sewer. Surface water flooding is a problem in many towns and cities across the South East RBD. This type of flooding can begin to occur within minutes of intense rain and is often closely linked to the nature of the local drainage system. The rapid onset and considerable variability in location and extent, make it almost impossible to forecast and difficult to manage.

Surface water flooding is of particular concern in urban areas. This is because the high proportion of impermeable surfaces limits the amount of infiltration that can take place. Surface water flooding usually only lasts a short time (a few hours) and is relatively shallow (less than 0.5m) unless combined with flooding from other sources.

The City of Brighton and Hove was identified as an FRA due to surface water flood risk in the first cycle FRMP. It remains a surface water FRA in this second cycle FRMP. This area was most recently affected by severe surface water flooding in 2014, with smaller events recorded in the summers of 2015, 2016 and 2017. Further surface water FRAs have been identified for this second cycle FRMP in:

- Worthing
- Eastbourne
- Hastings

Surface water flooding has been recorded in Eastbourne in both 2015 and 2018, and in Hastings in 2017.

Other highly urbanised areas, such as Portsmouth and Southampton, also suffer from surface water flooding. The risk in these locations is increased in some areas due to interactions with flooding from rivers and the sea. Various locations across the city of Southampton were affected by surface water flooding during Storm Alex in October 2020.

Lead Local Flood Authorities (LLFAs) are responsible for producing a Local Flood Risk Management Strategy for managing surface water flooding, along with flooding from other local sources within their area. These strategies provide:

- details of locations at risk
- the nature of the flood risk
- history of flooding
- associated actions planned to reduce or mitigate the effects of local flooding

LLFAs across the RBD work closely with local planning authorities and developers to ensure that new developments do not increase the risk of surface water flooding. This work is supported by the Environment Agency. Developers are encouraged to design and build natural surface features to store and control surface water, including:

- ponds which change level with rainfall
- wetlands
- ditches
- soakaways

These are known as sustainable drainage systems (SuDS) or green infrastructure. Storage of surface water in this way keeps it separate from sewerage systems. This reduces the risk of flooding from storm overflows. SuDS can also:

- improve water quality
- create new habitat
- increase biodiversity

Groundwater flood risk

Flooding from groundwater can happen when the level of water within the underground rock or soil rises and reaches ground level. It’s most common in areas where the underlying bedrock is chalk, but it can also happen in locations with sand and gravel such as in river valleys.

Groundwater flooding within the RBD is a significant problem. This is largely due to the geology of the region and low-lying nature of extensive lengths of the coastline. The New Forest and Isle of Wight are exceptions to this, only having minor groundwater issues.

This type of flooding is particularly problematic on the chalk catchments across the RBD. These include the River Test in the west, through to the River Dour in the far east of Kent. Chalk bedrock dominates the middle of the district. The porous nature of chalk means that water can infiltrate quickly, and move freely, within these rocks. When the rocks become saturated, water rises to the surface and can then start flowing above ground. This can give rise to groundwater flooding in late winter and early spring when there have been prolonged spells of wet weather.

Groundwater provides a significant base-flow for some rivers in the RBD, notably the:

- River Test
- River Itchen
- River Meon

These rivers have a slow response to rainfall, but long periods of wet weather can result in sustained flooding, such as during the winter of 2013 to 2014.

Some groundwater fed rivers will only flow when groundwater levels are high, such as the:

- River Lavant in Chichester
- Winterbourne Stream in Lewes
- Nailbourne in east Kent

The areas that are most susceptible to groundwater flooding include the:

- Test and Itchen
- Meon Valley
- Hambledon
- Rowlands Castle
- River Lavant valley
- Petham Bourne
- Alkham Bourne
- Nailbourne

Each of these areas were flooded most recently in 2014.

Groundwater flooding can also occur in low-lying areas away from watercourses. Parts of Brighton and Hove are susceptible to such groundwater flooding.

Extensive lengths of the coastal plain are also susceptible to groundwater flooding because of their low elevations. Such locations include:

- Farlington Marshes
- Bognor Regis
- Lancing
- Pevensey Levels
- the Combe Haven Valley
- Romney Marshes

Groundwater flooding is generally experienced over a longer timescale than with river and coastal flooding. It can extend over several months, causing basement flooding and disruption to local roads and sewerage systems. Although predictable, groundwater flooding can be extremely difficult to manage and protect against.

The Local Flood Risk Management Strategies produced by LLFAs cover groundwater flooding, along with other local sources of flooding within their area. LLFAs and the Environment Agency provide support to communities to minimise the impact of groundwater flooding through activities including:

- deployment of temporary barriers
- community emergency flood plans
- community resilience activities

Sewer flood risk

Southern Water Services is the principal sewer operator within the RBD and they manage a vast network of sewer pipes, pumping stations and drainage systems.

Sewer flooding can occur because sewerage systems are not designed to cope with flows from exceptional rainfall events. A high proportion of the sewers within the RBD were also built before modern sewer design standards were introduced. These were often combined sewers, taking both surface water and sewage. As a result, these older sewers may have even less capacity to deal with increased flows from heavy or prolonged rainfall. Blockages or failures within the sewer system will also increase the risk of flooding.

High groundwater in the RBD can increase the flows through the sewerage systems due to groundwater infiltration. In some locations, groundwater levels can become higher than the sewers, allowing groundwater to enter the system through any cracks or faulty joints.

When river or surface water flooding occurs in urban areas, the flood water can often interact with the sewer network. This can cause foul water to mix with flood waters leading to a risk to public health.

Water and Wastewater companies in England and Wales, including Southern Water Services, have committed to produce 'Drainage and Wastewater Management Plans' (DWMPs). These are new plans that'll set out how water and wastewater companies intend to extend, improve, and maintain a robust and resilient drainage and wastewater system. This will become increasingly important as the population of the South East grows, and with increasing rainfall intensity because of climate change.

DWMPs will have strong links with FRMPs, River Basin Management Plans and other local plans produced by local authorities such as Local Flood Risk Management Strategies. They will help improve water quality and drainage systems and reduce flooding and pollution. In the South East RBD, Southern Water are developing a DWMP for each of the 9 management catchments listed in the 'Overview of the South East RBD' section. The final DWMPs are expected to be published in 2023.

Canal flood risk

Canal flooding, although very rare, can be serious and happen without warning. Canals constitute linear impoundments of significant bodies of water. Flood risk can arise if an embankment fails where a canal is on ground above the level of nearby property, or a culvert beneath the canal collapses.

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

In the Rother catchment, the Royal Military Canal runs from Pett to Hythe covering 32km. During summer months, water is retained in the Royal Military Canal to provide a source of water for irrigation and 'wet fencing' across Romney Marsh. During winter months, the water level is lowered, enabling excess water to drain out to sea via outfalls to help prevent flooding. The main rivers which drain the North Downs to the north of Hythe run into this canal. It therefore influences flood risk in the second cycle Hythe Rivers and Sea FRA.

Reservoir flood risk

In the South East RBD there are less than 100 large raised reservoirs that hold at least 25,000m3 of water. The chances of a reservoir failing and causing flooding are very low, however the extent of flooding from a reservoir can be widespread. The consequences of a dam breach could be significant, including:

- death or injury to people caught in the flood wave
- flooding, damage or destruction of properties
- inundation of local transport infrastructure
- disruption to utilities and telecommunications
- environmental damage

As the enforcement authority for the Reservoir Act 1975 in England, the Environment Agency has a statutory duty to manage reservoir flood risk by securing compliance. This is in addition to its permissive powers under the Reservoirs Act.

However, reservoirs on or near a watercourse can help to reduce flood risk. Flood storage reservoirs are designed to temporarily store water and are effective in managing excess flood flows. They're normally located upstream of an urban area or downstream of newly developed urban areas to mitigate the impact of that development further downstream. Examples include:

- Aldington and Hothfield on the Great and East Stour, which reduce the risk of flooding in Ashford
- Mill Leese Flood Storage Area at Saltwood, Hythe which protects about 70 properties

Existing reservoirs can also be adapted for flood storage even if this is not its primary purpose. Flood storage reservoirs are most effective when they form part of a catchment-wide approach to managing flood risk.

Land management and flooding

The South East has continued to see increased urbanisation and intensification of land management practices, including the loss of valuable hedgerows and woodlands. Such changes increase the rate of surface water run-off and reduce the time it takes for rivers to respond to rainfall. This has significantly influenced river and surface water flood risk in the RBD, presenting challenges in managing and forecasting flood risk.

However, land use management also presents an opportunity to reduce flood risk. Working with landowners therefore continues to be an important part of flood risk management across the RBD.

Working with Natural Processes or Natural Flood Management (NFM) aims to protect, restore and sustain the natural functioning of catchments, flood plains, rivers and the coast. Using NFM measures where appropriate is an efficient, cost-effective and sustainable way to manage flood risk alongside wider environmental benefit. The Environment Agency will choose to implement NFM over 'hard' defences wherever it's the

most effective and viable approach to managing flood risk. Where this is not possible NFM measures will be considered in combination with more traditional, engineered defences.

As understanding and experience of NFM has increased since the first cycle FRMP, these approaches have become increasingly important to managing flood risk across the RBD. They're also an important component in the River Basin Management Plan. NFM can provide wide ranging environmental benefits, including improving water quality, and supporting the restoration and resilience of aquatic habitats and species. To identify opportunities to make catchments more resilient for the future, RMAs are working in partnership with:

- Catchment Partnerships
- landowners
- farmers
- other stakeholders

Several NFM projects are being planned and delivered across the RBD. For example:

- the Sussex Flow Initiative
- proposed schemes in Polegate upstream of the Eastbourne and Pevensey Bay FRA
- proposed schemes in the Combe Haven catchment, upstream of the Hastings FRAs

Along the coast and estuaries, RMAs and partners are seeking to regenerate habitat such as kelp forest and saltmarsh.

Flood risk management and maintenance activities in the RBD are also being adapted to consider the Working with Natural Processes approach wherever possible. For example, by stopping or reducing river maintenance such as:

- vegetation cutting
- desilting
- removal of woody debris

The new Environmental Land Management schemes will also provide opportunities to promote NFM.

There are 4 internal drainage boards (IDBs) across the South East RBD:

- River Arun Internal Drainage Board
- Pevensey and Cuckmere Water Level Management Board
- River Stour (Kent) Internal Drainage Board
- Romney Marshes Area Internal Drainage Board

The Lower Medway Internal Drainage Board operates within the Thames RBD. A small part of their area falls within the boundary of the Whitstable FRA, which is described within this FRMP for the South East RBD.

IDBs manage water levels where there is a special need for drainage, mainly in low-lying areas. Their focus historically was drainage of agricultural land. As RMAs, they have evolved to play a much wider role, contributing to flood risk management and protecting and enhancing the environment. Much of the work of IDBs involves the maintenance and improvement of watercourses and related infrastructure such as pumping stations.

History of flooding

This section of the draft 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 caused internal flooding of more than 20 residential properties in a single location.

Part A of the first cycle FRMP for the South East 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're used is in draft 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans'.

There have only been 3 significant flood events in the South East RBD since 2015, as shown in Table 2. In June 2016, an exceptional rainfall event resulted in about 20 residential properties flooding internally in the east of the city of Southampton. In August 2020, an exceptional rainfall event resulted in about 20 residential properties flooding internally in Winchester. During this event, more than half of the city's average August rainfall fell in just 15 minutes. In October 2020, over 2 days of heavy rain, Storm Alex caused internal flooding of about 20 residential properties across the city of Southampton. Whilst this summary is for residential properties, businesses and infrastructure will also have been affected during these events.

Several other events, each affecting less than 20 residential properties, have been reported in various locations across the South East RBD since 2015. A few properties have flooded on more than one occasion over this period. These events were responded to in the usual way by the relevant RMAs. Some properties that experience regular flooding deploy property resilience measures when alerted by flood warnings. In these locations, property flooding may not always be reported to the relevant RMA.

Table 2: Historical flood events from all sources since 2015. Number of properties are unverified and rounded to the nearest 10.

Date of flood	Location and approximate number of properties affected shown in brackets	Source of flood water
June 2016	Southampton (20)	surface water
August 2020	Winchester (20)	surface water
October 2020	Southampton (20)	surface water

Climate change and the South East RBD

South East Region

This section sets out what we know are likely to be the implications of climate change in the South East RBD. We use allowances for different climate scenarios over different epochs or 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 3 sets out how we expect mean sea levels to rise along the coastline by 2125.

Table 3: cumulative mean sea level rises between 2000 and 2125 (metres)*

Allowance	Sea level rise
Extreme (H++)	1.90m**
Upper end	1.60m
Higher central	1.20m

* 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. Table 4 sets out how much we expect peak river flows might increase by 2115. This is an average increase across the RBD.

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

Table 4: increases in peak river flows projected for the 2080s for the South East RBD.

Allowance category	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	99%
Higher central	49%
Central	33%

RBDs cover large areas. We know that some areas will be more affected by climate change than others. The range of increases for the South East RBD for the upper end scenario is from 64% to 127%. This range reflects a difference in anticipated change across management catchments within 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.

Table 5 sets out how much we expect rainfall intensity might increase by the 2080s. This is an average across all of England. These allowances are currently under review and will be updated for the final FRMPs.

Table 5: increases in rainfall intensity projected for the 2080s for all of England

Allowance category	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	40%
Central	20%

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.

Progress review of implementing the first cycle FRMP

This section assesses the achievements and what has happened across the South East 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 2015 FRMP. 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 FRR 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 South East 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 6 shows a summary of the implementation status of all the measures in the South East RBD since 2015, as of 31 March 2021. Chart 1 presents this information as a doughnut chart, showing the proportion of measures by implementation status.

Table 6: implementation status of measures for the South East RBD

Progress	Number of measures
Ongoing	121
Ongoing construction	10
Completed	77
Superseded	47
Not started - proposed	22
Not started - agreed	7

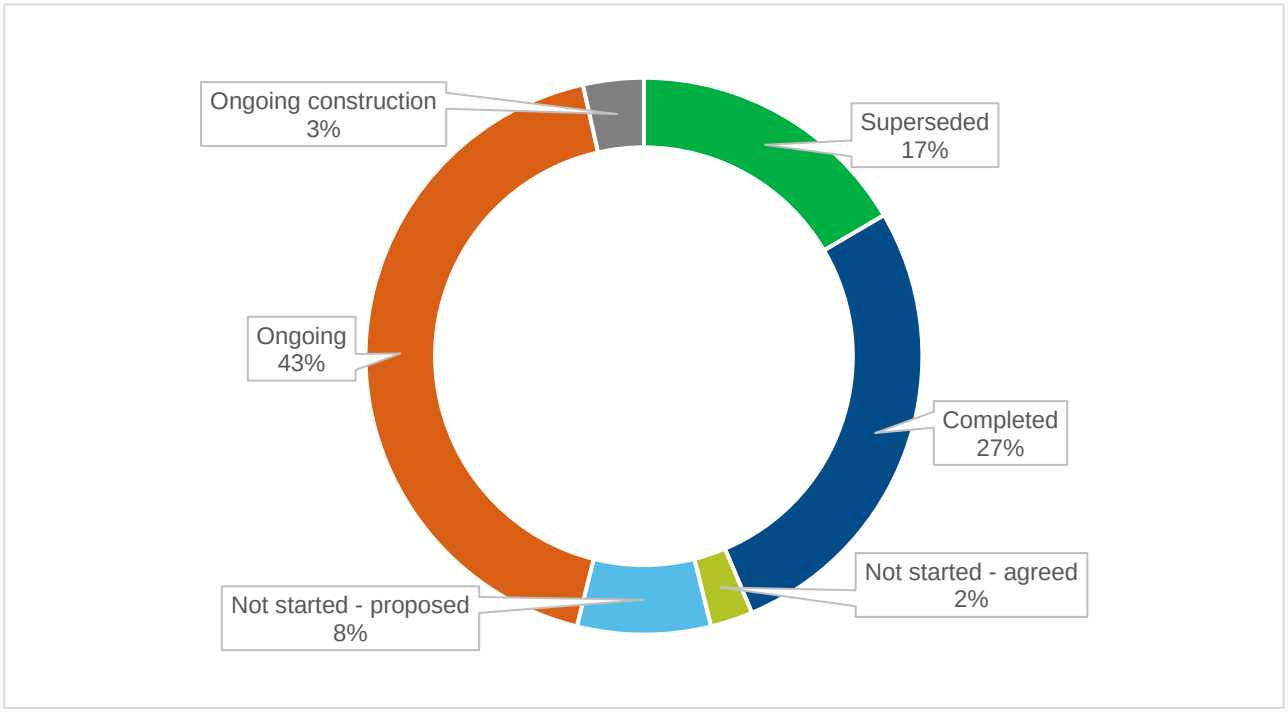


Chart 1: implementation status of measures for the South East RBD

27% of the measures published in the first cycle FRMP have been completed. 4% of the measures are ongoing in construction. 43% of the measures are ongoing. Of these ongoing measures, 80% are day to day activities which have been carried out by Risk Management Authorities (RMAs) in 2015-2021. These activities will be continuing in the period 2021-2027 and have been transitioned into the national-level measures. These national-level measures can be found in the interactive mapping tool – Flood Plan Explorer. 20% of the ongoing measures are outside of day to day activities. 27% of the measures proposed in the first cycle FRMP have not been implemented. The reasons for this are:

- further work showed it was not viable
- it has been postponed
- it has been included in another piece of work
- it has been replaced by another measure
- it does not yet have funding

Table 7 shows a breakdown of the reasons for not progressing measures in the South East RBD. Chart 2 presents this breakdown as a doughnut chart.

Table 7: reasons for not progressing measures in the South East RBD

Reason for not progressing measures	Number of measures
Not viable	19
Postponed	11
Included elsewhere	22
Replaced	6
No funding	18
Other	0

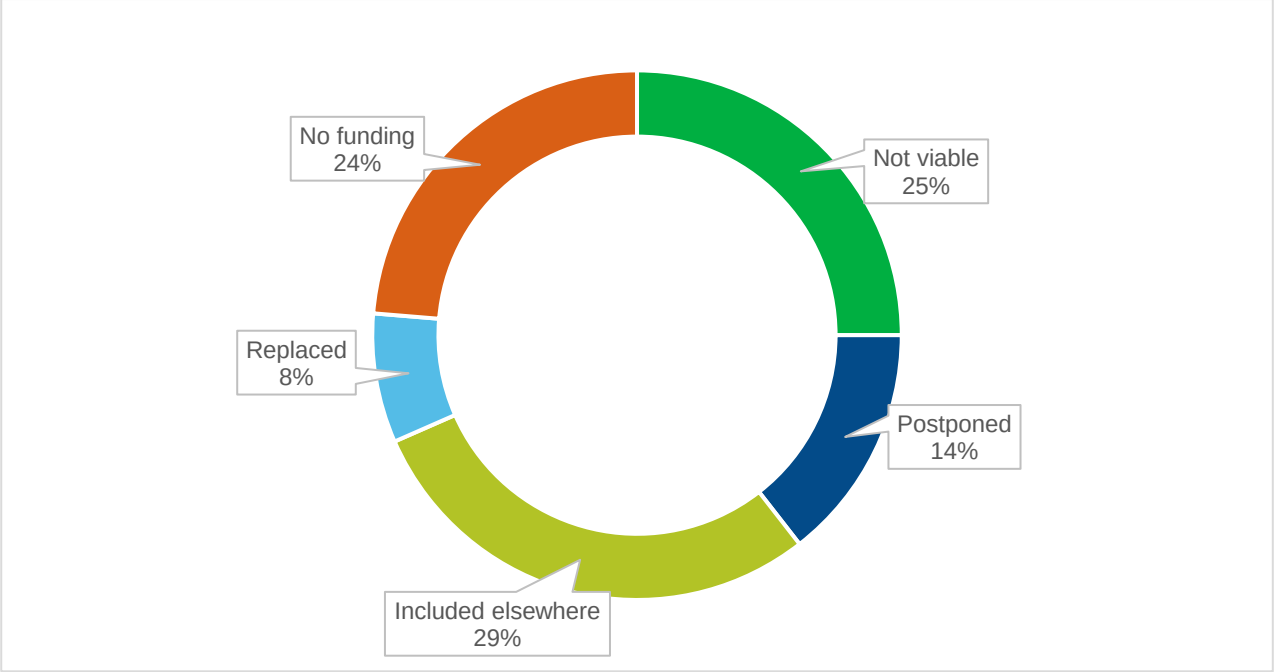


Chart 2: Reasons for not progressing measures in the South East RBD

How these measures were implemented and the main outcomes achieved

The FRR state that the FRMP must include measures relating to:

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

To meet the requirements of the FRR, measures included in the first cycle FRMP were grouped into the following themed approaches:

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

The following provides information on the proportion of completed measures under each of these themes, along with some examples and case studies. A small number of measures were not assigned to one of these themes, this accounts for 3% of completed measures.

Completed measures that have contributed to preventing flooding

8% of completed measures have contributed to the prevention of flooding. For example:

- Brighton and Hove City Council have completed a long-term strategy for flood and coastal risk management between the River Adur and Newhaven - this has helped to better manage flood risk in the first cycle ‘City of Brighton and Hove Flood Risk Area’
- a Natural Flood Management scheme has been completed in St. Mary Bourne, Hampshire by the local flood action group, with funding and support from the Environment Agency, Hampshire County Council and other local partners - this has reduced flood risk to 18 homes and 3 businesses and improved local habitats
- between 2017 and 2019, Southampton City Council implemented Property Level Resilience measures to 29 properties in the St.Deny’s area of the Upper Itchen estuary - this followed an earlier stage of property level and community resilience work in this location

Completed measures that have protected places from flooding

62% of completed measures have helped to protect individuals, communities, and the environment against the consequences of flooding. This includes about £158m invested in 45 projects completed by RMAs across:

- Kent
- East Sussex
- West Sussex
- Hampshire and the Isle of Wight

These projects have significantly reduced flood and erosion risk to 15,100 residential properties.

The following case studies provide a few examples of completed measures across the South East RBD that have protected people and places from flooding.

Case Study 1: Broomhill Sands Coastal Defence Scheme

The ‘Broomhill Sands Coastal Defence Scheme’ forms part of the ‘Folkestone to Cliff End Strategy’. It stretches from Camber Sands to Jury’s Gap in the Rother management catchment. Completed by the Environment Agency in 2016 at a cost of £30 million, the defences directly protect over 1,300 homes and more than 100 businesses.

Figure 3: Broomhill Sands Coastal Defence Scheme

The scheme has 3 main elements:

- rock revetment
- concrete wave wall
- shingle embankment

The improved standard of protection provided by the scheme is up to a flood event with a 0.5% chance of occurring each year. The scheme has also improved public realm space and access to the beach.

Case Study 2: Monktonmead Flood Alleviation Scheme

Figure 4: Monktonmead Flood Alleviation Scheme

The Environment Agency have completed a £5 million flood alleviation scheme at Ryde, in the Isle of Wight management catchment, in partnership with:

- the Isle of Wight Council
- the Southern Regional Flood and Coastal Committee

The scheme comprised:

- relocation of the sea outfall pipe
- creation of a flood storage area

Work was completed in 2018, reducing the risk of flooding to over 300 homes and businesses in the Simeon Street and Monktonmead Brook area.

Case study 3: Hastings Coastal Defence Works, Stage 2

Stage 2 of the ‘Hastings Coastal Defence Works’ was completed in 2017 by Hastings Borough Council at a cost of £4 million. The completed works protect Hastings’ main amenity beach, located between the Hastings Pier and the ‘harbour arm’, from coastal erosion. This beach forms part of the town’s sea defence system, protecting the highway and building infrastructure, including the proposed new development at Pelham Place.

The scheme comprised:

- new and raised rock groynes to retain shingle on the beach
- recycling of shingle from a wider section of beach to the new groyne bays
- strengthening of the ‘harbour arm’

The Hastings ‘harbour arm’ extends out into the sea at the western end of the main amenity beach. It protects material on the amenity beach and the Fisherman’s Beach to the east from coastal erosion. Strengthening work involved refacing the inner section with concrete and placing rock armour along each side and in gaps along the top.

Figure 5: Hastings Coastal Defence Works, Stage 2

Stage 3 works were carried out in 2020 to maintain the coastal defences to the west of the pier. Combined, these schemes reduce the risk of flooding from the sea to 164 residential properties. The work ensures that Hastings coastal defences continue to provide protection against tidal flooding with a 0.5% chance of occurring each year.

Completed measures that have supported people to prepare for flooding

19% of completed measures have helped to prepare people for flooding. For example:

- Southampton City Council has worked closely with the community of St.Deny's to support the set-up of a flood action group - this will help to ensure that this community has a better understanding of their flood risk and are able to respond more effectively to flooding
- the Environment Agency has worked with partners and communities affected by flooding in the Test Valley - this has helped communities to better understand their flood risk, allowing them to update flood plans and increase their future resilience

- the Test and Itchen management catchment has benefitted from projects to update modelling - this has improved understanding of flood risk and informed development of future schemes
- investigations recommended in the ‘Portsmouth Surface Water Management Plan’ have been completed to inform the need for further work
- West Sussex County Council, in partnership with Southern Water, have completed a Surface Water Management Plan for Lidsey and taken forward actions to reduce flood risk to this community

Completed measures that have supported communities to recover from flooding

8% of the completed measures have helped to support communities to recover from flooding. For example, following historic flood events, modelling projects in the Stour management catchment have improved understanding of flood risk from different watercourses. These include the River Dour and the Nailbourne.

Ongoing measures

The first cycle FRMP also included ongoing measures. These include about £98 million invested in 30 projects by RMAs, significantly reducing flood risk to over 32,100 residential properties by the end of the first cycle FRMP. These projects will continue into the second FRMP cycle. For example, Phase 3 of the ‘North Portsea Island Scheme’, completed by Coastal Partners on behalf of Portsmouth City Council. So far, this scheme has provided protection against tidal flooding that has reduced flood risk to:

- over 4,200 homes
- over 500 businesses
- critical infrastructure

This scheme has also:

- enhanced public realm space
- created intertidal habitat to encourage marine biodiversity and meet River Basin Management Plan objectives

This ongoing measure has been transitioned to the new second cycle Portsmouth Rivers and Sea Flood Risk Area.

Many of the ongoing measures reflect the day to day activities undertaken by RMAs which contribute to managing flood risk. These measures have continued throughout the period 2015-21. The following provides examples of such measures.

RMAs have continued to operate and maintain flood risk assets to help protect:

- individuals
- communities
- the environment

For example, the Environment Agency's Recondition Programme includes the repair and maintenance of key assets, such as:

- pumping stations
- outfalls
- culverts
- embankments
- sluice gates

The Environment Agency issued 139 flood warnings within the RBD between 2015 and 2021, warning and informing the public of the risk to give time to prepare. Improvements to this service are continually being sought. For example, 11 new or improved flood warning areas were set up between 2015 and 2021 across the RBD. This included a new area on the Pent Stream, which is described in the following case study.

Case Study 4: Pent Stream at Folkestone Flood Warning Area

The Pent Stream in Folkestone is a main river within the Rother management catchment. It has a steep urban catchment with a history of flash flooding. It was designated as a Rapid Response Catchment 2012.

In 2016, the Environment Agency launched a new Flood Warning Service for this area. This was achieved through:

- the introduction of new monitoring systems within the catchment
- use of modelling data from a national Rapid Response Catchment Project

Over 65% of properties at risk of flooding from the stream now benefit from flood warnings, following:

- a concerted effort to publicise the service in partnership with Folkestone and Hythe District Council and Kent Fire and Rescue Service
- the addition of the Extended Direct Warning Service, which provides automatic phone or email messages

Warning times are still very short and so a rapid response procedure, involving emergency service partners, has also been put in place.

These day to day activities will continue to be carried out during the second cycle period from 2021-2027. You can find more information about the routine day to day work that the Environment Agency and LLFAs carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

Additional measures implemented since 2015

Measures have been implemented which have emerged since the publication of the first cycle FRMP. These include about £13m invested in 22 projects completed by RMAs as part of the 6 year capital investment programme. These projects include a mixture of:

- engineered flood risk management schemes
- property flood resilience measures
- capital maintenance and refurbishment of flood risk management assets
- Natural Flood Management (NFM)
- habitat creation

These projects have:

- significantly reduced flood and erosion risk to 4,220 residential properties
- created or enhanced 70 hectares of water dependent habitat
- restored or enhanced 18.4km of river

A few significant examples are described in this section.

The ‘Central Hove and Portslade Property Level Protection Scheme’ in the first cycle City of Brighton and Hove Flood Risk Area was completed in 2021. It has reduced flood risk to 45 properties, including several listed buildings ensuring the ongoing protection of these heritage assets. The £500,000 scheme was funded by Brighton and Hove City Council and the Southern Regional Flood and Coastal Committee.

The village of Hambledon in East Hampshire has a long history of groundwater flooding in the winter months. A scheme to install a large culvert (known as the ‘Big Pipe’) under the village’s main road, and other drainage improvements, was completed in 2016. This £4.3 million scheme has reduced flood risk to over 120 properties and was achieved through close working between:

- Hampshire County Council
- Winchester City Council
- The Environment Agency
- Hambledon Parish Council

- Hambledon Flood Action Group

The Environment Agency has successfully worked in partnership with a developer to provide a flood alleviation scheme in Emsworth, Hampshire. In 2010, 24 properties were flooded from the West Brook upstream of a Victorian culvert. An options study showed that the most strategic solution was to provide upstream storage to reduce peak flows reaching this culvert. However, this was not affordable under the current funding rules.

In their role as a statutory consultee under the planning process, the Environment Agency saw an opportunity to influence a planning condition for an upstream development. The developer was required to construct a flood storage pond for surface water drainage. Following a contribution of £280,000 of government funding, a joint scheme was implemented to:

- enlarge the surface water storage pond
- divert the West Brook through the pond
- install an outfall to restrict flow back into the West Brook

This provided a strategic catchment solution to reduce flood risk to 24 properties that may otherwise not have been possible.

In 2017, the Environment Agency entered a partnership with Sussex Wildlife Trust and the Woodland Trust to contribute funding for the ‘Sussex Flow Initiative’. The ‘Sussex Flow Initiative’ was established prior to 2017 and operates in the River Ouse catchment. It works with stakeholders and landowners to demonstrate how sustainable NFM options can work alongside traditional flood risk management in rural and urban communities. Since 2017, the Sussex Flow Initiative has achieved a wide range of outcomes including:

- creation of 7.49 hectares of woodland
- planting of 6km of hedgerow
- reduction in flood risk to 18 residential properties
- creation of about 9,174 tonnes of carbon dioxide storage
- engaging with and providing NFM advice to landowners across an area of over 8,800 hectares

How well these measures have achieved the first cycle FRMP 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 FRMP objectives were grouped into one or more of the following categories:

- social
- economic
- environmental

Information on these objectives can be found in Part B of the first cycle FRMP for the South East.

Overall, the measures included in the first cycle FRMP have successfully achieved outcomes under each category of objectives. This has greatly improved the social, economic and environmental wellbeing of the South East RBD. 98% of measures that contribute to economic objectives are either:

- completed
- ongoing
- included in another piece of work (which is ongoing)
- replaced by another measure (which is ongoing)

For measures that contribute to social or environmental objectives, this figure is 78% and 70% respectively.

This equates to a total of 57 measures that were not started during the first cycle. A total of 38 of these measures do not currently have funding or have been postponed. Of these, 21 are expected to be complete or ongoing by 2027, i.e. within the second cycle FRMP period. 4 of these have been transitioned as measures in one of the following second cycle Flood Risk Areas:

- City of Brighton and Hove
- Portsmouth
- Canterbury

It's therefore expected that by 2027, 100%, 86% and 80% of the first cycle measures contributing to economic, social and environmental objectives respectively, will be complete or ongoing.

The remaining 36 measures are either assessed as unviable or are not expected to start until after 2027. This equates to 13% of the total number of measures across the RBD. These will be kept under review and opportunities to revisit their viability, or to bring forward their implementation, will be taken where possible. In some locations, alternative options to help manage flood risk or make communities more resilient to the impact of flooding will be explored. This includes one measure in the first cycle City of Brighton and Hove Flood Risk Area, where the need for a surface water scheme in Bevendean is being monitored.

The first cycle FRMP showed which objective category or categories each measure would help to deliver. The following describes measures under the objective category which they primarily benefit. 9% of the completed measures have contributed to achieving more than one of the objective categories and the total of the percentages given is therefore greater than 100%.

Completed measures that have contributed to social objectives

97% of completed measures contributed to achieving social objectives by:

- helping to enhance community preparedness and resilience to flooding
- working with Local Planning Authorities to ensure that new development does not increase the risk of flooding
- continuing to maintain assets and watercourses to minimise the risk of flooding to people and property

The following case studies provide examples of completed measures that have contributed to social objectives.

Case Study 5: Patcham Flood Alleviation Scheme

Patcham is an area about 5km north of the centre of Brighton. It's part of the first cycle City of Brighton and Hove Flood Risk Area, in the Adur and Ouse management catchment.

The steep upper catchment and chalk geology result in this area being at risk from both surface water runoff and groundwater, often in combination. Flooding of properties in this area from these sources has been reported as far back as 1877, with recent significant events in 2001 and 2015.

A scheme was completed in 2017 to:

- provide flood storage on the playing fields adjacent to Patcham Place
- install Property Level Resilience measures to properties along the Old London Road

This has reduced flood risk to 21 properties and the A23 trunk road into Brighton.

Case Study 6: Winchester Flood Alleviation Scheme

The 'Winchester Flood Alleviation Scheme' in the Test and Itchen management catchment was completed in January 2021. At a total cost of £2.9m, it protects over 70 homes and more than 30 businesses from flooding from the River Itchen. The scheme was a collaboration between the following authorities and was also part funded by the University of Southampton:

- Winchester City Council

- Hampshire County Council
- the Environment Agency

The scheme was implemented in 2 phases which saw the provision of various flood defence structures over a length of about 650m, comprising:

- flood defence walls
- demountable flood barriers
- timber sleeper walls
- flood defence bunds and embankments
- sluice gates

Figure 6: Winchester Flood Alleviation Scheme

These flood defences form a continuous barrier north of the city. This barrier will hold back water and enable Winchester City Council to manage and optimise flow through the city using the new and existing sluice gates. This improved control has added benefits for surface water flooding as outlets to the river can drain more effectively.

Completed measures that have contributed to economic objectives

6% of completed measures contributed to achieving economic objectives by:

- helping to minimise the risk of flooding to transport services
- considering the risk of flooding to agricultural land
- ensuring that flood risk management activities do not adversely affect the tourism industry

For example, the ‘Newhaven Flood Alleviation Scheme’ described in the following case study.

Case Study 7: Newhaven Flood Alleviation Scheme

The Environment Agency, in partnership with Lewes District Council, has constructed over 4km of tidal flood defences in Newhaven. Newhaven is one of the main urban centres along the coast of the Adur and Ouse management catchment.

Completed in spring 2021, the scheme reduces the risk of flooding from the sea for more than 300 homes and 200 businesses in and around Newhaven. It also helps to protect local infrastructure including the:

- road network
- railway line, which was closed due flooding from storms in December 2013
- train station

At a cost of £18 million the scheme is designed to protect against tidal flooding with a 0.5% chance of occurring each year. The scheme will also:

- support the wider regeneration of Newhaven
- help bring new investment, jobs and homes to the area

Figure 7: Newhaven Flood Alleviation Scheme

The scheme was made possible with contributions of £1.5 million from each of the following Local Enterprise Partnerships:

- Coast to Capital
- South East

Completed measures that have contributed to environmental objectives

6% of completed measures contributed to achieving environmental objectives by:

- minimising the negative impacts of flooding to designated nature conservation sites and designated heritage sites
- contributing to achieving Water Framework Directive objectives

For example, the Environment Agency has monitored the development of intertidal habitat created as part of the ‘Medmerry Managed Realignment Scheme’, which opened in 2013. This information has been used to assess the success of this scheme. It’ll also inform national research into managed realignment for the benefit of future schemes.

The Environment Agency has also removed invasive species from, and desilted, watercourses on the Pevensey Levels. This has improved a Site of Special Scientific Interest and reduced flood risk to agricultural land and people. Removal of invasive species from watercourses in this area continues to be an important activity for both the environment and flood risk management.

Ongoing measures that have contributed to the first cycle FRMP objectives

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 FRMP objectives.

For example, ‘opportunity maps’ have been produced for management catchments to show where Working with Natural Processes could help:

- reduce flood and coastal erosion risk
- catchments adapt and become more resilient to the impacts of climate change
- improve water quality
- improve the environment

This has contributed to the environmental objectives for the RBD by identifying opportunities for NFM schemes or other nature-based solutions.

The Environment Agency, LLFAs and other RMAs have also developed or maintained Multi Agency Flood Plans across the RBD contributing to both social and economic objectives.

These day to day activities will continue to be carried out during the second cycle period from 2021 to 2027. You can find more information about the routine day to day work that the Environment Agency and LLFAs carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

Second cycle summary of flood risk for the South East RBD

This section shows a summary of flood risk in the South East River Basin District (RBD) from:

- rivers and the sea
- surface water

The data in Tables 8 to 13 has been calculated from data available in December 2019. This data takes into account the presence and condition of defences. It shows the likelihood of flooding in each 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 8 summarises the risk of flooding from rivers and the sea to people in the RBD.

Table 8: summary of river and sea flood risk to people in the South East RBD

Risk to people	Total in RBD	High risk	Medium risk	Low risk	Very low risk
Number of people in RBD	3,926,853	29,094	56,200	135,931	21,723
Number of services	28,508	466	752	1,161	290

There are 3,926,853 people in the RBD. Of these:

- 6.2% live in areas at risk of flooding from rivers and the sea
- 0.7% live in areas at high risk of flooding

In this second cycle Flood Risk Management Plan (FRMP), 8 Flood Risk Areas (FRAs) have been identified because the risk of flooding from rivers and the sea is significant nationally. Of the 242,948 people in areas at risk of flooding from these sources in the RBD, 45% live in one of these FRAs.

There are 28,508 services in the RBD. Of these:

- 9.4% are in areas at risk of flooding from rivers and the sea
- 1.6% are in areas at high risk of flooding
- Table 9 summarises the risk of flooding from rivers and the sea to economic activity in the RBD.

Table 9: summary of river and sea flood risk to economic activity in the South East RBD

Risk to economic activity	Total in RBD	High risk	Medium risk	Low risk	Very low risk
Number of non-residential properties	154,295	3,561	3,690	8,195	2,188
Number of airports	3	2	0	0	0
Length of road (kilometres (km))	1,113	9	33	25	17
Length of railway (km)	1,001	22	52	44	9
Agricultural land (hectares (ha))	547,538	13,362	13,764	12,039	10,898

There are 154,295 non-residential properties in the RBD. Of these:

- 11.4% are in areas at risk of flooding from rivers and the sea
- 2.3% are in areas at high risk of flooding

2 out of the 3 airports in the RBD are in areas at high risk of flooding from rivers and the sea.

There are 1,113 km of roads in the RBD. Of these:

- 7.5% are in areas at risk of flooding from rivers and the sea
- 0.8% are in areas at high risk of flooding

There are 1,001 km of railways in the RBD. Of these:

- 12.6% are in areas at risk of flooding from rivers and the sea
- 2.2% are in areas at high risk of flooding

There are 547,538 hectares of agricultural land in the RBD. Of these:

- 9.1% are in areas at risk of flooding from rivers and the sea
- 2.4% are in areas at high risk of flooding

Table 10 summarises the risk of flooding from rivers and the sea to the natural and historic environment in the RBD.

Table 10: summary of river and sea flood risk to the natural and historic environment in the South East 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)	20	19	0	0	0
Number of Environmental Permitting Regulations (EPR) installations within 50m	146	14	3	5	2
Area of Special Area of Conservation (SAC) within area (ha)	81,981	5,239	1,544	2,737	703
Area of Special Protection Area (SPA) within area (ha)	99,178	8,560	1,097	2,150	869
Area of Ramsar site within area (ha)	48,979	6,738	2,180	4,794	1,526
Area of World Heritage Site within area (ha)	48	0	0	0	0
Area of Site of Special Scientific Interest (SSSI) within area (ha)	77,282	9,280	3,286	6,095	2,480
Area of parks and gardens within area (ha)	12,392	176	171	84	2

Risk to the natural and historic environment	Total in RBD	High risk	Medium risk	Low risk	Very low risk
Area of Scheduled Ancient Monument within area (ha)	3,405	132	91	50	69
Number of listed buildings within area	33,144	612	964	906	162
Number of licensed water abstractions within the area	2,124	599	156	119	16

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

There are 20 EU designated bathing waters in the RBD. Of these, 95% are in areas at high risk of flooding from rivers and the sea due to their nature and location.

There are 146 Environmental Permitting Regulations (EPR) installations in the RBD. Of these:

- 16.4% are in areas at risk of flooding from rivers and the sea
- 9.6% are in areas at high risk of flooding

There are 81,981 hectares of Special Area of Conservation (SAC) in the RBD. Of these:

- 12.5% are in areas at risk of flooding from rivers and the sea
- 6.4% are in areas at high risk of flooding

There are 99,178 hectares of Special Protection Area (SPA) in the RBD. Of these:

- 12.8% are in areas at risk of flooding from rivers and the sea
- 8.6% are in areas at high risk of flooding

There are 48,979 hectares of Ramsar sites in the RBD. Of these:

- 31.1% are in areas at risk of flooding from rivers and the sea
- 13.8% are in areas at high risk of flooding

All of the areas within World Heritage Sites in the RBD are outside areas at risk of flooding from rivers and the sea.

There are 77,282 hectares of Site of Special Scientific Interest (SSSI) in the RBD. Of these:

- 27.4% are in areas at risk of flooding from rivers and the sea
- 12.0% are in areas at high risk of flooding

There are 12,392 hectares of parks and gardens in the RBD. Of these:

- 3.5% are in areas at risk of flooding from rivers and the sea
- 1.4% are in areas at high risk of flooding

There are 3,405 hectares of Scheduled Ancient Monument in the RBD. Of these:

- 10.0% are in areas at risk of flooding from rivers and the sea
- 3.9% are in areas at high risk of flooding

There are 33,144 listed buildings in the RBD. Of these:

- 8.0% are in areas at risk of flooding from rivers and the sea
- 1.8% are in areas at high risk of flooding

There are 2,124 licensed water abstractions in the RBD. Of these:

- 41.9% are in areas at risk of flooding from rivers and the sea
- 28.2% are in areas at high risk of flooding

Table 11 summarises the risk of flooding from surface water to people in the RBD.

Table 11: summary of surface water flood risk to people in the South East RBD

Risk to people	Total in RBD	High risk	Medium risk	Low risk
Number of people in RBD	3,926,853	32,746	60,395	278,285
Number of services	28,508	150	290	1,042

There are 3,926,853 people in the RBD. Of these:

- 9.5% live in areas at risk of flooding from surface water
- 0.8% live in areas at high risk of flooding

In this second cycle FRMP, 4 FRAs have been identified because the risk of flooding from surface water is significant nationally. Of the 371,426 people in areas at risk of flooding from this source in the RBD, 19% live in one of these FRAs. Surface water flooding is a major risk to many communities across the RBD, even though only a small number of locations are identified as significant nationally.

There are 28,508 services in the RBD. Of these:

- 5.2% are in areas at risk of flooding from surface water
- 0.5% are in areas at high risk of flooding

Table 12 summarises the risk of flooding from surface water to economic activity in the RBD.

Table 12: summary of surface water flood risk to economic activity in the South East RBD

Risk to economic activity	Total in RBD	High risk	Medium risk	Low risk
Number of non-residential properties	154,295	2,047	3,440	13,177
Number of airports	3	2	0	0
Length of road (kilometres (km))	1,113	39	39	127
Length of railway (km)	1,001	42	45	131
Agricultural land (hectares (ha))	547,538	8,555	5,890	23,410

There are 154,295 non-residential properties in the RBD. Of these:

- 12.1% are in areas at risk of flooding from surface water
- 1.3% are in areas at high risk of flooding

2 out of the 3 airports in the RBD are in areas at high risk of flooding from surface water.

There are 1,113 km of roads in the RBD. Of these:

- 18.5% are in areas at risk of flooding from surface water
- 3.5% are in areas at high risk of flooding

There are 1,001 km of railways in the RBD. Of these:

- 21.7% are in areas at risk of flooding from surface water
- 4.2% are in areas at high risk of flooding

There are 547,538 hectares of agricultural land in the RBD. Of these:

- 6.9% are in areas at risk of flooding from surface water
- 1.6% are in areas at high risk of flooding

Table 13 summarises the risk of flooding from surface water to the natural and historic environment in the RBD.

Table 13: summary of surface water flood risk to the natural and historic environment in the South East 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)	20	4	2	4
Number of Environmental Permitting Regulations (EPR) installations within 50m	146	41	23	45
Area of Special Area of Conservation (SAC) within area (ha)	81,981	993	568	2,208
Area of Special Protection Area (SPA) within area (ha)	99,178	851	467	2,014
Area of Ramsar site within area (ha)	48,979	974	592	2,570
Area of World Heritage Site within area (ha)	48	3	3	9
Area of Site of Special Scientific Interest (SSSI) within area (ha)	77,282	1,486	939	3,895
Area of parks and gardens within area (ha)	12,392	209	116	410
Area of Scheduled Ancient Monument within area (ha)	3,405	36	29	112
Number of listed buildings within area	33,144	146	199	901
Number of licensed water abstractions within the area	2,124	335	135	374

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

There are 20 EU designated bathing waters in the RBD. Of these:

- 50.0% are in areas at risk of flooding from surface water
- 20.0% are in areas at high risk of flooding

There are 146 Environmental Permitting Regulations (EPR) installations in the RBD. Of these:

- 74.7% are in areas at risk of flooding from surface water
- 28.1% are in areas at high risk of flooding

There are 81,981 hectares of Special Area of Conservation (SAC) in the RBD. Of these:

- 4.6% are in areas at risk of flooding from surface water
- 1.2% are in areas at high risk of flooding

There are 99,178 hectares of Special Protection Area (SPA) in the RBD. Of these:

- 3.4% are in areas at risk of flooding from surface water
- 0.9% are in areas at high risk of flooding

There are 48,979 hectares of Ramsar sites in the RBD. Of these:

- 8.4% are in areas at risk of flooding from surface water
- 2.0% are in areas at high risk of flooding

There are 48 hectares of World Heritage Site in the RBD. Of these:

- 30.3% are in areas at risk of flooding from surface water
- 5.7% are in areas at high risk of flooding

There are 77,282 hectares of Site of Special Scientific Interest (SSSI) in the RBD. Of these:

- 8.2% are in areas at risk of flooding from surface water
- 1.9% are in areas at high risk of flooding

There are 12,392 hectares of parks and gardens in the RBD. Of these:

- 5.9% are in areas at risk of flooding from surface water
- 1.7% are in areas at high risk of flooding

There are 3,405 hectares of Scheduled Ancient Monument in the RBD. Of these:

- 5.2% are in areas at risk of flooding from surface water
- 1.1% are in areas at high risk of flooding

There are 33,144 listed buildings in the RBD. Of these:

- 3.8% are in areas at risk of flooding from surface water
- 0.4% are in areas at high risk of flooding

There are 2,124 licensed water abstractions in the RBD. Of these:

- 39.7% are in areas at risk of flooding from surface water
- 15.8% are in areas at high risk of flooding

Some people living in the RBD will be included in the numbers at risk of flooding in both Tables 8 and 11. This is because they're at risk of flooding from both rivers and the sea, and surface water. This is particularly the case in towns located in the low-lying coastal plain. For example, parts of Eastbourne and Hastings are within areas identified as significant nationally because of flooding from both rivers and the sea, and surface water. Similarly, some of the economic and environmental features within the RBD will be at risk of flooding from both sources.

Groundwater flooding is also a major source of flood risk in the RBD. Whilst statistics are not provided for this source, groundwater flooding frequently combines with, and increases the consequences of river and surface water flooding.

The combined effects of flooding from multiple sources presents complex challenges for all Risk Management Authorities (RMAs). These challenges will only increase with the effects of climate change. Closer and more innovative ways of working between RMAs will be essential during the second FRMP cycle to:

- achieve the second cycle FRMP objectives
- align with the ambitions of the government's '25 Year Environment Plan'
- align with the 'National Flood and Coastal Erosion Risk Management Strategy for England'
- better address flood risk from multiple sources
- support achieving wider environmental benefits
- support society's growth ambitions

Second cycle objectives and measures

A full list of the draft objectives is in the draft 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans'.

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

- drawn **conclusions** from the risk and hazard 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 draft FRMP, the RMAs considered several different factors. The main ones are outlined in the draft 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans'.

The Environment Agency and other RMAs will work with partners and communities to implement the measures. Not all measures in this draft FRMP have secured funding and so they're not guaranteed to be implemented. For some of these measures, RMAs can apply for Grant-in-Aid to help pay for the work. The Environment Agency administers this funding, allocating it in line with government policies and priorities.

Finding the draft 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 of the measures proposed as part of this plan. This information mainly includes:

- where the measure is
- a description of the measure and what it's 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

National level objectives and measures

There are a number of 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, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

Flood Risk Area Measures

There are 64 measures applicable to managing flood risk in the nationally identified FRAs in the South East River Basin District. This is the total number of measures in this draft FRMP. A full list of FRAs in the South East RBD can be found in the introduction of this plan. More information on how FRAs were identified can be found in the draft 'Part A: National Overview of Flood Risk Management in England for Second Cycle Flood Risk Management Plans'. The FRAs are described in the following sections.

The Canterbury Rivers and Sea FRA

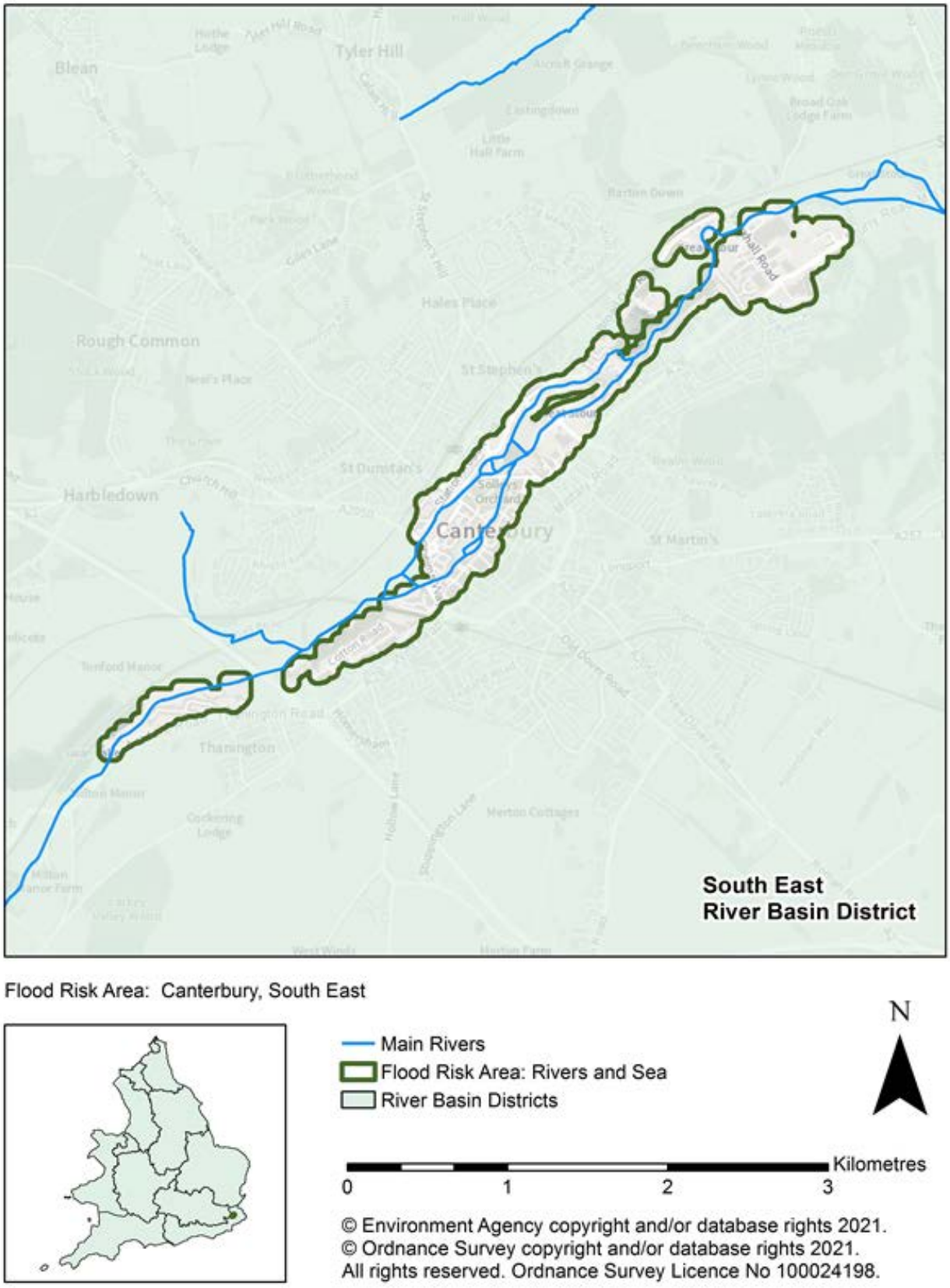


Figure 8: a map showing the boundary of the Canterbury Rivers and Sea Flood Risk Area

Introduction to the Canterbury Rivers and Sea FRA

The Canterbury Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers is significant nationally for people, the economy or the environment (including cultural heritage). This FRA is not at risk of flooding from the sea.

The primary source of flooding in this area is from the Great Stour main river which flows north-eastwards through the city. The city ranks first in England for the number of scheduled monuments at risk of flooding and thirteenth for the number of listed buildings at risk.

The Environment Agency take the lead on the development and delivery of the Flood Risk Management Plan for this FRA. Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA. Kent County Council is the Lead Local Flood Authority (LLFA) whose remit includes flood risk from ‘local’ sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The FRA is in the Stour management catchment and covers the urban areas within the floodplain of the Great Stour in Canterbury. It extends from Thanington at the upstream end to the Canterbury Wastewater Treatment Works off Sturry Road at the downstream end. The boundary of the FRA is shown on Figure 8.

Geologically, the city sits between areas of chalk to the south and London clay to the north. It’s on a central region formed mostly of Thanet Sand Formation, which is often clayey, overlaid with superficial deposits of alluvium.

The most significant fluvial flood event recorded happened in 1909, affecting many properties. There has been large scale development since that time which has increased the number of properties on the floodplain. Since 1909, there have been 9 small flood events. The most severe was in 2000/01 when the annual probability of the flood event was calculated at 5%.

Modelling has shown that areas of the city are also at risk of surface water flooding. Due to the importance of the city centre, in particular the Cathedral, road gullies and drains are cleared regularly to reduce this risk. Where flooding does occur from this source many incidents are related to high river levels on the Great Stour. Parts of Canterbury are also potentially at risk from groundwater flooding. Combined, the city is at a relatively high risk of flooding from surface water and groundwater.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Canterbury FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Canterbury FRA, 4,413 people live in areas at risk of flooding from rivers. Of these people, 38% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 265 non-residential properties
- 0.5km of A-roads
- 6ha of agricultural land
- 183 listed buildings
- part of a World Heritage Site
- Scheduled Ancient Monuments

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

The management of flood risk from rivers within the FRA is led by the Environment Agency in collaboration with other RMAs and partners. These include:

- Canterbury City Council
- Kent County Council
- Southern Water
- River Stour (Kent) Internal Drainage Board

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

Canterbury City Council monitor water levels on the Great Stour and operate sluice structures to control levels and reduce the risk of flooding. However, there remains a risk of flooding in the low-lying areas closest to the Great Stour during severe fluvial flood events.

In 2011, Southern Water completed a project to increase the capacity of the wastewater infrastructure in the city. Storm water storage tanks were constructed underground at Kingsmead Road and above ground at Canterbury Wastewater Treatment Works on the Sturry Road. A new pumping station and sewers were built to move wastewater from Kingsmead to the Canterbury Wastewater Treatment Works.

Southern Water are also developing a 'Drainage and Wastewater Management Plan' for the Stour management catchment. This will identify further opportunities to reduce flooding and improve drainage systems.

The Environment Agency continues to work with Kent County Council and Canterbury City Council to consider a range of flood risk management options between Ashford and Canterbury. The aim is to reduce the risk of fluvial flooding within the FRA and areas downstream.

There are 2 flood warning areas within the FRA for fluvial flooding. The Environment Agency monitor river levels on the Great Stour and data from here is used to decide when to issue warnings of fluvial flooding.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

The intensity of rainfall is expected to increase in the future and inland this will increase river flows. As rainfall intensity increases, surface water flooding will also become more frequent as higher rainfall totals will be seen more often.

Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Canterbury Rivers and Sea FRA

Measures have been developed that apply specifically to the Canterbury FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The City of Brighton and Hove Surface Water FRA

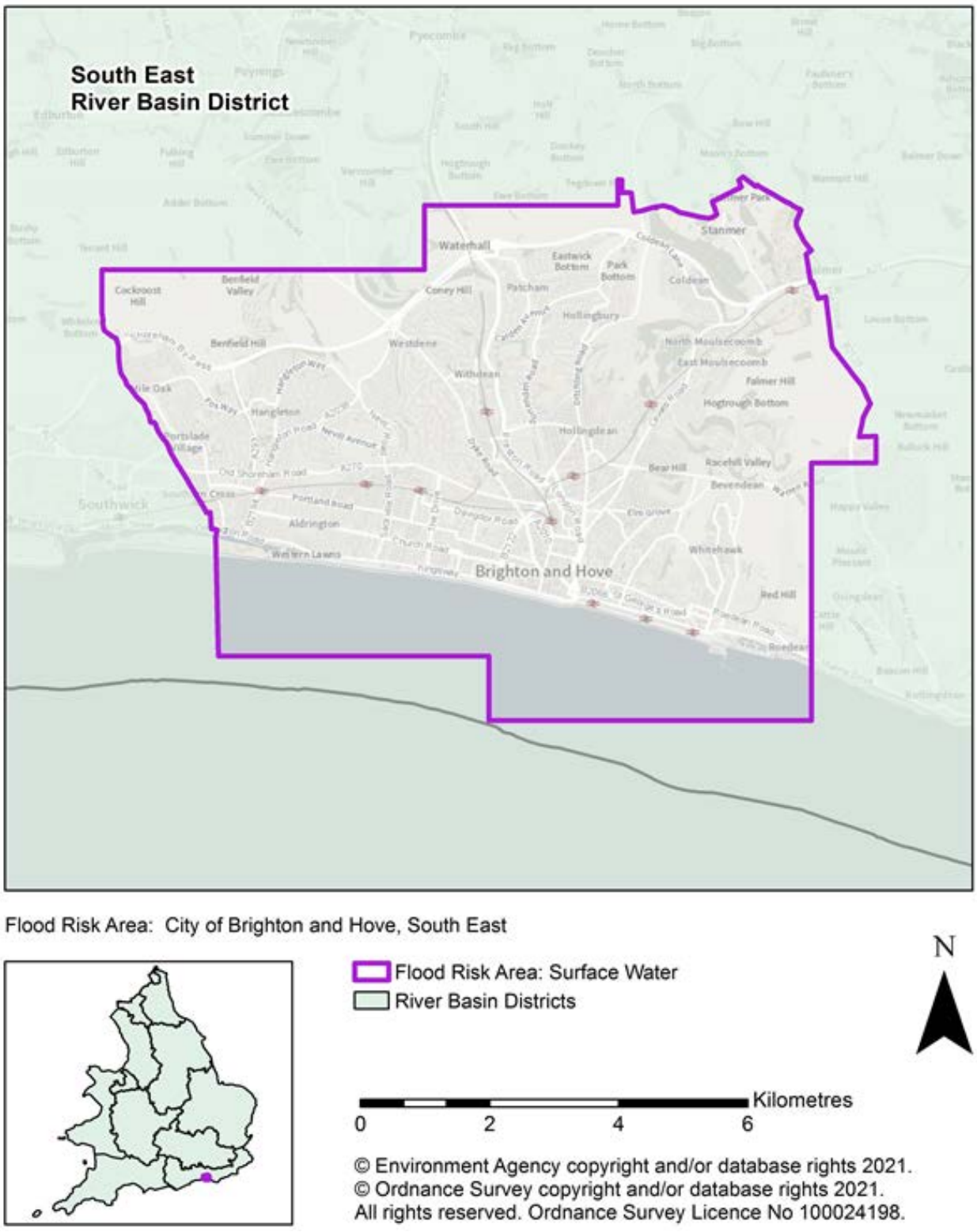


Figure 9: a map showing the boundary of the City of Brighton and Hove Surface Water Flood Risk Area

Introduction to the City of Brighton and Hove Surface Water FRA

The City of Brighton and Hove Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from surface water is significant nationally for people, the economy or the environment (including cultural heritage). This location was also identified as an FRA in the first cycle Flood Risk Management Plan (FRMP).

Brighton and Hove City Council take the lead on the development and delivery of the FRMP for this FRA. They're the Lead Local Flood Authority (LLFA) responsible for managing flood risk from 'local' sources. For Brighton and Hove, these local sources of flooding are surface water and groundwater. There are no rivers within the FRA.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The City of Brighton and Hove FRA covers the urban district of the City of Brighton and Hove. The urban area includes:

- residential
- business
- amenity

The FRA is in the Adur and Ouse management catchment. It's surrounded to the north by a green belt of farmland and the South Downs National Park. To the south of the city is 14km of coastal frontage and amenity beach. Within the FRA, there are parks and several listed buildings at risk of flooding. The boundary of the FRA is shown in Figure 9.

The geology in the FRA is extensively chalk downland, with isolated pockets of clay, silt and sand in the south-west. The chalk downland acts as an aquifer, providing the city with its main water supply. The highly permeable nature of this bedrock significantly contributes to flood risk within the FRA, through over land flow when rising groundwater levels reach the surface.

During periods of prolonged rainfall, groundwater is known to emerge in locations on the northern edge of the urban area, such as in Portslade and Patcham. A series of earth embankments provide cut-offs and diversions for the main overland routes in the northern part of the city.

Over time, development of the city has resulted in several historic watercourses being culverted and then built over. These comprise the main Victorian sewers, which continue to provide drainage routes beneath roads through the city to the coast. In the upper catchments, there are separate surface water and foul sewers. In the lower, flatter part of the catchment, the sewer system is combined. A large modern storm water tunnel, or drain, runs along the coastal frontage of the city.

The existing soakaway and sewer system can cope with rainfall events that have less than about a 3% chance of occurring each year. However, in more extreme rainfall events, it can become overwhelmed. This is a particular issue in the Preston Park area, due to the combined effects of a reduction in sewer size and low-lying ground.

Flooding is made worse when the chalk aquifer also reaches capacity, resulting in combined surface water and groundwater flooding.

The risk of flooding from the sea within the FRA is not significant.

Current flood risk

Since 2015, flooding of properties and services has occurred in isolated locations including:

- Patcham
- Portslade
- Central Hove

These areas were identified as being at risk of flooding in the first cycle FRMP and measures have since been implemented to help manage this risk.

The Flood Risk and Hazard Maps for Surface Water in England provide data on the likelihood and consequence of flooding for the City of Brighton and Hove FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Surface Water in England show that in the City of Brighton and Hove FRA, 46,293 people live in areas at risk of flooding from surface water. Of these people, 9% are in areas of high risk.

Also shown to be in areas at risk of flooding from surface water are:

- 2,571 non-residential properties
- services - including hospitals, schools and colleges and public utilities
- 9.2km of A-roads - including parts of the A27, A23 and A259
- 8km of railway
- 36ha of agricultural land
- 107 listed buildings
- parks and gardens
- water abstraction points

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Brighton and Hove City Council manage the surface water risk in collaboration with Southern Water and work with other partners including the Environment Agency.

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The long-term strategy for managing local flood risk is set out in the Brighton and Hove 'Local Flood Risk Management Strategy' and 'Surface Water Management Plan'. These can be found on the flood and drainage policies section of Brighton and Hove City Council's website and will both be updated in 2022.

Flood risk maps are published based on the outputs from mathematical modelling to inform:

- the public and business of their flood risk
- potential developers and local planning authorities
- the assessment and design of flood risk management work

In 2018, Brighton and Hove City Council introduced interim planning guidance for Sustainable Drainage Systems (SuDS) for all future development within the planning authority boundary.

Brighton and Hove City Council manage and maintain most of the permanent flood risk assets within the FRA. These include several earth embankments and open channels. Southern Water are responsible for the storm water tunnel along the coastal frontage of the city. Flood risk assets installed as part of Property Flood Resilience (or Property Level Protection) Schemes within the FRA are maintained by the homeowner.

The following flood risk improvements have been carried out in the FRA since 2015:

- 'Patcham Flood Alleviation Scheme'

- ‘Central Hove and Portslade Property Level Protection Scheme’
- ‘Warmdene Road Property Level Protection Scheme’
- ‘Carden Avenue Sustainable Drainage Systems Scheme - Phase 1’
- Wolseley Road earth embankment and drain

A potential SuDS scheme has been identified at Preston Park, by a flood risk management group comprising:

- Brighton and Hove City Council
- Southern Water
- the Environment Agency

The scheme will reduce the risk of surface water and combined sewer flooding to:

- homes
- small businesses
- transport links into the city

Southern Water are developing a ‘Drainage and Wastewater Management Plan’ for the Adur and Ouse management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

Information on groundwater levels (including at the Ladies Mile borehole) and rainfall data is collected by the Environment Agency. This data is used to issue flood warnings to a groundwater flood warning area in the Patcham area. Rainfall data is also collected at further sites across the city that are managed and maintained by the University of Brighton. This data is used by Brighton and Hove City Council to inform their flood incident response and reporting activities.

You can find more information about the routine day to day work that all LLFAs carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As rainfall intensity increases, it means that surface water flooding will become more frequent as higher rainfall totals will be seen more often. Please refer to the ‘Climate change and the South East RBD’ section for more information on what we know is likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the City of Brighton and Hove Surface Water FRA

Measures have been developed that apply specifically to the City of Brighton and Hove FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Eastbourne Surface Water FRA

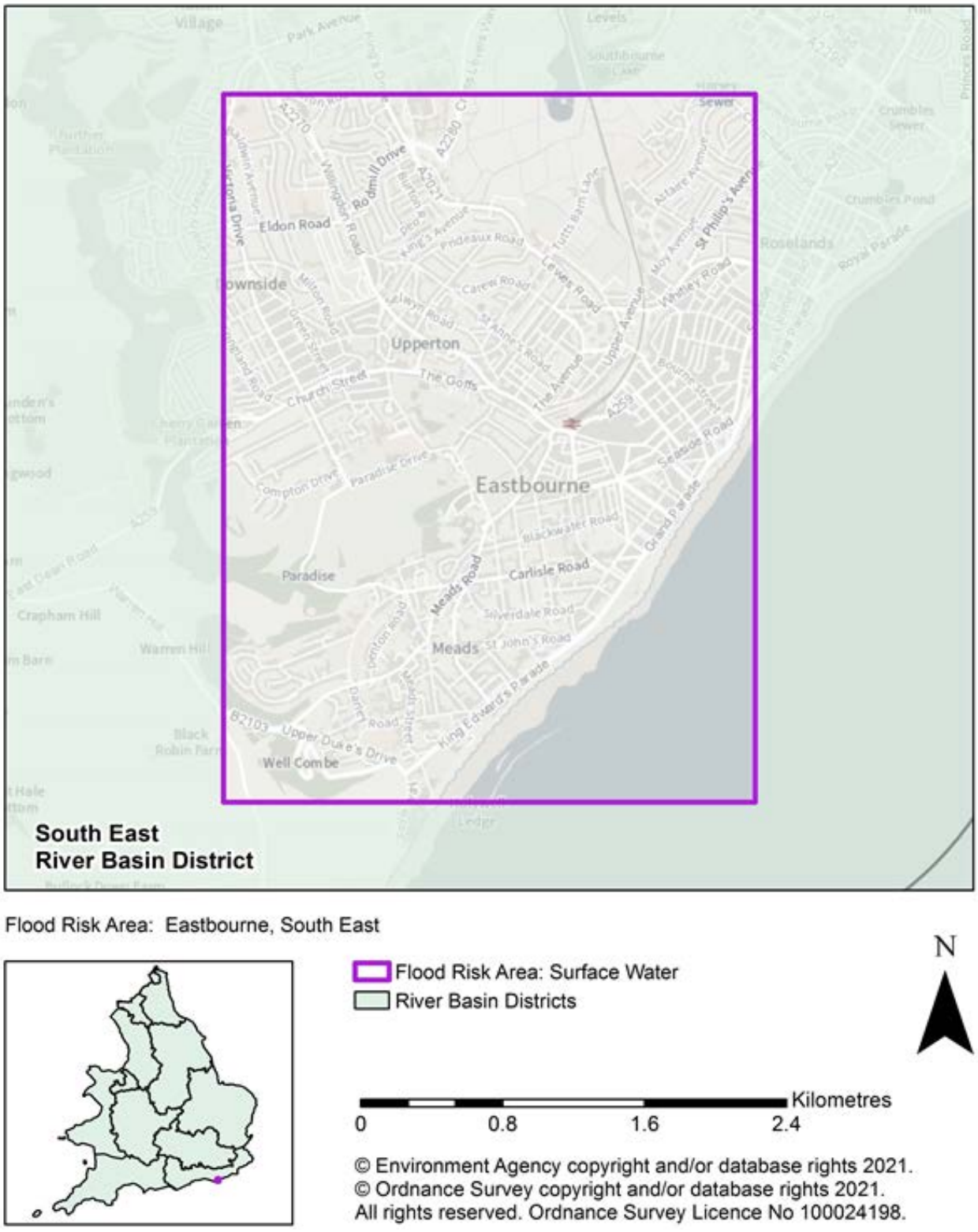


Figure 10: a map showing the boundary of the Eastbourne Surface Water Flood Risk Area

Introduction to the Eastbourne Surface Water FRA

The Eastbourne Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from surface water is significant nationally for people, the economy or the environment (including cultural heritage).

East Sussex County Council take the lead on the development and delivery of the Flood Risk Management Plan for this FRA. They're the Lead Local Flood Authority (LLFA) responsible for managing flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The Environment Agency's remit covers flood risk from rivers and the sea. Flooding from rivers and the sea in parts of Eastbourne has also been assessed as nationally significant. This is described in more detail in 'The Eastbourne and Pevensey Bay Rivers and Sea FRA' section. The rivers and sea FRA overlaps with part of the eastern end of this surface water FRA.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

Eastbourne is also partially within the Pevensey and Cuckmere Water Level Management Board area. The board maintains the most critical ordinary watercourses which are not main river and structures that control the movement of water through its drainage district.

The Eastbourne FRA is in the Cuckmere and Pevensey Levels management catchment. The boundary of the FRA is shown on Figure 10. The FRA covers the urban borough of Eastbourne, located on the lower slopes of the South Downs, which are to the west of the town. The urban area includes:

- residential
- business
- amenity

The topography of the FRA is steep in the west becoming gradually flatter moving east and along the coast. Most of the FRA is underlain by chalk which results in areas that are vulnerable to groundwater flooding. Increased urbanisation of the town has exacerbated surface water flooding that's triggered by intense rainfall. A large proportion of the urban area is low-lying with some parts being lower than sea level. This affects how easily flood water can be drained from the area.

Surface water originates in the upper reaches of the catchment to the west and north. It flows through the urban areas to the ‘Levels’ and the coast. Surface water flooding also occurs in the lower parts of Eastbourne when groundwater levels are high, adding to the overall risk.

Eastbourne town centre has been the focus of growth within the borough. This is set to continue within the emerging Eastbourne Borough Local Plan (2018 to 2038). The potential for urban extension is constrained by the:

- South Downs National Park to the north
- English Channel to the south
- areas of high flood risk

Intense urbanisation is therefore expected to continue within the borough. This will present further strain on the existing drainage system and increase the risk of surface water flooding.

The catchment of Eastbourne is heavily engineered. ‘The Eastbourne Park Scheme’ comprises 4 flood storage lakes constructed in the early 1990s to manage risk from new development. Heavy siltation of each of the 4 lakes is known to have occurred since their construction. The level of service provided by the Eastbourne Park Scheme is therefore considered to be deteriorating.

The public sewer system is vulnerable to storm events and high groundwater levels. When sewer capacity is reached, flooding can occur at critical low spots in the catchment. During high tide, outfalls such as that from the Crumbles Sewer are vulnerable to ‘tide-locking’, resulting in surface water accumulating in the upstream drainage system.

Areas along the lower sections of coast are susceptible to a combination of:

- high groundwater
- ‘tide-locking’
- a drainage system that cannot cope

This puts properties at risk of flooding. This problem will increase with sea level rise driven by climate change.

Current flood risk

Eastbourne has a long history of surface water flooding. Historic flood records identify that most flood incidents occur in the month of August highlighting the towns susceptibility to intense rainfall events.

The most notable flood event in recent years occurred on 13 August 2015, when an exceptional rainfall event coincided with a high tide. This led to ‘tide-locking’ of outfalls and the sewer and highway drainage network becoming overwhelmed, resulting in flooding at the Arndale Centre and Terminus Road.

The Flood Risk and Hazard Maps for Surface Water in England provide data on the likelihood and consequence of flooding for the Canterbury FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Surface Water in England show that in the Eastbourne FRA, 11,594 people live in areas at risk of flooding from surface water. Of these people, 13% are in areas of high risk.

Also shown to be in areas at risk of flooding from surface water are:

- 673 non-residential properties
- 22ha of agricultural land
- a few listed buildings
- a small area of a Scheduled Ancient Monument
- parks and gardens
- a water abstraction point

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

Data from flood risk maps will be further refined through planned studies as part of the South Wealden and Eastbourne Innovation Fund project. This project is described in the following section and will be used to inform flood risk management work in the FRA.

How the risk is currently managed

The strategic management of surface water flood risk is coordinated by East Sussex County Council, in collaboration with other RMAs and partners. These include:

- the Environment Agency
- Pevensey and Cuckmere Water Level Management Board
- Wealden District Council
- Eastbourne Borough Council
- Southern Water

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The long-term strategy for managing local flood risk is set out in the 'East Sussex Local Flood Risk Management Strategy' (2016 to 2026).

The 2011 'Eastbourne Surface Water Management Plan' provides a preliminary understanding of surface water risk and identifies potential mitigation options. These include:

- kerb raising
- diversion of surface water sewers
- surface water storage areas

East Sussex County Council continues to work with developers to ensure appropriate use of sustainable drainage systems (SuDS), encouraging all developments to use SuDS to manage flood risk and improve:

- water quality
- the local environment
- wildlife habitats

An integrated hydraulic model with Southern Water's sewer model was developed for the Bourne Stream catchment in 2015 to better understand the system. Options for separating surface water from the public sewer network are currently being investigated to reduce flood risk. This work is being led by East Sussex County Council in partnership with:

- Eastbourne Borough Council
- Southern Water
- the Environment Agency

Multiple sources of flood risk are present in the FRA. Partnership working is essential to provide integrated, dynamic management solutions. East Sussex County Council has been successful as one of 25 project areas to secure funds under Defra's £150 million innovation fund. The proposed 'Dynamic Flood Risk Management' project will focus upon Southern Wealden and Eastbourne over a 6 year programme.

The project will provide a better understanding of how the catchment works across all sources of flood risk. This will be led by East Sussex County Council in partnership with the following RMAs, and supported by expertise from the University of Exeter:

- Environment Agency
- Pevensey & Cuckmere Water Level Management Board
- Eastbourne Borough Council
- Wealden District Council
- Southern Water

The project will provide the evidence necessary to:

- develop a strategic approach to catchment management
- inform development planning
- improve the efficiency of asset operation and maintenance
- establish a framework for adaptation for communities and RMAs

One of the aims of the innovation project is to introduce live and automated procedures for:

- operation
- monitoring
- response

Systems that are integrated across the different sources of flood risk within the catchment will help to increase the resilience of communities at risk within the FRA.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Cuckmere and Pevensey Levels management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As rainfall intensity increases, it means that surface water flooding will become more frequent as higher rainfall totals will be seen more often.

Please refer to the ‘Climate change and the South East RBD’ section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Eastbourne Surface Water FRA

Measures have been developed that apply specifically to the Eastbourne FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Eastbourne and Pevensey Bay Rivers and Sea FRA

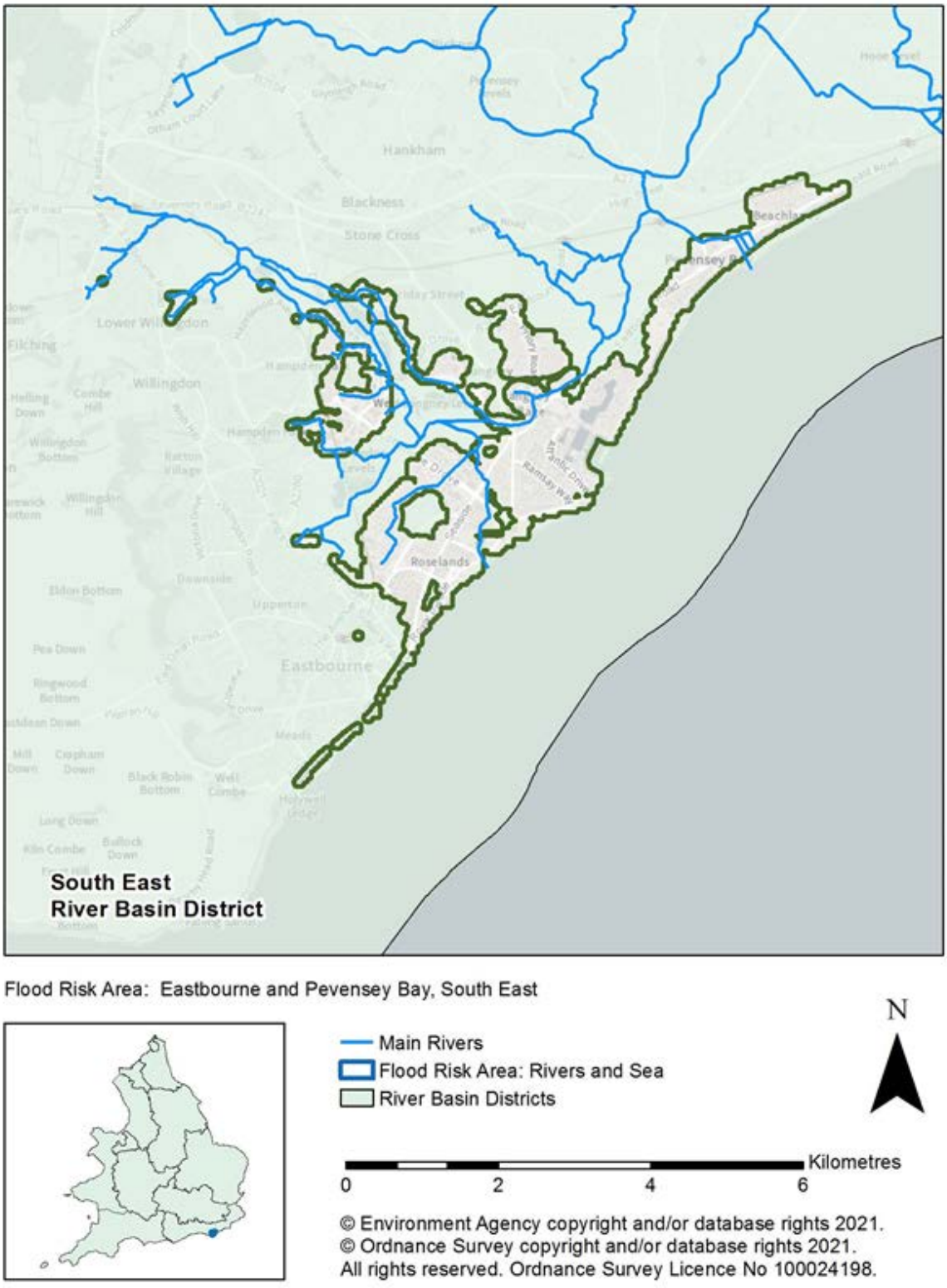


Figure 11: a map showing the boundary of the Eastbourne and Pevensey Bay Rivers and Sea Flood Risk Area

Introduction to the Eastbourne and Pevensey Bay Rivers and Sea FRA

The Eastbourne and Pevensey Bay Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for this FRA.

East Sussex County Council are the Lead Local Flood Authority (LLFA), whose remit includes flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The risk of surface water flooding in the town of Eastbourne has also been assessed as nationally significant. This is described in more detail in 'The Eastbourne Surface Water FRA' section. The surface water FRA overlaps with small parts of the south-western end of this rivers and sea FRA.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Eastbourne and Pevensey Bay FRA is in the Cuckmere and Pevensey Levels management catchment. The boundary of the FRA is shown on Figure 11. It covers many of the urban districts of Eastbourne and Pevensey Bay. These areas include:

- residential
- business
- amenity
- important road and rail infrastructure

The flat topography in the FRA means that many of these areas are at risk of flooding from the sea.

The river network in the FRA is also complex because of this flat topography. All surface water not entering the combined sewer network is transported through various watercourses to eventually discharge into the sea. In the northern part of the FRA, the Horsey Sewer and Langney Haven flow into the Salt Haven and then to the sea outfalls at Pevensey Bay. In the southern part of the FRA, the Crumbles Sewer discharges to the sea through the Crumbles Outfall. Each of these sea outfalls have tidal gates which close to prevent high tides moving up the rivers. This results in 'tide-locking' which increases the risk of localised fluvial flooding in some very low-lying parts of Eastbourne.

Drainage of the river network in the low-lying parts of the FRA can be slow and challenging to maintain. Weed-cutting, including the removal of dense invasive vegetation, is important to ensure the capacity in the watercourses is maximised. In recent years there has been a significant increase in the growth of pennywort, a non-native invasive species of weed, in the watercourses in the FRA. This primarily occurs on the Pevensey Levels but is now spreading into the Langney Haven and the Crumbles Sewer.

To the north and east of the FRA is an area of low-lying marshes known as the Pevensey Levels. This area is designated as a:

- Site of Special Scientific Interest
- Special Area of Conservation
- Ramsar site

Parts of these sites are also within a National Nature Reserve. Existing coastal defences, including those within this FRA, protect parts of these sites from flooding from the sea.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Eastbourne and Pevensey Bay FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Eastbourne and Pevensey Bay FRA, 33,016 people live in areas at risk of flooding from rivers and the sea. Of these people, 10% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 924 non-residential properties - including industrial estates
- services, including East Sussex fire and rescue depot, Area Police Headquarters, numerous medical centres and schools
- 1.8km of A-roads - including the parts of the A22 and A2290
- 1.8km of railway
- 131ha of agricultural land
- areas under national and international designations for nature conservation
- listed buildings
- part of a Scheduled Ancient Monument
- a water abstraction point

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'South Foreland to Beachy Head Shoreline Management Plan'.

The management of flood risk from rivers and the sea is led by the Environment Agency in collaboration with other RMAs and stakeholders. These include:

- Eastbourne Borough Council
- East Sussex County Council
- Southern Water
- Wealden District Council
- the Pevensey and Cuckmere Water Level Management Board

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

At present the low-lying areas are protected from flooding and coastal erosion by existing coastal defences along the entire frontage of the FRA. Responsibility for these defences is divided into 2 main parts.

The Environment Agency manage those defences to the north of Sovereign Harbour. These were implemented in 2000 under the 'Pevensey Bay Sea Defence Scheme'. This was the first sea defences project in the world to be funded as a Public Finance Initiative. The contract with Pevensey Coastal Defence Limited ensures that residents and the internationally designated sites are guaranteed a consistent standard of protection until 2025.

In their role as Coast Protection Authority, Eastbourne Borough Council manage those defences to the south of the harbour under the Coast Protection Act 1949. A post-2025 project to assess the standard of service and seek to unify both the Pevensey and

Eastbourne frontages is currently being progressed. Premier Marinas manage the defences around the harbour itself.

Weed-cutting is undertaken by the Environment Agency to help manage flood risk in the low-lying parts of the FRA. Clearance of non-native invasive weeds is also beneficial for the environment.

The Environment Agency continues to pursue Natural Flood Management in the upland parts of the area such as Polegate. This will help to identify projects that can help offset peak flows within the FRA.

Tidal forecasts are created by the Flood Forecasting Centre, using data from the Eastbourne tidal gauge. River level and rainfall data is collected on the Langney Haven by the Environment Agency. This information is used by the Environment Agency to issue flood warnings to 4 coastal and one fluvial flood warning areas in the FRA. The Environment Agency continues to investigate launching new flood warning areas in currently unserviced areas.

Multiple sources of flood risk are present in the FRA. Partnership working is therefore essential to provide integrated, dynamic management solutions. East Sussex County Council has been successful as one of 25 project areas to secure funds under Defra's £150 million innovation fund.

The proposed 'Dynamic Flood Risk Management' project will focus on Southern Wealden and Eastbourne, which covers large parts of this FRA. The work will run over a 6 year programme to provide a better understanding of how the catchment works across all sources of flood risk. This will be led by East Sussex County Council in partnership with the following RMAs, and supported by expertise from the University of Exeter:

- Environment Agency
- Pevensey & Cuckmere Water Level Management Board
- Eastbourne Borough Council
- Wealden District Council
- Southern Water

The project will provide the evidence necessary to:

- develop a strategic approach to catchment management
- inform development planning
- improve the efficiency of asset operation and maintenance
- establish a framework for adaptation for communities and RMAs

One of the aims of the innovation project is to introduce live and automated procedures for:

- operation
- monitoring
- response

Systems that are integrated across the different sources of flood risk within the catchment will help to increase the resilience of communities at risk within the FRA.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Cuckmere and Pevensey Levels management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

The topography and location of the Eastbourne and Pevensey Bay FRA means that it'll always be exposed to flood risk from the sea. As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. Higher tide levels will also result in more frequent 'tide-locking' which is likely to inhibit drainage of fluvial watercourses on a more regular basis. Rainfall intensity is expected to increase in future which will also cause river flows to increase.

Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Eastbourne and Pevensey Bay Rivers and Sea FRA

Measures have been developed that apply specifically to the Eastbourne and Pevensey Bay FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Hastings Rivers and Sea FRA

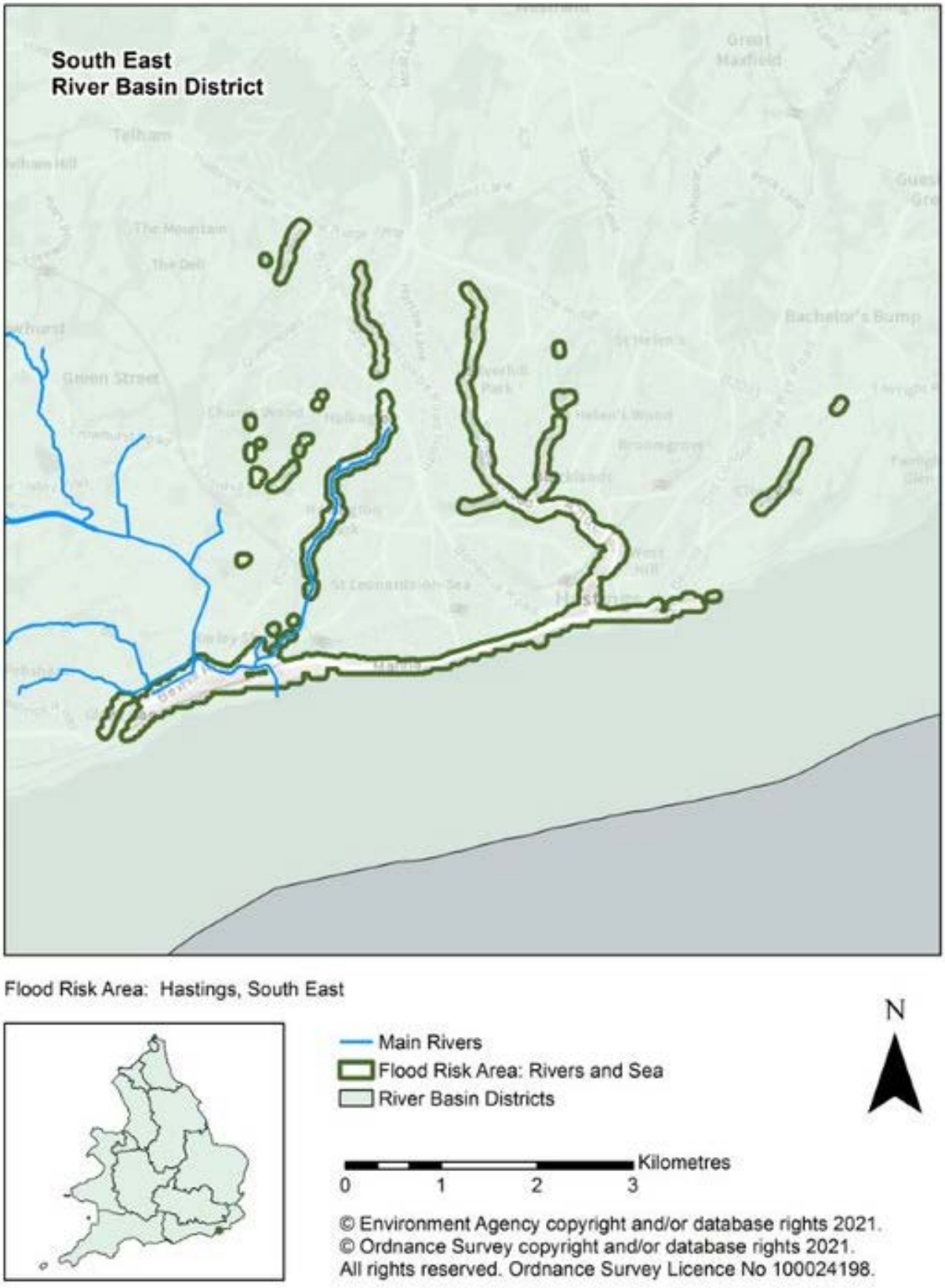


Figure 12: a map showing the boundary of the Hastings Rivers and Sea Flood Risk Area

Introduction to the Hastings Rivers and Sea FRA

The Hastings Rivers and Sea Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for this FRA.

East Sussex County Council are the Lead Local Flood Authority (LLFA), whose remit includes flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The risk of surface water flooding in the town of Hastings has also been assessed as nationally significant. This is described in more detail in 'The Hastings Surface Water FRA' section. The surface water FRA overlaps with small parts of the southern end of this rivers and sea FRA.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Hastings Rivers and Sea FRA is in the Cuckmere and Pevensey Levels management catchment. The boundary of the FRA is shown in Figure 12. The FRA covers many of the urban districts of:

- Hastings
- St Leonards-on-Sea
- Bulverhythe

These areas include:

- residential
- business
- amenity
- important road and rail infrastructure

The steep topography in the north of the FRA means that many of these areas are at risk of flooding from the upper catchment from the:

- fast-rising Hollington Stream and Combe Haven main rivers to north-west

- Priory Stream (Alexandra Park) and Old Roar Gill ordinary watercourses to the north-east
- Bourne Stream ordinary watercourse to the east

Localised flooding also occurs through ‘tide-locking’ of the outfalls on the coast at the lower end of the catchments. This is a particular issue upstream of the Bulverhythe Outfall where the Combe Haven catchment drains to the sea.

Large areas of development along the coastal frontage are at risk of flooding from the sea. This includes:

- amusements
- car parks
- roads
- a section of mainline railway in the south-west of the FRA

Coastal defences are present along most of the frontage of the FRA. Hastings’ main amenity beach forms part of this system.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Hastings Rivers and Sea FRA. This data is from 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Hastings Rivers and Sea FRA, 3,384 people live in areas at risk of flooding from rivers and the sea. Of these people, 14% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 443 non-residential properties - including industrial estates, churches and the Priory Meadow shopping centre
- services - including schools
- 2.7km of trunk roads including the A259 and A21
- 1.5km of railway
- 1.3ha of agricultural land
- areas under national and international designations for nature conservation
- listed buildings
- parks and gardens

- bathing water area

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'South Foreland to Beachy Head Shoreline Management Plan'.

The management of flood risk from rivers and the sea is led by the Environment Agency in collaboration with other RMAs and stakeholders. These include:

- Hastings Borough Council
- Rother District Council
- East Sussex County Council
- Southern Water

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The Hollington Stream is classed as a rapid response river by the Environment Agency. Cameras have therefore been positioned in critical areas, such as at weed-screens (or grilles), to enable a targeted response in times of heavy rainfall. Grille clearance is a particularly important action in the management of flood risk from this river to prevent culvert blockages and maintain flow through residential areas.

The Combe Haven, with a catchment of over 5,150ha, receives flows from several tributaries mostly located outside the FRA. This watercourse can also become 'tide-locked' which can prevent drainage of the lower catchment through the Bulverhythe outfall. During periods of heavy rain and high tides, tide levels and weed screens are closely monitored to ensure a timely response.

The Environment Agency continues to pursue Natural Flood Management in the upland parts of the Combe Haven catchment. This will help to identify projects that can help offset peak flows within the FRA.

Hastings' main amenity beach provides protection to the highway and building infrastructure, including the proposed new development at Pelham Place. Works were undertaken between 2016 and 2020 to maintain and improve the sea defences. This reduced the risk of flooding from the sea to a 0.5% chance each year. The improvements also protect the Fisherman's Beach, east of the 'harbour arm', from the prevailing south westerly waves.

At Bulverhythe, a £6 million scheme was completed in 2006 to improve protection from coastal flooding to:

- nearly 800 residential properties
- 80 businesses
- the railway lines
- the A259

The scheme involved building rock revetment along the most vulnerable part of the coastline between Galley Hill and West Marina Gardens. The adjacent beaches were also raised and widened with imported shingle. The Environment Agency continues to undertake beach management along this section of the coast.

The remainder of the frontage between Bulverhythe and Hastings pier are monitored and regularly maintained as required by Hastings Borough Council. This is in their role as Coast Protection Authority, under the Coast Protect Act 1949.

Tidal forecasts are created by the Flood Forecasting Centre, using data from the Eastbourne tidal gauge. River level and rainfall data is collected on the Combe Haven and Hollington Stream by the Environment Agency. This information is used by the Environment Agency to issue flood warnings to 2 coastal and one fluvial flood warning areas in the FRA. The Environment Agency continues to investigate launching new flood warning areas in currently unserviced areas.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Cuckmere and Pevensey Levels management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. Higher tide levels will also result in more frequent ‘tide-locking’ which is likely to inhibit drainage of fluvial watercourses on a more regular basis. Rainfall intensity is expected to increase in future which will cause river flows to increase.

Please refer to the ‘Climate change and the South East RBD’ section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Hastings Rivers and Sea FRA

Measures have been developed that apply specifically to the Hastings Rivers and Sea FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Hastings Surface Water FRA

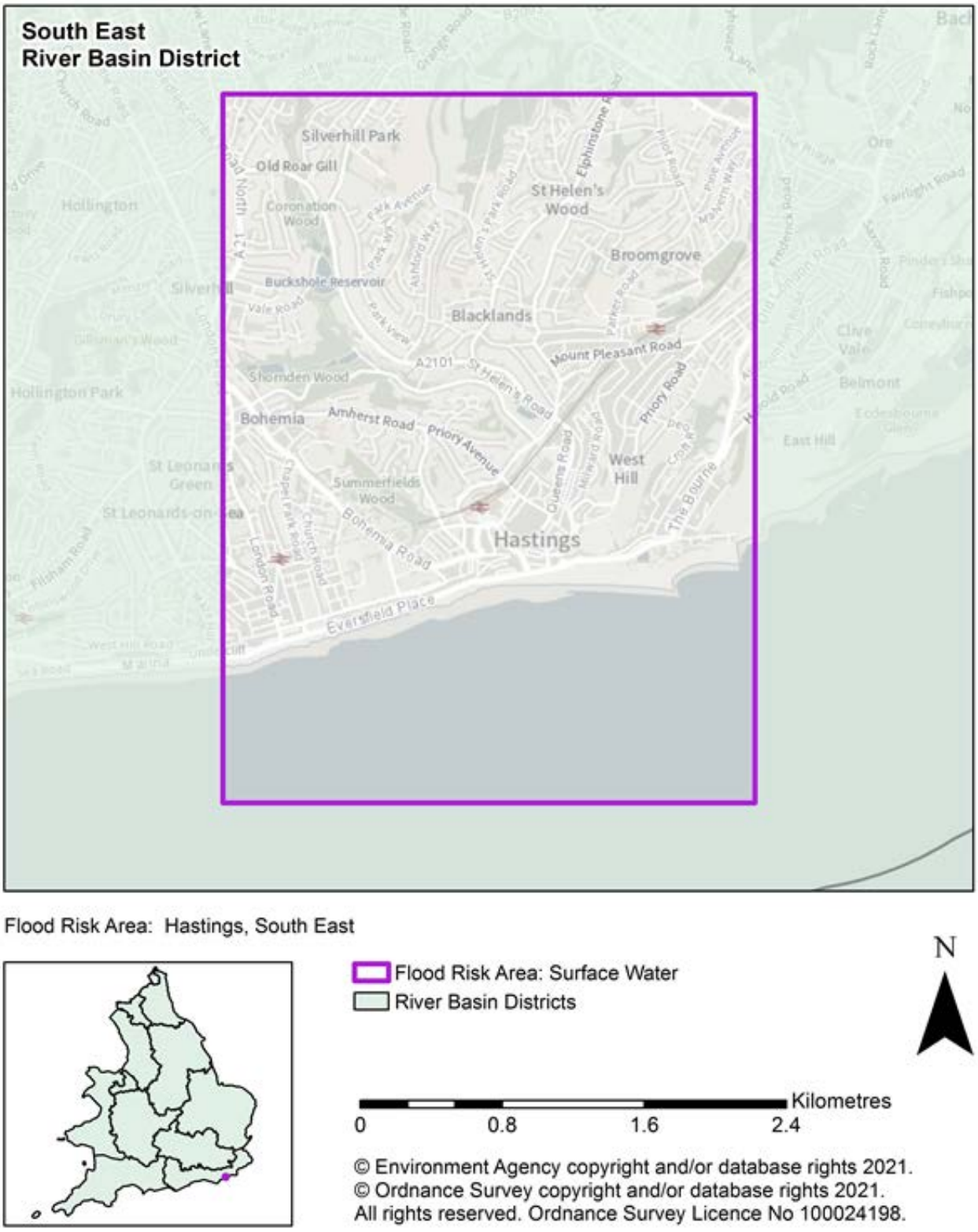


Figure 13: a map showing the boundary of the Hastings Surface Water Flood Risk Area

Introduction to the Hastings Surface Water FRA

The Hastings Surface Water Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from surface water is significant nationally for people, the economy or the environment (including cultural heritage).

East Sussex County Council take the lead on the development and delivery of the Flood Risk Management Plan for this FRA. They're the Lead Local Flood Authority (LLFA) responsible for managing flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The Environment Agency's remit covers flood risk from rivers and the sea. Flooding from rivers and the sea in parts of Hastings has also been assessed as nationally significant. This is described in more detail in 'The Hastings Rivers and Sea FRA' section. The rivers and sea FRA overlaps with discrete parts of this surface water FRA.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Hastings Surface Water FRA is in the Cuckmere and Pevensey Levels management catchment. The FRA covers the urban borough of Hastings situated on the coast. The boundary of the FRA is shown on Figure 13.

Most of the borough is densely developed, with levels of urbanisation in the central southern part of the FRA matching some central London boroughs. The shoreline is characterised by human intervention and coastal defence to provide protection from flooding and coastal erosion. Areas to the north-west and south-east are more rural and are part of the High Weald Area of Outstanding Natural Beauty. Further development is proposed within Hastings, particularly within the town centre and Bohemia area.

Hastings is characterised by complex geology and topography which varies significantly over a short distance. The catchment for the central part of Hastings, known as Hastings Central, is surrounded by the steep topography of the High Weald. This causes significant overland flow and associated risk of surface water flooding. In Hastings Central, land slopes steeply towards the Priory Stream (also known as the Alexandra Park stream), a deeply incised, steep watercourse, before flattening out in Alexandra Park. This park is flat through the centre of Hastings with land rising again before reaching the sea front.

The St Leonards Warrior Square catchment slopes steeply down towards the sea front. Within this catchment a broad valley exists before opening within Warrior Square Gardens and on towards the sea front.

Surface water risk is highly influenced by topography. The steep topography of the catchment results in fast overland flow which leads to significant amounts of surface water collecting on the lower ground. High risk areas within Hastings are associated with areas of locally low topography, including the valley lines of the watercourse network.

The geology of Hastings is very variable with Wadhurst Clay, Ashdown Formation and the Tunbridge Wells Sand formations underlying the town centre. Alluvium deposits found in the south-western tip can present a groundwater risk, particularly where deposits are thin.

Surface water risk often occurs in combination with high river flows or high tide levels (or both), which restrict surface water drainage. In particular, outfalls to the sea can become ‘tide-locked’ during high tides. Hastings is also susceptible to elevated groundwater. High groundwater levels and resultant spring flows along the coastal strip can be influenced by the tide which further increases the risk. As the sewer system is largely combined, such issues can also contribute to sewer flood risk. Climate change is expected to further increase flood risk in the FRA.

The Hollington Stream is mostly culverted throughout the borough. Part of the outfall from this watercourse at Denmark Place was damaged during winter storms in 2017/18. Options for its repair or replacement are being looked at as part of the ongoing ‘Hastings Flood Alleviation Scheme’ study.

The Hastings sewer network is primarily a public combined sewer taking both surface and foul water. The northern parts of Hastings have separate surface and foul water systems having been constructed more recently.

In the late 1990s to early 2000s, Southern Water constructed a large, combined relief tunnel across Hastings to collect combined sewage from the town. The tunnel runs to a pumping station at Warrior Square Gardens. It provides flood relief by storing combined sewage in heavy rainfall events and improves bathing water quality on the Hastings seafront.

Current flood risk

In Hastings, most surface water flooding incidents are located in the town centre. This is the lowest point within the catchment, prior to land rising to up again to the sea front. Many are as result of combined or foul sewer flooding and water pooling on the highway.

The most significant event occurred on 10th December 2017 and primarily affected the Denmark Place area. Water was reported to have flowed down Albert Road onto Denmark

Place and along Pelham Street to the town centre. At the time of flooding, it was noted that the Denmark Place Outfall was ‘tide-locked’.

The Flood Risk and Hazard Maps for Surface Water in England provide data on the likelihood and consequence of flooding for the Hastings Surface Water FRA. This data is from 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Surface Water in England show that in the Hastings Surface Water FRA, 9,070 people live in areas at risk of flooding from surface water. Of these people, 17% are in areas of high risk.

Also shown to be in areas at risk of flooding from surface water are:

- 671 non-residential properties
- 3.9km of A-roads
- 1.8km of railway
- listed buildings
- a small area of a Scheduled Ancient Monument
- parks and gardens

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

The strategic management of surface water flood risk is coordinated by East Sussex County Council, in collaboration with other RMAs and partners. These include:

- the Environment Agency
- Hastings Borough Council
- Southern Water

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that’s:

- efficient
- targeted
- risk-based

The long-term strategy for managing local flood risk is set out in the 'East Sussex Local Flood Risk Management Strategy' (2016 to 2026).

The 2011 Hastings 'Surface Water Management Plan' included possible measures for mitigating surface water flood risk, such as seeking opportunities to:

- introduce borough-wide education and flood resilience measures
- retrofit sustainable drainage systems (SuDS)
- reduce the risk of surface water flooding on critical infrastructure

A surface water flood study was commissioned for Hastings in 2018 to understand and more accurately model and map the flood risk within the town. This study is currently being used as a baseline to design schemes to alleviate surface water flooding in Hastings. For example, the Hastings Flood Alleviation Scheme is currently investigating options for a new outfall at Denmark Place.

East Sussex County Council continues to work with developers to ensure appropriate use of SuDS, encouraging all developments to use SuDS to manage flood risk and improve:

- water quality
- the local environment
- wildlife habitats

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Cuckmere and Pevensey Levels management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As rainfall intensity increases, it means that surface water flooding will become more frequent as higher rainfall totals will be seen more often.

Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East RBD.

Objectives and measures for the Hastings Surface Water FRA

Measures have been developed that apply specifically to the Hastings Surface Water FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Herne Bay Rivers and Sea FRA

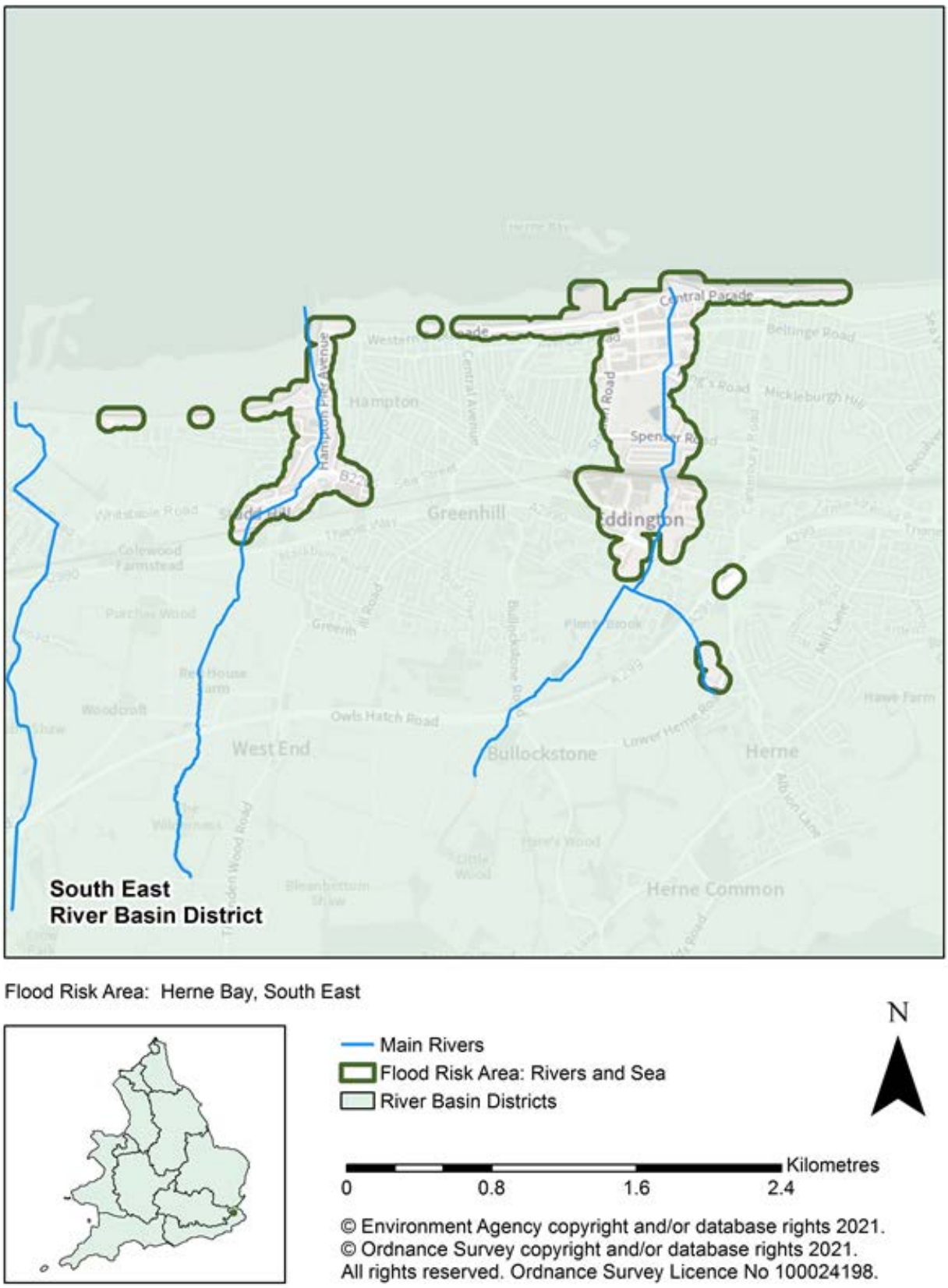


Figure 14: a map showing the boundary of the Herne Bay Rivers and Sea Flood Risk Area

Introduction to the Herne Bay Rivers and Sea FRA

The Herne Bay Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The primary source of flood risk in the FRA is from the sea. There is also a risk of flooding from the 2 main rivers which flow across the area, the:

- West Brook
- Plenty Brook

These are collectively known as the Oyster Coast Brooks, along with those in the Whitstable FRA. The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for the Herne Bay FRA.

The coastal frontage and defences are managed by Canterbury City Council in their role as Coast Protection Authority, under the Coast Protection Act 1949. Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Environment Agency is responsible for managing the risk of flooding from the main rivers. Kent County Council is the Lead Local Flood Authority (LLFA) whose remit includes flood risk from ‘local’ sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The FRA is in the Stour management catchment and is largely in 2 parts. These run inland along the line of the 2 main rivers to Studd Hill on the West Brook and Eddington on the Plenty Brook. The more easterly of the 2 extends along the coast in each direction. The boundary of the FRA is shown on Figure 14.

The area is largely urban with the western and eastern edges of the coastline protected by national and international nature conservation designations. The railway line to Margate runs across the southern edges of the FRA.

The town has substantial coastal defences along its entire frontage including an offshore granite breakwater known as Neptune’s Arm. This was built in 1992 to protect against wave action.

The Plenty Brook rises near Herne and flows north passing under the railway embankment via a culvert. North of the railway it remains culverted until it reaches its outfall at the sea. The limited capacity of the culvert and associated sewers used to cause serious problems

in the Eddington area to the south. Improvements upstream have helped to reduce the pressure on the system and flooding has become less frequent and less severe.

The West Brook is largely rural but can present a risk of flooding when high tides stop the brook from discharging to the sea. This is known as ‘tide-locking’.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Herne Bay FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Herne Bay FRA, 2,481 people live in areas at risk of flooding from rivers and the sea. Of these people, 49% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 163 non-residential properties
- 0.1km of A-road - the A299 Thanet Way is vulnerable to overtopping and acts as a flow route
- 7ha of agricultural land
- listed buildings
- areas under national and international designations for nature conservation

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future and current impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the ‘Isle of Grain to South Foreland Shoreline Management Plan’.

The management of flood risk from rivers and the sea within the FRA is led by the Environment Agency in collaboration with other RMAs and partners. These include:

- Canterbury City Council
- Southern Water
- Kent County Council

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and

coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The coastal defences are maintained and operated by Canterbury City Council. Improvement works in 2013 increased the standard of protection on the frontage to a 0.5% chance of flooding occurring each year. Canterbury City Council shut tidal gates at the outfalls of the West Brook and Plenty Brook during times of high tidal surges. This stops the sea entering the watercourses.

Following these improvements, the main risk of flooding is now from 'tide-locking' or from the failure of pumps on the surface and sewage water system. Southern Water has made various improvements to reduce this risk on the Plenty Brook, including extending a reservoir at Eddington and creating balancing ponds upstream.

Southern Water are also developing a 'Drainage and Wastewater Management Plan' for the Stour management catchment. This will identify further opportunities to reduce flooding and improve drainage systems.

There are 2 flood warning areas within the FRA, one for fluvial flooding and one for coastal flooding. The Environment Agency monitor river levels on the West Brook and data from here is used to decide when to issue warnings of fluvial flooding. Coastal warnings are issued based on data from the Sheerness tidal gauge and tidal forecasts from the Flood Forecasting Centre. The Sheerness gauge is managed by the Environment Agency's Thames Tidal Defences team. The Environment Agency continues to investigate launching new flood warning areas in currently unserviced areas.

There are no raised fluvial defences along the 2 brooks. There has been significant development in the upper catchment of the Plenty Brook. The Environment Agency therefore needs to re-assess their modelled data and investigate the need for flood defence improvements along this watercourse. The only concern currently on the West Brook is a length of culvert that serves no purpose. The Environment Agency plans to investigate the potential benefits of removing this culvert.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. Higher tide levels will also result in more frequent ‘tide-locking’ which is likely to inhibit drainage of fluvial watercourses on a more regular basis.

The intensity of rainfall is also expected to increase in the future and inland this will increase river flows.

Please refer to the ‘Climate change and the South East RBD’ section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Herne Bay Rivers and Sea FRA

Measures have been developed that apply specifically to the Herne Bay FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Hythe Rivers and Sea FRA

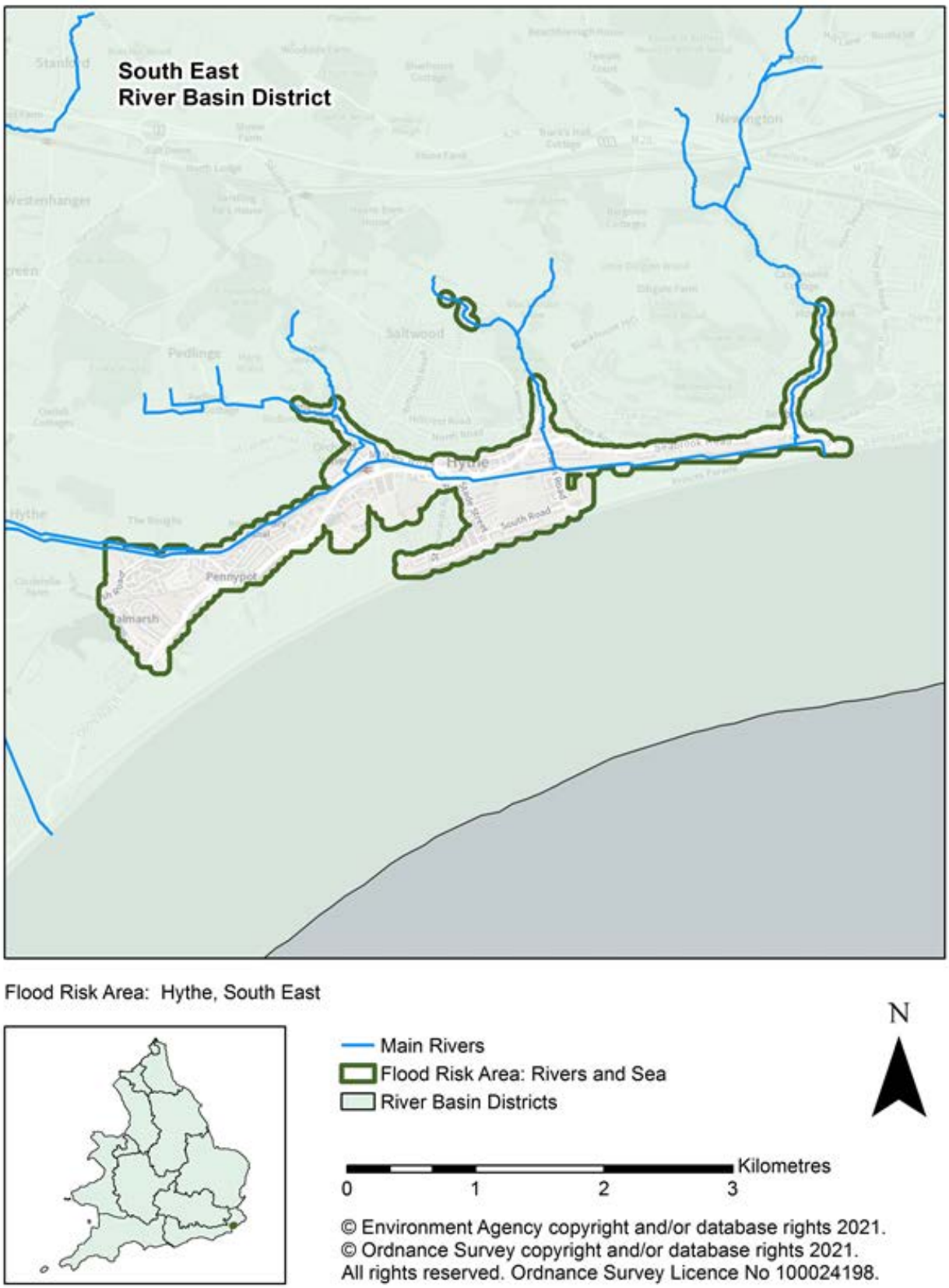


Figure 15: a map showing the boundary of the Hythe Rivers and Sea Flood Risk Area

Introduction to the Hythe Rivers and Sea FRA

The Hythe Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The primary source of flood risk in the FRA is from the sea but there is also a significant risk of flooding from the following main rivers:

- Brockhill Stream
- Mill Leese and Saltwood Stream
- Seabrook Stream

These flow into the Royal Military Canal which discharges into the sea via the Seapoint Outfall and is also designated as main river. The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for this FRA.

From West Parade, in an eastward direction, the coastal frontage and defences are managed by Folkestone & Hythe District Council. This is in their role as Coast Protection Authority, under the Coast Protection Act 1949. The Environment Agency manages the risk of flooding from main rivers. They also maintain the coastal defences along the Hythe Ranges to the west and at Fishermans Beach.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA. Kent County Council is the Lead Local Flood Authority (LLFA), whose remit includes flood risk from ‘local’ sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The FRA is in the Rother management catchment. It follows the line of the Royal Military Canal from Burmarsh in the west to the Seapoint outfall in the east. The FRA extends inland along the 3 main river tributary streams and down to the coast to encompass areas around:

- West Parade
- Stade Street
- Twiss Road

The boundary of the FRA is shown on Figure 15.

Hythe is the second largest town within the Folkestone & Hythe district and the FRA is largely urban. The Hythe Ranges and sections of the Royal Military Canal within the FRA are both designated as local wildlife sites.

The western part of the FRA is part of the Romney Marshes, a broad low-lying expanse of historically reclaimed land. The Marshes rely on a continuous line of coastal defences extending west to Camber. For much of their length, these defences protect against coastal flood events that have up to a 0.5% chance of occurring each year. These defences are largely engineered sea wall but at the Hythe Ranges and in other locations shingle beaches are managed to provide protection. East of Fishermans Beach to the Seapoint Outfall the town is protected by a shingle beach and seawall maintained by Folkestone & Hythe District Council.

The 3 streams drain the largely rural catchments of the North Downs to the north of Hythe. They flow from permeable sandstone or chalk down to clay and then mudstone. The steep upper catchments are a significant contributing factor to the flood risk in the FRA.

As it crosses the marsh, the Royal Military Canal is divided into 3 sections by dams with culverts and sluice gates built into them. These allow control of the water level in the canal. The section of the canal which flows through Hythe begins at the West Hythe Dam, about a mile and a half west of Burmarsh. At its easternmost point it drains into the sea through the Seapoint Outfall when tidal conditions are favourable.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Hythe FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Hythe FRA, 7,777 people live in areas at risk of flooding from rivers and the sea. Of these people, 27% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 290 non-residential properties
- 4.7km of A-roads
- 15ha of agricultural land
- listed buildings
- a Scheduled Ancient Monument

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'South Foreland to Beachy Head Shoreline Management Plan'.

The management of flood risk from rivers and sea within the FRA is led by the Environment Agency in collaboration with other RMAs and partners. These include:

- Folkestone and Hythe District Council
- Southern Water
- Romney Marshes Area Internal Drainage Board

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

Work was completed in March 2021 to improve the flood defences on Hythe Ranges and Fishermans Beach, refurbishing the timber groynes and recharging the shingle. These improvements are designed to protect against coastal flood events with a 0.5% chance of occurring each year. The defences on the Hythe Ranges are owned by the Ministry of Defence and maintained by the Environment Agency.

Sea defences east of Fishermans Beach and to Seapoint Outfall comprise of a shingle beach and a sea wall which protects against a 0.5% chance of flooding each year. Rock groynes help to retain shingle on the frontage. The defences are owned and maintained by Folkestone and Hythe District Council.

At the top of the Mill Leese and Saltwood Stream, on the eastern branch, a flood storage area was constructed by Shepway District Council in 1999. Flow entering a culvert through a disused railway embankment is restricted and water is stored in the valley above. This reduces flood risk to central areas of Hythe. Responsibility for maintenance and operation of this flood storage area transferred to the Environment Agency in 2005, when the Saltwood Stream became a main river.

Water levels on the Royal Military Canal are managed by the Environment Agency who also maintain and operate the Seapoint Outfall.

An investigation is planned into flood risk management options in the area.

There is one flood warning area within the FRA for coastal flooding. Coastal warnings are issued based on data from the Dover tidal gauge which is owned and operated by the Environment Agency and tidal forecasts from the Flood Forecasting Centre.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Rother management catchment. This will identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. The intensity of rainfall is also expected to increase in the future and inland this will increase river flows.

Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Hythe Rivers and Sea FRA

Measures have been developed that apply specifically to the Hythe FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Portsmouth Rivers and Sea FRA

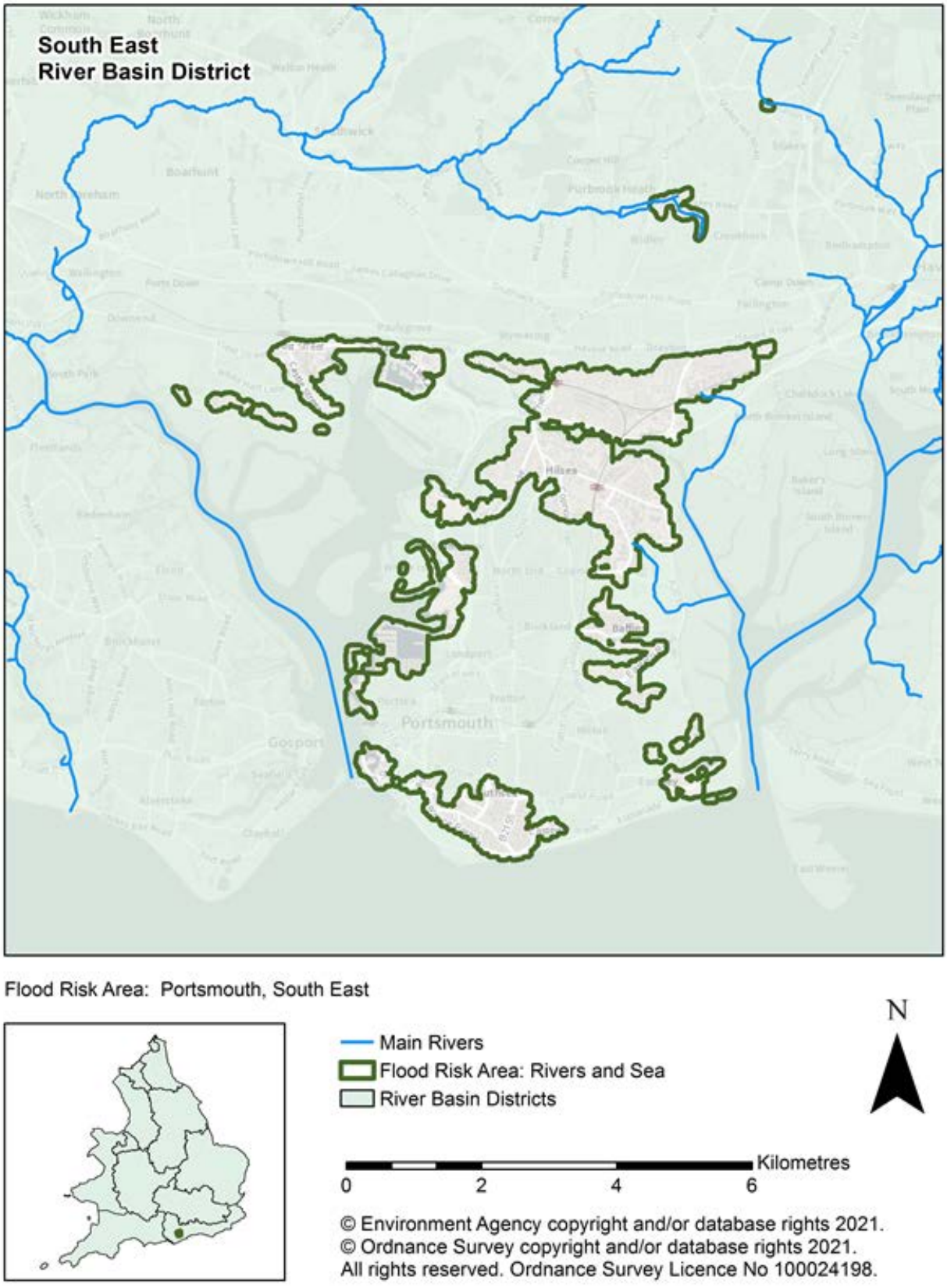


Figure 16: a map showing the boundary of the Portsmouth Rivers and Sea Flood Risk Area

Introduction to the Portsmouth Rivers and Sea FRA

The Portsmouth Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for this FRA.

Portsmouth City Council is the Lead Local Flood Authority (LLFA), whose remit includes flood risk from ‘local’ sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

Portsmouth City Council are also the Coast Protection Authority under the Coast Protection Act 1949. Their remit therefore also includes coastal erosion and coastal flooding.

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Portsmouth FRA is in the East Hampshire management catchment and is in 2 main parts. On Portsea Island, it covers urban areas adjacent to the sea, including:

- Southsea
- Old Portsmouth
- Eastney
- Anchorage Park

On the mainland, it includes urban and sub-urban areas in the coastal plain from Portchester in the west to Farlington in the east. The boundary of the Portsmouth FRA is shown on Figure 16.

Portsmouth is unique in that it’s the only island city in the UK with the second highest population density after London. Portsea Island makes up most of the city with its boundary extending onto the coastal plain to the north rising to the chalk anticline of Portsdown Hill.

Portsmouth Harbour, a deep-water port to the west, is a cross-channel ferry port and home of the Royal Navy. Several significant wildlife sites surround Portsea Island including:

- Langstone Harbour Site of Special Scientific Interest
- Farlington Marshes Special Protection Area
- Solent Maritime Special Area of Conservation

The Portsmouth FRA is at risk of flooding from:

- the sea
- groundwater
- surface water
- sewers

The dominant source of flood risk is from the sea. Both tidal harbours flanking Portsea Island and the open coastline of Southsea present a significant source of flood risk to the local population and critical infrastructure.

Many areas within the city are low-lying and protected from flooding by pumped drainage systems and man-made flood defences. These flood defence structures include:

- sheet piled walls with capping beams
- concrete walls
- concrete revetments
- rock armour
- simple earth and shingle embankments

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Portsmouth FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Portsmouth FRA, 42,698 people live in areas at risk of flooding from rivers and the sea. Of these people, 5% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 2,231 non-residential properties - including factories, retail parks, hotels, the Pyramids Leisure Centre and parts of the Continental Ferry Port
- services - including primary and high schools, medical centres, doctor’s surgeries, Highbury College, Portsmouth College and several electricity sub-stations
- more than 1km of roads - including parts of the trunk road network

- 5.4km of railway
- 10ha of agricultural land
- areas under national and international designations for nature conservation
- parks and gardens
- Scheduled Ancient Monuments
- 132 listed buildings
- water abstraction and discharge points

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'Selsey Bill to Hurst Spit (North Solent) Shoreline Management Plan'. The following coastal strategies also cover this FRA:

- 'Portsea Island Coastal Strategy Study'
- 'River Hamble to Portchester Coastal Strategy'
- 'Portchester Castle to Emsworth Coastal Strategy'

The management of flood risk from rivers and sea within the FRA is led by the Environment Agency in collaboration with other RMAs and partners. These include:

- Portsmouth City Council
- Fareham Borough Council
- Coastal Partners who provide coastal engineering management services to councils along the Hampshire coast - including Portsmouth City Council, Fareham Borough Council, Havant Borough Council and Gosport Borough Council
- Southern Water

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted

- risk-based

In 2011, the 'Portsea Island Coastal Strategy Study' recommended that coastal flood and erosion risk management solutions are prepared at the earliest opportunity. This is to manage the risks of flooding from the sea to the existing communities and infrastructure on the island. As a result of this strategy, Portsmouth City Council, working with Coastal Partners, have obtained significant funding to upgrade coastal defences on Portsea Island. Sections of the North Portsea Island flood defences have already been completed and construction of the £100m Southsea flood defence scheme commenced in winter 2020/21. Both schemes include ecological enhancements which will help to contribute to River Basin Management Plan objectives.

The mainland of the Portsmouth FRA is covered by the 'River Hamble to Portchester Coastal Strategy' and the 'Portchester Castle to Emsworth Coastal Strategy'. Most of the properties at risk from tidal flooding in this area are protected by the A27 / M27 highway embankment which is in good condition. The tidal defences along the Portchester to Paulsgrove section require upgrading. However, opportunities to provide new defences require significant third party contributions under the current Defra funding rules.

The Environment Agency is working in partnership with Portsmouth City Council to investigate options for a sustainable solution to flood risk management at Farlington Marshes. The project is in its early stages of development but will eventually protect the A27 and legally designated habitat within Farlington Marshes.

Although the FRA has been identified due to flood risk from rivers and the sea, surface water also presents a major source of flood risk. Discharge from surface water outfalls and groundwater levels are directly affected by high tides.

Management of surface water flood risk is challenging as the city is very flat and has a combined sewer system. The lowest parts of Southsea suffered combined sewer flooding in 2000. This was due to Eastney pumping station being overwhelmed by a rainfall event that had less than a 1% chance of occurring each year.

The 'Portsmouth Local Flood Risk Management Strategy' identified several options to reduce surface water flood risk within the city through the 'Surface Water Management Plan'. These documents can be found on the flooding section of Portsmouth City Council's website. Southern Water, working closely with the City Council, have invested in major schemes to improve pumping capacity at Eastney and to separate surface water from the combined sewer. Many of the recommended improvement options have been completed and further investigations are planned for the Little Morass area in Southsea.

Southern Water are developing a 'Drainage and Wastewater Management Plan' (DWMP) for the East Hampshire management catchment. Portsmouth drainage is entirely within the Budds Farm sub-catchment of Southern Water. Portsmouth City Council are closely

involved in helping to shape the evolving DWMP for East Hampshire. This will help identify further opportunities to reduce flooding and improve drainage systems.

Portsmouth City Council's 'Flood Response Plan' describes the management structures and procedures used in response to a flooding event. This plan can be found on the flooding section of the Council's website. The plan focuses on the roles and responsibilities of the Council within a multi-agency response to an incident. In particular, the Council receives flood warnings and alerts from the Environment Agency to operate flood gates in Old Portsmouth and at the Pyramids Leisure Centre. The Council also closes access to vehicles on Clarence Esplanade when deemed unsafe due to storm conditions.

Tidal forecasts are created by the Flood Forecasting Centre using data from the Portsmouth tidal gauge. These are used by the Environment Agency to issue flood warnings to up to 7 coastal flood warning areas in the FRA.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

The topography and location of Portsmouth means the city will always be exposed to tidal and surface water flood risk.

As sea levels rise, coastal flooding will become more likely as higher water levels and storms will occur more frequently. New tidal defences are in construction now and more are planned. These will reduce the risk of flooding from the sea to a 0.5% chance each year for the next 100 years. This will better protect over 6,000 residential properties from internal flooding and a further 6,000 properties from loss of access. The impact of climate change on sea levels will require further interventions and innovative solutions to maintain the current footprint of our coastal communities.

Surface water flooding will also become more frequent as rainfall intensity and duration increases particularly in summer months due to thunderstorms.

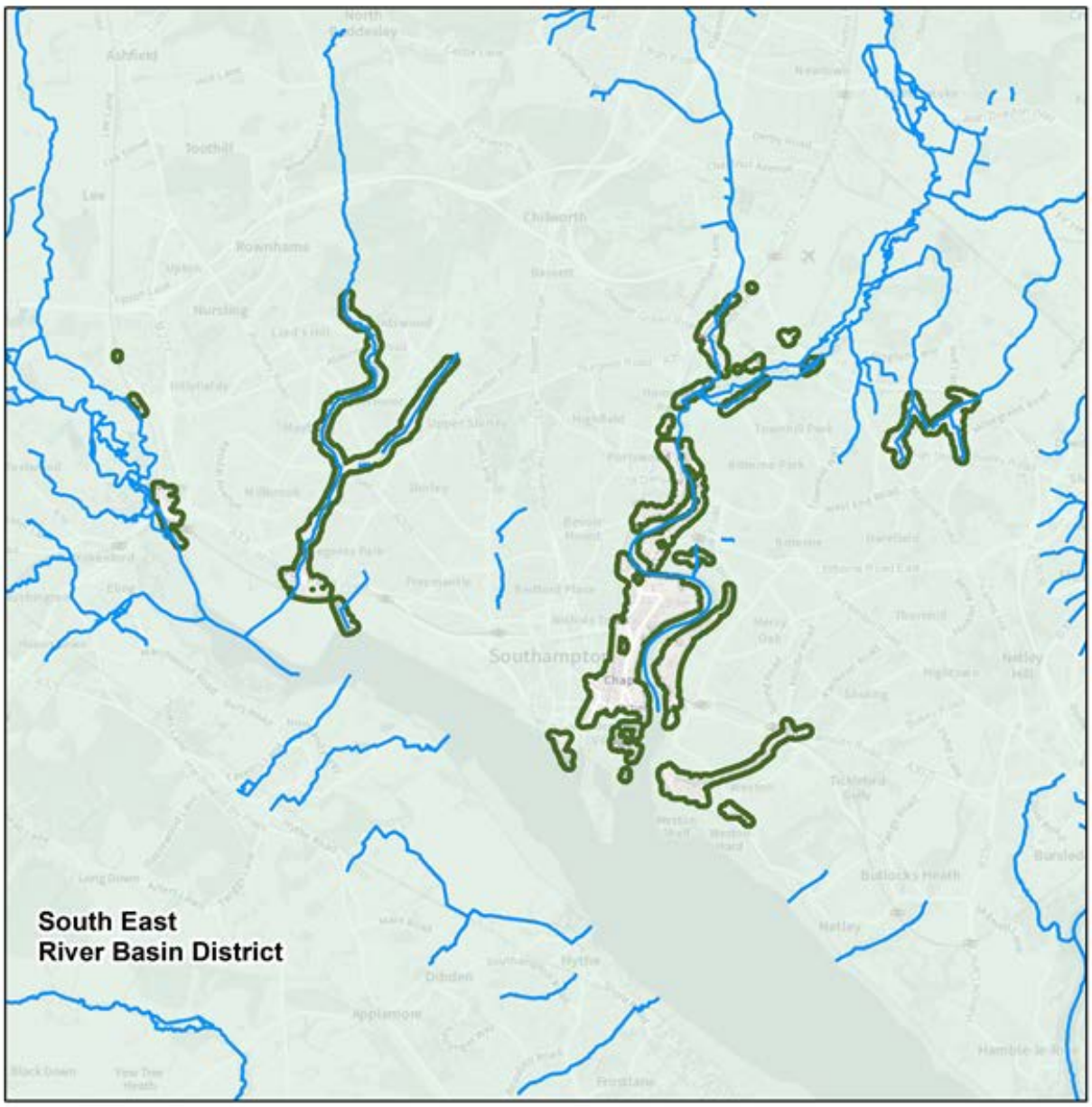
Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East RBD.

Objectives and measures for the Portsmouth Rivers and Sea FRA

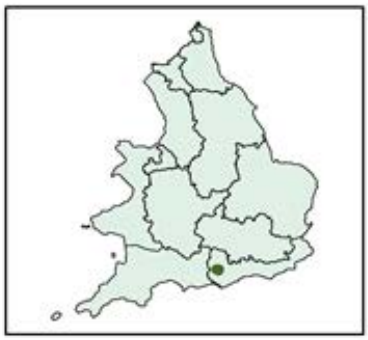
Measures have been developed that apply specifically to the Portsmouth FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Southampton Rivers and Sea FRA



Flood Risk Area: Southampton, South East



Main Rivers
Flood Risk Area: Rivers and Sea
River Basin Districts

N

0 2 4 6 Kilometres

Figure 17: a map showing the boundary of the Southampton Rivers and Sea Flood Risk Area

Introduction to the Southampton Rivers and Sea FRA

The Southampton Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy and the environment (including cultural heritage).

The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan for this FRA.

Southampton City Council are the Lead Local Flood Authority (LLFA), whose remit includes flood risk from 'local' sources. These local sources of flooding are:

- surface water
- ordinary watercourses
- groundwater

Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Southampton FRA is in the Test and Itchen management catchment and is in 2 main parts. The most extensive of these follows the River Itchen from Southampton Water in the south to the M27 in the north. In the south, it includes urban areas along both banks of the tidal River Itchen. A large part of this area is used for marine and maritime operations or activities. In the north, it includes urban areas along both banks of the fluvial Lower Itchen and Monk's Brook.

To the north-west, the FRA includes the fluvially dominated Tanners Brook and Holly Brook, which flow through densely populated areas of the city. Smaller parts of the FRA are located along tributaries of the River Itchen to the east and south, and the River Test to the west. The boundary of the Southampton FRA is shown on Figure 17.

Due to the low-lying frontages within Southampton, tidal flood risk from the rivers Itchen and Test pose the biggest flood risk within the city. This is particularly so on the west bank of the River Itchen to the north of Ocean Village. Work to develop the 'River Itchen Flood Alleviation Scheme' in this location has been ongoing for several years.

There are no formal raised flood defences along this part of the tidal River Itchen. Most of the existing informal flood defence structures have been privately constructed in a piecemeal manner and are poorly maintained. This offers a varied and often low standard of protection against tidal flooding. At present, the onset of tidal flooding occurs from an event with a 20% chance of occurring each year in some locations. The extent of flooding increases significantly during more extreme tidal flood events and will continue to increase as a result of climate change.

Southampton has a unique tidal regime, including a double high tide, which results in sustained high tide levels for approximately 2 to 4 hours. This increases the potential for storm surges to coincide with high tides.

Whilst tidal flooding poses the greatest risk in terms of the potential consequences of an extreme event, surface water flooding is more likely to occur. The limited capacity of watercourses within the city, which are often culverted or otherwise confined, can have a direct effect on surface water flooding. This is particularly the case when heavy rain coincides with high tides and rivers are not able to drain freely to the sea. Surface water sewers that outfall directly to the sea can also be prevented from draining during high tides, increasing the risk of surface water flooding. All sources of flood risk therefore need to be considered holistically.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Southampton FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Southampton FRA, 6,804 people live in areas at risk of flooding from rivers and the sea. Of these people, 37% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 868 non-residential properties - including industrial facilities/areas and a dockyard
- services, including hospitals, schools and colleges, a cemetery and public utilities
- short section of the A33 trunk road
- 2km of railway
- 10ha of agricultural land
- areas under national and international designations for nature conservation
- listed buildings
- a historic site
- water abstraction and discharge points

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'Selsey Bill to Hurst Spit (North Solent) Shoreline Management Plan' (SMP). The 'Southampton Coastal Flood and Erosion Risk Management Strategy' was produced in 2012 to identify ways to implement the policy set out in the SMP. This coastal strategy provided the basis for the 'River Itchen Flood Alleviation Scheme' and Property Level Resilience schemes described in this section.

The long-term strategy for managing local flood risk from all sources is set out in the 'Southampton Local Flood Risk Management Strategy'. This can be found in the strategies, plans and studies section of Southampton City Council's website and is currently being updated.

The management of flood risk from rivers and the sea is led by the Environment Agency in collaboration with other RMAs and stakeholders. These include:

- Southampton City Council
- Southern Water
- Network Rail
- Associated British Ports

To assist with the co-ordination of flood risk management activities within Southampton, a formal Joint Flood Management Board ('Southampton Flood Board') was established in 2008. The aim of this board is to reduce the probability and consequences of flooding in the city through partnership working with stakeholders.

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The Environment Agency is working in partnership with Southampton City Council to design and build the 'River Itchen Flood Alleviation Scheme' by 2026. The proposed scheme is located along the frontage of west bank of the River Itchen. It extends from Mount Pleasant Industrial Estate in the north, to the Southampton Water Activities Centre, just south of the Itchen Bridge. When complete, it's expected that the scheme will initially

reduce tidal flood risk to over 250 businesses and 150 homes. By 2120, this would increase to over 900 businesses and 1,150 homes.

Since 2013, Southampton City Council have reduced tidal flood risk to over 50 properties in the St. Deny's area through completion of property and community flood resilience schemes. A flood action group has also been set up in this area.

Opportunities to retrofit Sustainable Drainage Systems continue to be taken by Southampton City Council where possible. The Environment Agency and Southampton City Council plan to work together to explore innovative ways to further reduce flows and run-off reaching the FRA.

Fluvial flood risk on the main rivers in Southampton is generally well understood and has been modelled (and mapped) to illustrate the potential extent of flooding that could occur. Tidal flood risk has been modelled in the Southampton Water Model. Part of this model was updated in 2020 to support the development of the 'River Itchen Flood Alleviation Scheme'. Further updates to the overall model are planned.

To the north of the city, the 'Holly Brook Flood Alleviation Scheme' protects downstream properties during periods of high flows. The nearby golf course serves as an area of flood storage during such events.

Tidal forecasts are created by the Flood Forecasting Centre using data from the Woolston tidal gauge. River level, river flow and rainfall data are collected by the Environment Agency across the:

- River Test
- River Itchen
- Monks Brook
- Tanners Brook

This information is used by the Environment Agency to issue flood warnings to 3 coastal and 5 fluvial flood warning areas in the FRA.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Test and Itchen management catchment. This will help identify further opportunities to reduce flooding and improve drainage systems.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. Rainfall intensity is expected to increase in future which will cause river flows to increase, as well as increasing the frequency of surface water flooding.

Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Southampton Rivers and Sea FRA

Measures have been developed which that specifically to the Southampton FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Whitstable Rivers and Sea FRA

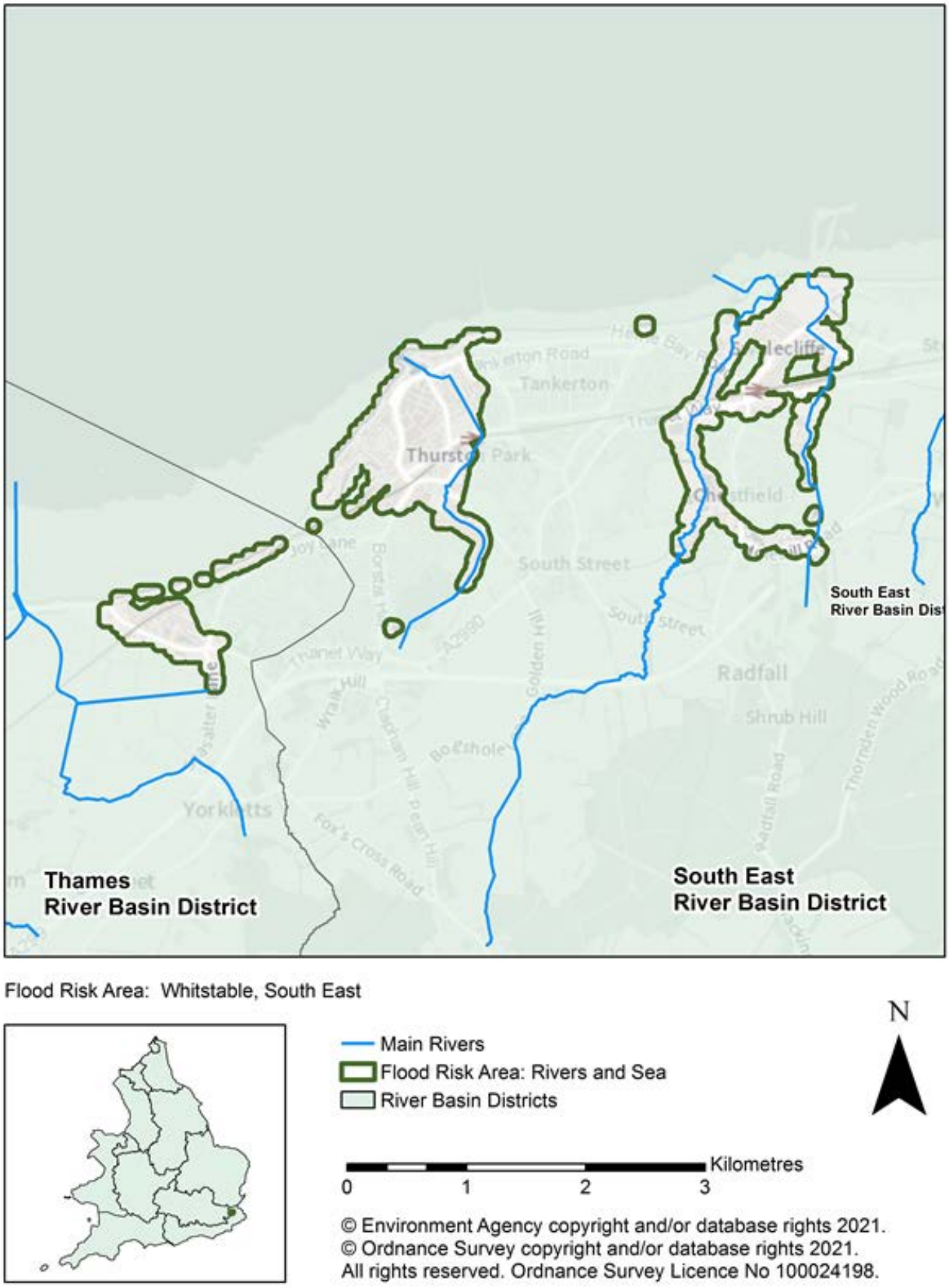


Figure 18: a map showing the boundary of the Whitstable Rivers and Sea Flood Risk Area

Introduction to the Whitstable Rivers and Sea FRA

The Whitstable Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from rivers and the sea is significant nationally for people, the economy or the environment (including cultural heritage).

The primary source of flood risk in the FRA is from the sea. There's also a risk of flooding from 3 main rivers which flow across the area, the:

- Gorrell Stream
- Swalecliffe Brook
- Kite Farm Ditch

These are collectively known as the Oyster Coast Brooks, along with those in the Herne Bay FRA. The Environment Agency takes the lead on the development and delivery of the Flood Risk Management Plan (FRMP) for the Whitstable FRA.

Most of the coastal frontage and defences within the FRA are managed by Canterbury City Council. This is in their role as Coast Protection Authority under the Coast Protection Act 1949. Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The Environment Agency is responsible for managing the risk of flooding from the main rivers and those sections of coast not covered by Canterbury City Council. Kent County Council is the Lead Local Flood Authority (LLFA), whose remit includes flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The Whitstable FRA is in 3 main parts. At Seasalter, on the fringe of the Seasalter Levels, it runs south to Applegarth caravan park. At Whitstable, it stretches along the coast from West Beach to Tower Hill. This part also covers the area north of the railway line before stretching south along the Gorrell Stream to Trench Wood. To the east at Swalecliffe it runs south along the Swalecliffe Brook and Kite Farm Ditch down to Chestfield. The boundary is shown on Figure 18.

The eastern part of the FRA is in the Stour management catchment in the South East River Basin District (RBD). The western part is in the Kent North management catchment in the Thames RBD. The Whitstable FRA is described solely within this FRMP for the South East RBD.

The FRA is largely urban with several nationally and internationally designated nature conservation sites running along parts of the coastal fringe. The railway line to Margate runs across the FRA.

There are extensive sea defences along the coast. West of Faversham Road on the edge of the FRA the defence consists of a clay embankment on the landward side of the road. This links to the Canterbury City Council defences at Beach Court Park. At this point, the defence becomes a concrete sea wall which runs east to Whitstable. Timber groynes, positioned at close intervals on the beach in front of the sea wall, retain shingle.

Around Whitstable harbour, the defences consist of sheet-piled quay walls and concrete flood walls set back from the quayside. These were reconstructed in 2015. An embankment, known as Long Rock, surrounds the mouth of the Swalecliffe Brook. Tidal gates, operated by Canterbury City Council, sit at the mouth of both the Swalecliffe Brook and Kite Farm Ditch. These gates are closed to prevent high tides moving up these rivers.

The 3 main rivers within the FRA run from steep upper sections to relatively flat lower sections by the sea. They have small catchments, but the underlying clay and local topography causes them to react quickly to rainfall.

The Gorrell Stream flows through Whitstable in a combination of culverts and maintained open channels. The lower sections from Downs Avenue are entirely culverted and discharge into the sea via the Southern Water Gorrell Tank. Automatic tidal gates close to stop the tide entering the culvert. When the stream is ‘tide-locked’ in this way, water can be pumped out to sea through the adjacent Diamond Road pumping station.

Within the catchment, there has been urban development on areas that were once floodplain and the ground levels within these areas remain low. The Gorrell Stream was realigned away from its historic route west of Cromwell Road and diverted through the downstream culvert system in the 1970s. The former path of the stream is now a Southern Water surface water sewer. Water can revert to the old route if the capacity of the new channel is exceeded.

Current flood risk

The Flood Risk and Hazard Maps for Rivers and Sea in England provide data on the likelihood and consequence of flooding for the Whitstable FRA. This data is from 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Rivers and Sea in England show that in the Whitstable FRA, 9,790 people live in areas at risk of flooding from rivers and the sea. Of these people, 9% are in areas of high risk.

Also shown to be in areas at risk of flooding from rivers and the sea are:

- 549 non-residential properties
- services - including the Swalecliffe Wastewater Treatment Works
- 0.25km of railway
- 37ha of agricultural land
- listed buildings
- small areas under national and international designations for nature conservation

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

How the risk is currently managed

Coastal flood and erosion risks within this FRA are managed in line with the policies of the 'Isle of Grain to South Foreland Shoreline Management Plan'.

The management of flood risk from rivers and sea within the FRA is led by the Environment Agency in collaboration with other RMAs and partners. These include:

- Canterbury City Council
- Southern Water
- Kent County Council
- the Lower Medway Internal Drainage Board (in the western part of the FRA around Seasalter)

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The clay embankment on the landward side of the Faversham Road is maintained by the Environment Agency. It's designed to protect against a 0.5% chance of flooding occurring each year. East of here, the coastal frontage and defences at Whitstable are managed by Canterbury City Council. They also provide a standard of protection of at least 0.5% in any year.

The shingle beach on the Whitstable frontage is the most stable on the North Kent coast with very small losses due the good condition of the groynes. The Strategic Beach Monitoring Programme surveys the beach twice a year and all coastal assets are inspected annually.

There are currently no formal fluvial defences on the:

- Gorrell Stream
- Kite Farm Ditch
- Swalecliffe Brook

Southern Water are developing 'Drainage and Wastewater Management Plans' for the Stour and Kent North management catchments. These will identify further opportunities to reduce flooding and improve drainage systems.

There are 3 flood warning areas within the FRA; one for fluvial flooding and 2 for coastal flooding. The Environment Agency monitor river levels on the Swalecliffe Brook and data from here is used to decide when to issue warnings of fluvial flooding. Coastal warnings are issued based on data from the Sheerness tidal gauge and tidal forecasts from the Flood Forecasting Centre. The Sheerness gauge is managed by the Environment Agency's Thames Tidal Defences team. The Environment Agency continues to investigate launching new flood warning areas in currently unserviced areas.

You can find more information about the routine day to day work that the Environment Agency and LLFA carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As sea levels rise, coastal flooding will become more frequent as higher water levels and storms will be seen more often. Higher tide levels will also result in more frequent 'tide-locking', which is likely to inhibit drainage of fluvial watercourses on a more regular basis.

The intensity of rainfall is also expected to increase in the future and inland this will increase river flows.

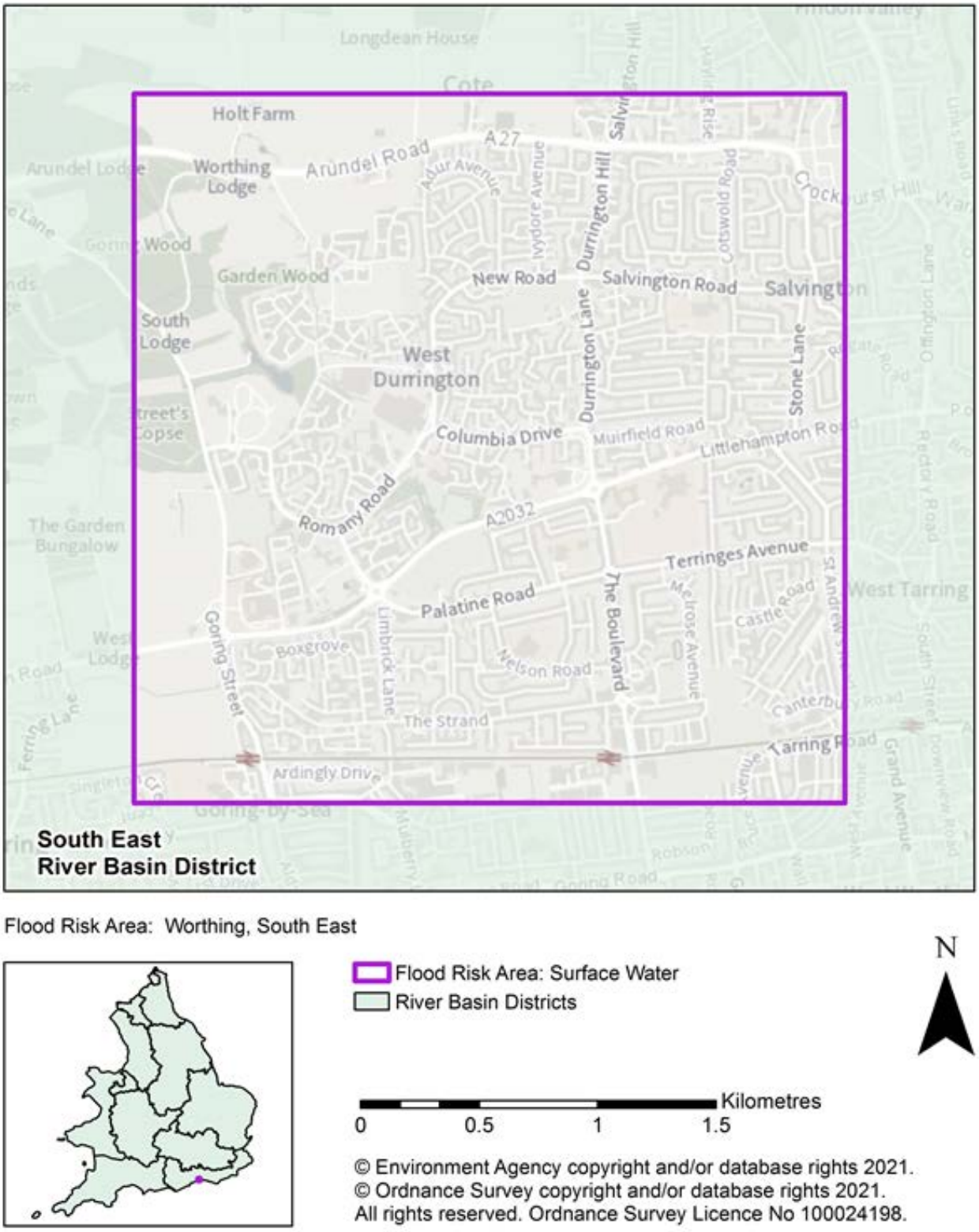
Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East RBD.

Objectives and measures for the Whitstable Rivers and Sea FRA

Measures have been developed that apply specifically to the Whitstable FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

The Worthing Surface Water FRA



Flood Risk Area: Worthing, South East

Flood Risk Area: Surface Water
River Basin Districts

N

Kilometres
0 0.5 1 1.5

Figure 19: a map showing the boundary of the Worthing Surface Water Flood Risk Area 20

Introduction to Worthing Surface Water FRA

The Worthing Flood Risk Area (FRA) has been identified as an FRA because the risk of flooding from surface water is significant nationally for people, the economy or the environment (including cultural heritage).

West Sussex County Council take the lead on the development and delivery of the Flood Risk Management Plan for this FRA. They're the Lead Local Flood Authority (LLFA) responsible for managing flood risk from 'local' sources. These local sources of flooding are:

- surface water
- groundwater
- ordinary watercourses

The Environment Agency's remit covers flood risk from the Ferring Rife. Southern Water is the water and sewage company that owns, operates and maintains the sewerage network and wastewater treatment infrastructure in the FRA.

The borough of Worthing is in the flat coastal plain at the foot of the steep sloping South Downs and is mostly urbanised. The Worthing FRA is located to the west of the borough, covering West Durrington and parts of Salvington, West Tarring and Goring-By-Sea as shown on Figure 19. The FRA extends from the A27 in the north to just south of the railway line in the south. It's mostly urban, with a scattering of public amenity areas.

The West Durrington, Salvington and Goring-by-Sea areas of the FRA fall within the Arun and Western Streams management catchment. The West Tarring area falls within the Adur and Ouse management catchment.

There is a high risk of surface water flooding within the FRA due to the:

- local topography
- presence of impermeable surfaces
- ageing drainage infrastructure

Surface water mapping shows a flow path running from the north-west of West Durrington, in a south-easterly direction, through the FRA. This generally follows the course of the Ferring Rife watercourse. A further flow path starts in the north-east around Salvington. Several clusters of properties are at risk from these sources, the largest of which are in West Durrington. There has been historic flooding in the West Tarring area that lies to the south-east directly downstream of the FRA.

The geology of the Worthing FRA consists of chalk with clay, silt and sand. Due to the presence of chalk, following prolonged rainfall, West Durrington and Goring-by-Sea are

also susceptible to groundwater flooding. Past and future development within the FRA has and will reduce the capacity for natural attenuation of both surface water and groundwater flows. This increases the risk of flooding downstream of these areas, such as in the southern part of the FRA towards Goring-by-Sea.

The West Durrington area is also at risk of fluvial flooding from the Ferring Rife watercourse. This can occur in combination with both the surface water and groundwater sources described in this section.

Current flood risk

The Flood Risk and Hazard Maps for Surface Water in England provide data on the likelihood and consequence of flooding for the Worthing FRA. This data is from December 2019. It considers the presence and condition of defences.

The Flood Risk and Hazard Maps for Surface Water in England show that in the Worthing FRA, 4,953 people live in areas at risk of flooding from surface water. Of these people, 3% are in areas of high risk.

Also shown to be in areas at risk of flooding from surface water are:

- 109 non-residential properties
- 0.8km of A-roads - including parts of the A27 which is part of the trunk road network
- 0.3km of railway
- 70ha of agricultural land
- one listed building

Based on this information, Risk Management Authorities (RMAs) have concluded that further steps should be taken to reduce the likelihood of flooding and the current and future impact it could have on the FRA.

Further work needs to be undertaken to support the risk and hazard predictions and better understand flood risk within the FRA.

How the risk is currently managed

The management of surface water flood risk is led by West Sussex County Council, in collaboration with other RMAs and partners. West Sussex Flood Risk Action Group meet quarterly to discuss relevant local flood risk issues and coordinate strategic work programmes. Members of this group comprise:

- West Sussex County Council, including Highways
- borough and district council drainage engineers, including those from Adur and Worthing Councils

- the Environment Agency
- Southern Water
- the South Down's National Park Authority

The Southern Regional Flood and Coastal Committee (RFCC) provides a link between the Environment Agency, LLFA and other RMAs to build an understanding of flood and coastal erosion risk in their area. To ensure that flood and coastal erosion risk management work represents value for money and benefits local communities, the RFCC encourage investment that's:

- efficient
- targeted
- risk-based

The long-term strategy for managing local flood risk in areas across West Sussex is set out in the West Sussex Local Flood Risk Management Strategy (LFRMS), 2021 – 2026. This strategy currently identifies Worthing as a Priority Area. It can be found in the flood risk management area of West Sussex County Council's website.

Following significant flooding in 2012, West Sussex County Council created Operation Watershed and launched the Active Communities Fund, to help address issues with drainage infrastructure in the county. Operation Watershed supports people in their local communities who want to work with the Council to become more prepared for or reduce the risk of flooding. Since its launch, West Sussex County Council have successfully supported hundreds of projects across the county. This includes a project combining sustainable urban drainage and natural processes in an area close to the FRA.

The 'rain garden project' was carried out by the Tarring Flood Action Group, an active flood group in the borough. The project started in 2018, with the first phase completed in 2020. West Sussex County Council will continue to work with communities to understand local flood risk issues and support local actions and projects.

Cyclic gully cleansing and other routine maintenance programmes have the potential to influence flood risk in the FRA. An objective within the LFRMS is for West Sussex County Council to work with Highways and Southern Water to better understand this.

Southern Water are developing a 'Drainage and Wastewater Management Plan' for the Arun and Western Streams and Adur and Ouse management catchments. This will help identify further opportunities to reduce flooding and improve drainage systems.

The Environment Agency collects data on river levels on the Ferring Rife to provide flood warning to one fluvial flood warning area in the FRA.

You can find more information about the routine day to day work that all LLFAs carry out in the national-level measures in the Flood Plan Explorer, an interactive mapping tool.

The impact of climate change and future flood risk

As rainfall intensity increases, surface water flooding will become more frequent as higher rainfall totals will be seen more often. Please refer to the 'Climate change and the South East RBD' section for more information on what we know are likely to be the implications of climate change in the South East River Basin District.

Objectives and measures for the Worthing FRA

Measures have been developed that apply specifically to the Worthing FRA.

You can find information about these measures, including which national objectives each measure helps to achieve, in the Flood Plan Explorer, an interactive mapping tool.

Links between the draft 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 risk management and the water environment and biodiversity can be joined together wherever possible.

This is particularly important 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 draft South East RBMP.

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

A third of the draft FRMP measures across the 12 Flood Risk Areas (FRAs) in the South East River Basin District (RBD) have the potential to contribute to the achievement of RBMP objectives. For example, by:

- reducing flood risk through Natural Flood Management
- improving water quality through sustainable drainage systems or other actions
- reducing flood risk through control of invasive non-native species
- incorporating ecological enhancements into measures
- naturalisation of channels through removal of structures

In some cases, specific schemes have not yet been scoped or proposed in an FRA because further investigation is required. RMAs have included measures which set out the intention to also consider opportunities that improve the water environment in these investigations.

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

- the challenges that our waters face
- the 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 above examples are closely aligned with some of the main themes in responses that identify with the South East RBD.

By visiting the draft South East RBMP, you can find more information on the objectives and measures for the draft South East RBMP.

As outlined in the 'Introduction to the draft FRMP' section, this draft second cycle FRMP focusses on the areas with the highest risk of flooding. It presents measures at the FRA scale. There will be many more examples across the RBD of where flood risk management work by RMAs also helps to improve the wider water environment.

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 and other Risk Management Authorities to monitor progress in achieving all of 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'll 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).

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