

# River Witham Catchment Flood Management Plan

Summary Report December 2009



managing  
flood risk

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December 2009

# Introduction

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**I am pleased to introduce our summary of the River Witham Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the River Witham catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.**

The River Witham CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, groundwater, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding). This is covered by Shoreline Management Plans (SMPs). Our coverage of surface and groundwater flooding is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to flood risk management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

There are different sources of flood risk in the catchment. River flooding can occur from the River Witham, South Forty Foot Drain, Stonebridge Drain and their tributaries. This can affect Horncastle and Lincoln. Tidal flooding from the Haven overtopping the tidal defences could

inundate large parts of Boston. Breaching/failure of embankments that carry the main upland rivers across the Fens pose a significant flood risk. Surface water and sewer flooding can affect Lincoln, Horncastle, Grantham and Boston. Parts of Sleaford and the surrounding area could be susceptible to groundwater flood risk.

We cannot reduce flood risk on our own. We will therefore work closely with all our partners to improve the co-ordination of flood risk activities. For example, in parts of the catchment Internal Drainage Boards (IDBs) have an important role in managing flood risk. We will work in partnership with the IDBs to agree the most effective way to manage flood risk in the future. We also work with many other organisations, groups and individuals with an interest in how flood risk is managed. This includes local authorities, water companies, conservation bodies such as Natural England and the public.

This is a summary of the main CFMP document. If you would like to see the full document an electronic version can be obtained by emailing [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk) or telephoning 08708 506 506. Alternatively, paper copies can be viewed at any of our offices in Anglian Region.

A handwritten signature in black ink that reads "Paul Woodcock". The signature is written in a cursive style with a horizontal line underneath the name.

**Paul Woodcock**  
**Regional Director Anglian Region**

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↑ Flat Bridge Willingham, Upper Till



# The purpose of a CFMP in managing flood risk

CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

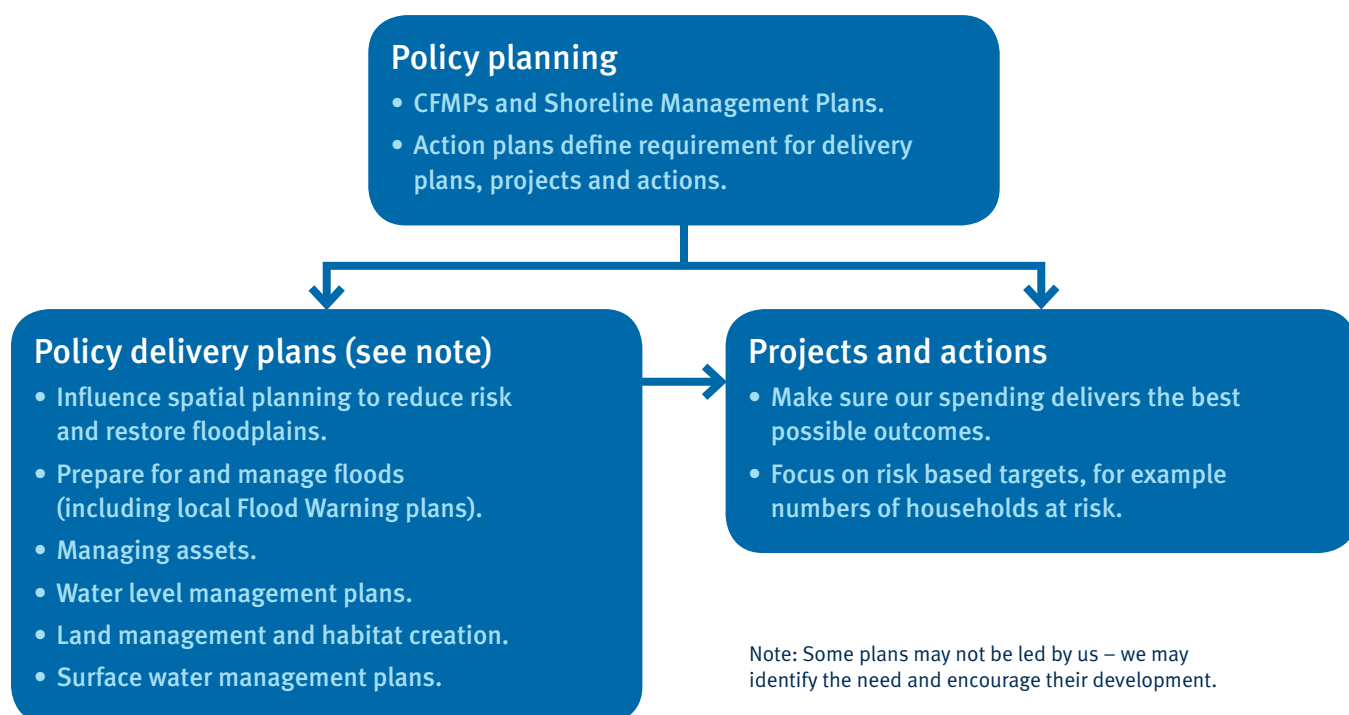
- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- regional planning bodies and local authorities who can use the plan to inform spatial planning activities and emergency planning;

- Internal Drainage Boards (IDBs), water companies and other utilities to help plan their activities in the wider context of the catchment;
- transportation planners;
- land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in Figure 1.

Figure 1 The relationship between CFMPs, delivery plans, projects and actions



# Catchment overview

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The catchment of the River Witham is located in the east of England. The River Witham rises south of Grantham and flows northwards, through Lincoln, before turning southeast and discharging into the Haven at Boston, and eventually The Wash. Map 1 shows the location and extent of the River Witham CFMP catchment. The River Witham catchment includes the River Brant, River Till, Fossdyke Canal, Barlings Eau, River Bain and many other smaller watercourses. The catchments of the South Forty Foot Drain and Stonebridge Drain are also included in the CFMP area, both of which flow into Boston and into the tidally influenced Haven.

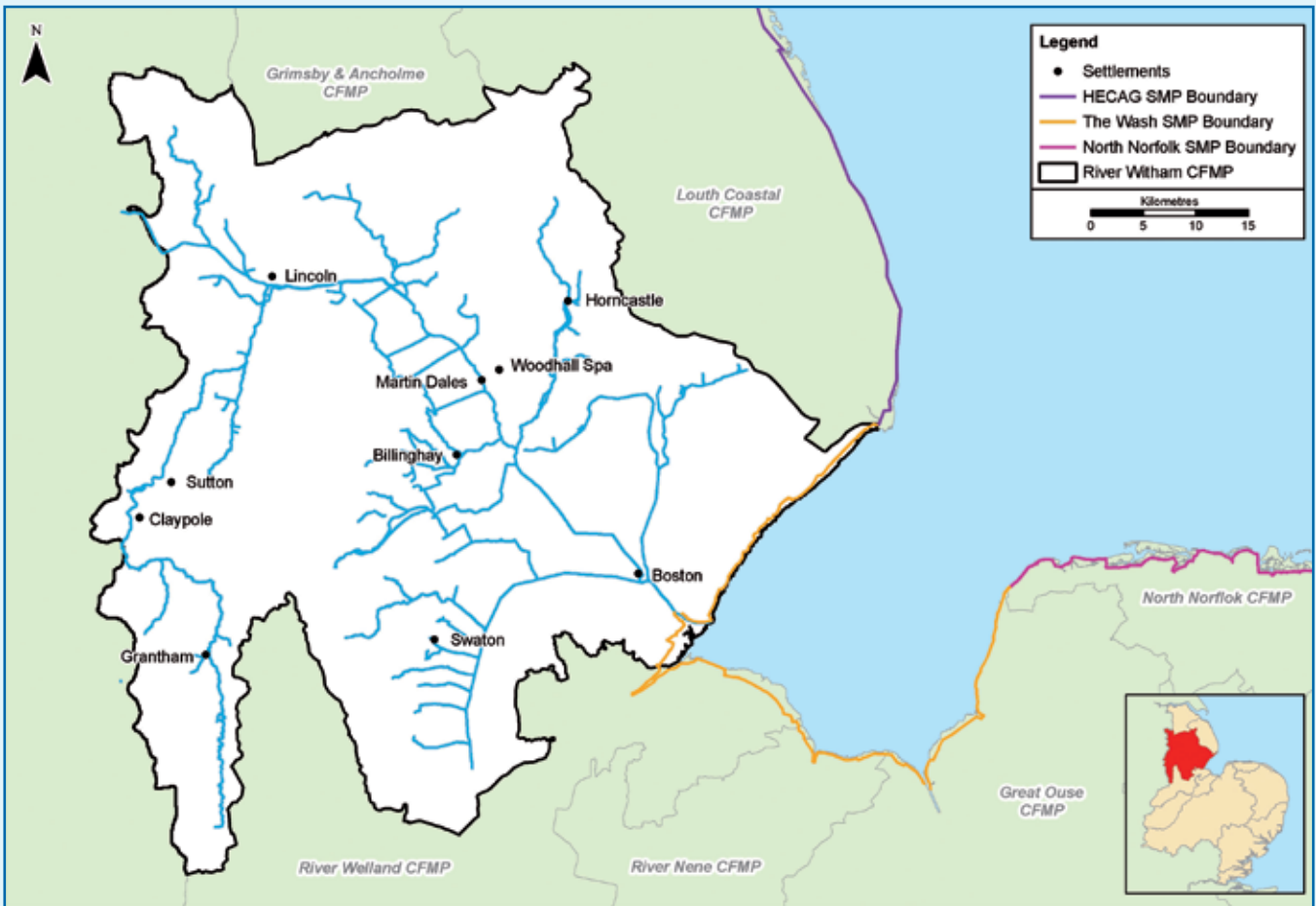
The downstream limit of the CFMP catchment is located at Hobhole, which is The Wash Shoreline Management Plan (SMP) boundary. The SMP deals with coastal flood management issues from The Wash. The CFMP considers tidal flood risk along the Haven upstream of Hobhole to Black Sluice, Grand Sluice and Maud Foster Sluice, which form the tidal limit on the South Forty Foot Drain, River Witham and Stonebridge Drain respectively.

The entire CFMP area is approximately 3,000 km<sup>2</sup> with a population of around 375,000 people. The catchment is predominantly rural. Approximately 90% of the CFMP area is used for arable farming and there is high grade agricultural land in the Fens. Only 3% of the CFMP area is urban and the main urban areas are Lincoln, Boston, Grantham, North Hykeham, Sleaford and Horncastle.

Within the catchment there are two ridges of relatively high ground; the Lincolnshire Limestone Ridge roughly in the centre of the CFMP area, north and south of Lincoln, and the Lincolnshire Wolds in the north-east, north of Horncastle. The remainder of the CFMP area, downstream of Lincoln, is primarily low-lying, and a large number of watercourses are heavily modified. In the low lying Fens (between Lincoln and Boston) the rivers and their tributaries are embanked, with drainage influenced by a number of pumping stations and the tidal cycle. This means that when tide levels are high, less water will be able to drain from the system. IDBs have an important role in managing land drainage within these low-lying areas.

The underlying geology of the catchment is mudstones to the west of Lincoln and clays to the east. There is a ridge of limestone running north-south through Lincoln and chalk in the far north-east. Where the underlying rock is non-porous clay and mudstones, there are higher rates of rainfall runoff, and runoff flows directly into the watercourses. In the areas where there is limestone or chalk bedrock, runoff may infiltrate the rock delaying the response of rivers to rainfall and reducing peak flood flows. There is also a risk from groundwater flooding in these areas. Within the River Witham catchment there are a number of sites designated for their environmental importance, including The Wolds Area of Outstanding Natural Beauty (AONB) and 41 Sites of Special Scientific Interest (SSSIs). The Wash, an internationally protected Ramsar site, Special Protection Area (SPA) and Special Area of Conservation (SAC) is located downstream of the CFMP area boundary, however the River Witham and flood risk management activities can have an effect on this area. Scheduled Monuments (SMs) and listed buildings, designated for their heritage value, are also found throughout the CFMP area.

Map 1 Location and extent of the River Witham CFMP area



↑ Till Washlands, Lincoln

# Current and future flood risk

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## Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period, it is expressed as a percentage. For example, a 1% annual probability flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% annual probability flood has a 0.5% chance or 0.005 probability of occurring in any one year. The flood risks quoted in this report are those that take account of flood defences already in place.

The catchment has a history of flooding. Most recently, intense rainfall caused flooding in many urban areas throughout the CFMP area in June/July 2007. Urban areas also suffer from the more general risks from surface water and sewer flooding under storm conditions. This occurred in Lincoln in 2007.

Currently the main sources of flood risk for people, property, infrastructure and the land are:

- river flooding from the River Witham in Grantham, Lincoln and Boston, from the River Bain in Horncastle, and from the South Forty Foot Drain within the eastern outskirts of Boston;
- tidal flooding from the Haven rising over the top of the embankments. This could cause flooding to large parts of Boston;
- breaching/failure of embankments that carry the main upland rivers across the Fens. This type of flooding is difficult to predict but could cause the rapid flooding of the areas immediately behind the embankments leading to a severe risk of loss of life;
- surface water drainage and sewer flooding, which has occurred in parts of Lincoln, Horncastle, Grantham and Boston;
- groundwater flooding is a risk in the limestone chalk areas when there are high groundwater levels within the underlying rock. There are records of groundwater flooding in Sleaford and the surrounding area.

## What is at risk?

At present there are around 3,500 people and 1,500 commercial and residential properties at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. Around 8,700 people and 4,500 commercial and residential properties are at risk from the 0.5% annual probability tidal flood. These estimates take into account the current flood defences. This means that 3% of the total population living in the catchment are currently at risk from flooding. Table 1 shows the critical infrastructure at risk of flooding in a 1% annual probability river flood and 0.5% annual probability tidal flood.

It is difficult to assess the current impact of flooding to environmental features within the catchment. Four SSSIs may be at some flood risk from the impact of flooding during a 1% annual probability river flood, two may be negatively impacted by flooding to a significant level; Horbling Fen SSSI and Wilsford and Rauceby Warrens SSSI. There are 29 Scheduled Monuments and 63 listed buildings at risk from the 1% annual probability river flood, and three SMs and 44 listed buildings at risk from the 0.5% annual probability tidal flood. Table 1 shows the critical infrastructure that is at risk.



## Where is the risk?

Around 72% of the people and property at risk from a 1% annual probability river flood are located in isolated properties or in towns and villages scattered throughout the low-lying Fens between Lincoln and Boston. This is taking current flood defences into account, but not flooding from IDB drains. Outside of this area large numbers of people and property are at risk from river flooding in Horncastle. All of the

people and property at risk from a 0.5% annual probability tidal flood are located in Boston<sup>1</sup>; there are also 23 properties in Boston at risk from a 1% annual probability river flood.

Map 2 illustrates the distribution of properties at risk from a 1% annual probability river flood and a 0.5% annual probability tidal flood in Boston, but does not include

flooding from IDB drains. The flood risk illustrated on Map 2 takes account of current flood defences. Table 1 summarises where there is flood risk to more than 25 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

**Table 1** Locations of towns and villages with 25 or more properties at risk in a 1% annual probability river flood and 0.5% annual probability tidal flood

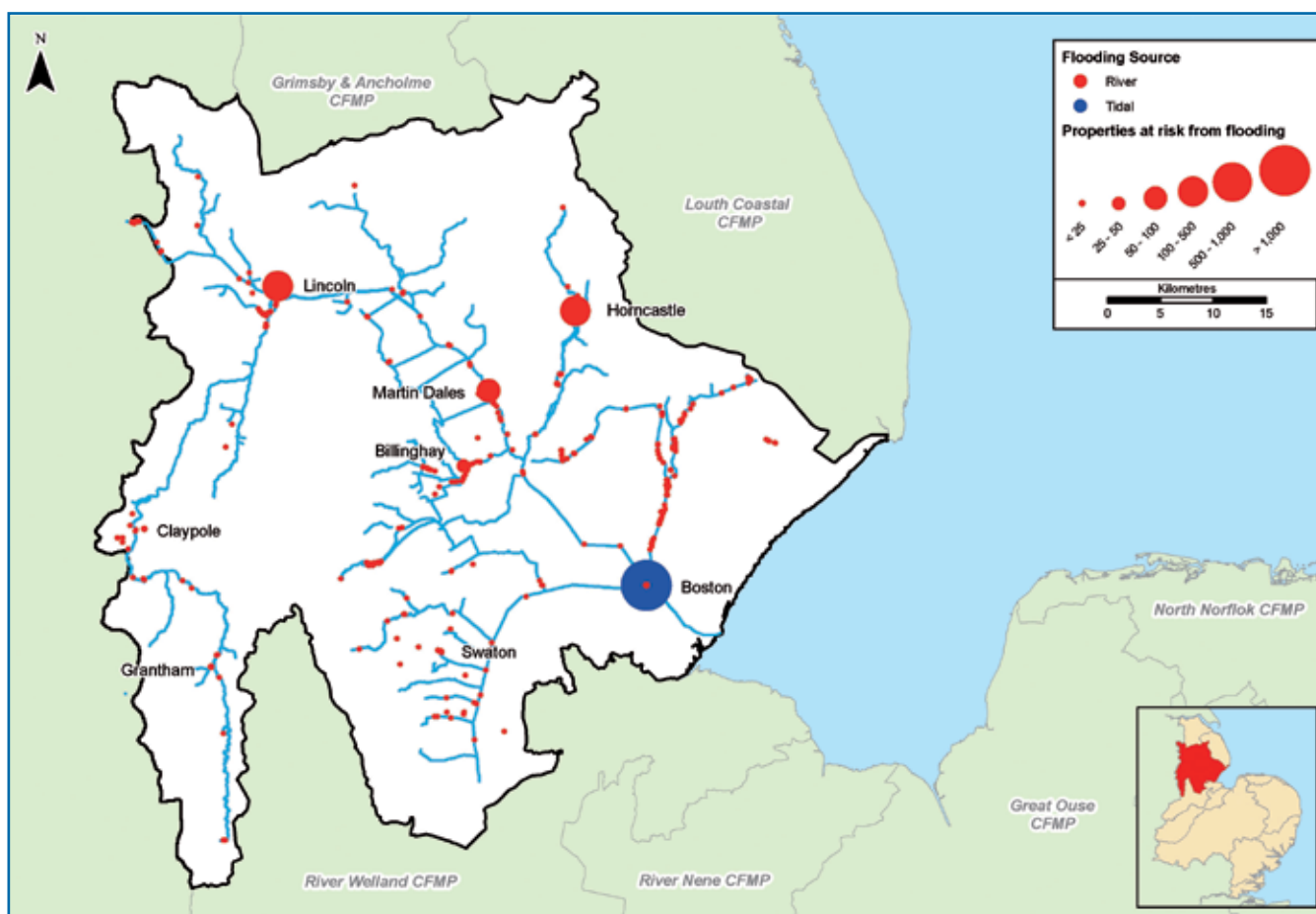
Number of properties at risk	Locations	
	At risk from 1% annual probability river flood	At risk from 0.5% annual probability tidal flood
Over 1,000	None	Boston
500 to 1,000	None	None
100 to 500	Horncastle, Lincoln	None
50 to 100	Martin Dales	None
25 to 50	Billinghay	None

**Table 2** Critical infrastructure at risk in the catchment

	Risk from a 1% annual probability river flood	Risk from a 0.5% annual probability tidal flood
Critical Infrastructure at risk	Three electricity sub-stations, Seven Wastewater Treatment Works, Sections of A-road and railway	Four electricity sub-stations, Sections of A-road and railway

<sup>1</sup> The CFMP has only considered tidal flooding along the River Witham upstream of Hobhole. The Wash SMP considers the risk of tidal flooding in other areas of the River Witham catchment.

**Map 2** Flood risk to property from the 1% annual probability river flood and 0.5% annual probability tidal flood, taking account of current flood defences



## How we currently manage the risk in the catchment

The catchment has a history of flooding, generally due to the high rainfall that can lead to watercourses and drains being overwhelmed, flood defences overtopped or raised embankments breached. Over the last 100 years, numerous engineering schemes have been implemented to reduce flood risk in the catchment, including:

- the widening, straightening and embanking of rivers. For example, earth embankments on the River Witham, River Brant, River Bain, River Slea, Nine Foot River,
- constructing concrete walls. For example the concrete floodwalls in Lincoln, Boston and Sleaford;
- building conveyance channels. For example conveyance channels along Burton Catchwater and the River Witham;
- constructing tidal flood defences. For example the Haven tidal flood defence provides protection to Boston up to the 0.66% annual probability tidal flood. The Boston Combined Strategy aims to implement a tidal barrier across the Haven in Boston by 2013;
- flood alleviation schemes. The Till Washland flood alleviation scheme and Witham/Brant Washland flood alleviation scheme provide protection to Lincoln up to the 1% annual probability river flood.

These measures have all reduced flood risk and around 27% of the total catchment population currently live in areas that benefit from flood risk management schemes.

In addition to these engineering schemes, other flood risk management activities are carried out in the catchment. These include activities which help to reduce the probability of flooding and those that address the consequences of flooding.

Activities that reduce the probability of flooding include:

- maintaining and improving existing flood defences and structures;
- maintaining river channels;

- maintenance of drainage networks by Internal Drainage Boards (IDB) and landowners;
- maintenance of road drainage and sewer systems.

Activities that reduce the consequences of flooding include:

- working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25);
- understanding where flooding is likely by using flood risk mapping;
- providing flood forecasting and warning services;

- promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood;
- promoting resilience and resistance measures for those properties already in the floodplain.

Combinations of engineering and other flood risk management activities are used to reduce the probability or consequences of flooding. We have investigated which activities are likely to be most effective and appropriate in different parts of the catchment area in the future.



↑ Stamp End Sluice, Lincoln

## The impact of climate change and future flood risk

In the future, flooding can be influenced by changes in land use (for example urban development), rural land management and climate change. Using river models we tested the sensitivity of the rivers in the catchment to these drivers.

For urbanisation, we tested the sensitivity of the rivers in the catchment to 10% increase in urban growth up to 2100. Increasing urbanisation did not have an impact on flood risk.

For rural land management, we adjusted the river models to represent the effect of reducing and increasing intensive farming practices. At a catchment scale this had a limited impact on flood risk.

For climate change we tested the following changes up to 2100:

- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood risk;
- A total sea level rise of 964 mm by the year 2100. This will increase the probability of tidal flooding and increase the length of time watercourses will not be able to flow freely to the sea at high tide (tide-locked). Climate change was shown to have a significant impact on flood risk.

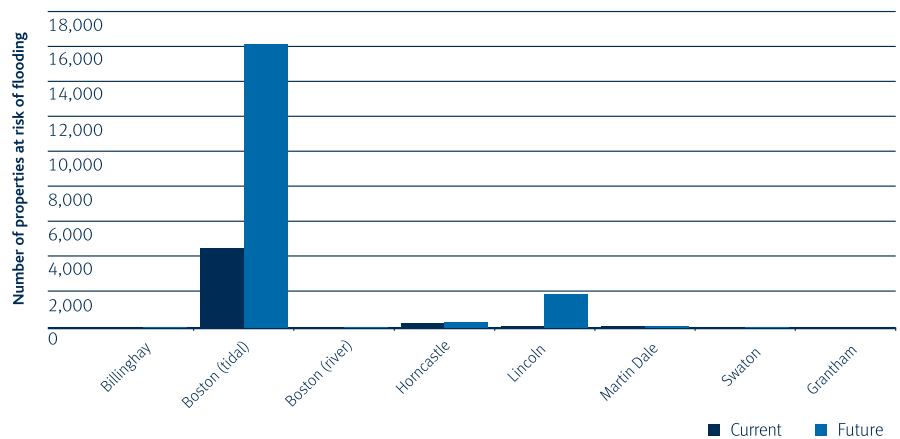
In the River Witham CFMP area, climate change was shown to have the greatest impact on flood risk. Therefore, the scenario used to model future flood risk was based on the current level of urbanisation and current rural land management situation and the changes in climate change as described.

Using river models we estimate that by 2100, 7,000 people and 3,700 commercial and residential properties will be at risk from the 1% annual probability river flood, this does not include flooding from IDB drains. Around 32,000 people and 16,000 properties will be at risk from the 0.5% annual probability tidal

flood. These figures take account of current flood defences. Flood risk from rivers increases mainly in Lincoln and Horncastle. The risk from tidal overflow will increase at Boston.

Figure 2 shows the difference between current and future flood risks for a 1% annual probability river flood at key locations in the CFMP area, and for a 0.5% annual probability tidal flood at Boston. Following on from the CFMP organisations need to work together to investigate flood risk from other sources (for example surface water and groundwater flooding) in more detail.

**Figure 2** Current and future (2100) flood risk to property from a 1% annual probability river flood at key locations in the CFMP area and 0.5% annual probability tidal flood at Boston, taking into account current flood defences. This does not include flooding from IDB drains





Flood risk to infrastructure or transport services also increases. During a 1% annual probability flood there is risk to five electricity sub-stations, eight wastewater treatment works and sections of A road and railway. During a 0.5%

annual probability tidal flood there is risk to 22 electricity sub-stations and sections of A road and railway. Generally, it is unlikely that the impact of flooding on environmental sites will change significantly in the future. There are nine additional

Scheduled Monuments at risk from the future 1% annual probability river flood, one additional Scheduled Monument and 100 additional listed buildings at risk from a future 0.5% annual probability tidal flood.



↑ Dunston Beck, Sleaford

# Future direction for flood risk management

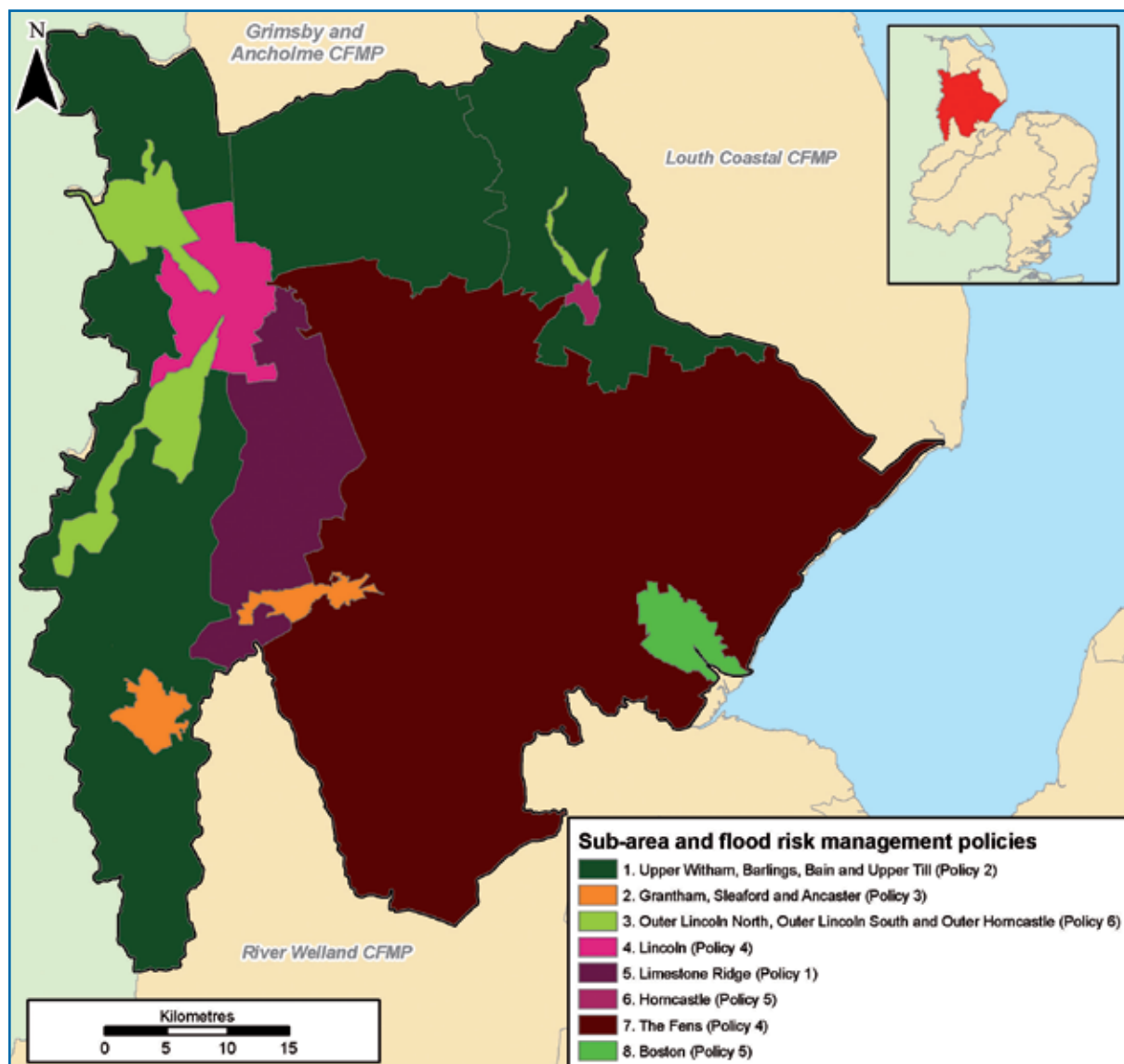
## Approaches in each sub-area

We have divided the River Witham catchment into eight distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified

the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

To select the most appropriate policy, the plan considers how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

Map 3 Sub-areas and flood risk management policies



### Table 3 Flood risk management policy options

#### → Policy 1

##### **Areas of little or no flood risk where we will continue to monitor and advise**

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

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#### → Policy 2

##### **Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions**

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

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#### → Policy 3

##### **Areas of low to moderate flood risk where we are generally managing existing flood risk effectively**

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

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#### → Policy 4

##### **Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change**

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

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#### → Policy 5

##### **Areas of moderate to high flood risk where we can generally take further action to reduce flood risk**

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

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#### → Policy 6

##### **Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits**

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

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# Upper Witham, Barlings, Bain and Upper Till

## Our key partners are:

South Kesteven District Council

North Kesteven District Council

West Lindsey District Council

Newark and Sherwood District Council

Melton Borough Council

Rutland County Council

East Lindsey District Council

Lincolnshire County Council

## The issues in this sub-area

Within this large sub-area there is relatively low risk to people and property located in small towns and villages, or in isolated areas scattered throughout the rural region. River flooding is infrequent and the consequences of flooding are low. Currently, 102 properties within this sub-area are at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. The properties at risk are concentrated within Barlings in settlements such as Scothern and Nettleham. There is approximately 1,206 hectares (ha) of grade three agricultural land and approximately 274 ha of grade two agricultural land at risk of flooding in the 1% annual probability river flood. Tables 4, 5, 6 and 7 detail flood risk to people and property in this sub-area, this does not include flooding from IDB drains.

**Table 4 Risk to people and property within the Upper Witham sub-area during a 1% annual probability river flood, taking into account raised defences**

	Current	Future (2100)
Number of people at risk	56	56
Number of properties at risk	29	29

**Table 5 Risk to people and property within the Barlings sub-area during a 1% annual probability river flood, taking into account raised defences**

	Current	Future (2100)
Number of people at risk	130	135
Number of properties at risk	52	55

**Table 6 Risk to people and property within the Bain sub-area during a 1% annual probability river flood, taking into account raised defences**

	Current	Future (2100)
Number of people at risk	48	48
Number of properties at risk	20	20



**Table 7 Risk to people and property within the Upper Till sub-area during a 1% annual probability river flood, taking into account raised defences**

	Current	Future (2100)
Number of people at risk	3	3
Number of properties at risk	1	1

## The vision and preferred policy

**Policy option 2:** Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.

In these rural reaches the current activity to manage flooding is out of proportion with the level of flood risk, or is not effective. In general, overall flood risk management activities will be reduced within the sub-areas, however where flood risk is more concentrated (for example in towns and villages) existing actions to manage flooding may be continued. The preferred approach is to reduce bank and channel maintenance in some locations. This will enable limited resources to be targeted to other areas of the catchment where the risks are greater, to ensure value for money. The preferred approach will also help improve the flow between the river and its floodplain and so improve wetland and aquatic habitats.

Flood warning is an important way of managing the consequences of flooding throughout the catchment. Therefore, the local flood warning infrastructure (such as river flow gauging stations) needs to be maintained.

## The key messages

- Where feasible, flood risk management activities will be reduced as the current activity to manage flooding is out of proportion with the level of flood risk.
- Reducing bank and channel maintenance will help naturalise rivers and improve the flow between the river and its floodplain.

- Maintain flood warning infrastructure (such as river flow gauging stations) to ensure that an effective flood warning service can be provided throughout the catchment.

## Proposed actions to implement the preferred policy

### General actions across the sub-area:

- Investigate options to cease or reduce current bank and channel maintenance and flood defence maintenance. In addition, changes in land use, development of sustainable farming practices and environmental enhancement should be investigated to mitigate an increase in flooding in the future.
- Continue with the flood warning service including the maintenance of flood warning infrastructure (such as river flow gauging stations) and public awareness plans.
- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.

### Action specific to Upper Witham, Barlings, Bain and Upper Till:

- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be targeted to areas with lowest flood risk, must not increase risk to existing development and should provide opportunities to improve river environments.

### Action specific to Upper Witham, Barlings and Upper Till:

- Work with partners to develop emergency response plans for critical infrastructure and transport links at risk from flooding.

### Action specific to Barlings:

- Continue with the current level of flood risk management in Langworth, Scothern and Nettleham.

# Grantham, Sleaford and Ancaster

## Our key partners are:

South Kesteven District Council

North Kesteven District Council

Lincolnshire County Council

Anglian Water

## The issues in this sub-area

This sub-area contains settlements located in and around river floodplains, which are at risk from river flooding, for example Grantham, Ancaster and Wilsford. Currently there are 30 properties within this sub-area at risk from the 1% annual probability river flood. Raised defences have been constructed along some of the watercourses in this area and water level control structures have been built. These reduce the risk from river flooding in this area. Extensive maintenance work along the rivers in this area is also carried out. There is approximately two ha of grade three agricultural land at risk in Grantham. There is no grade two agricultural land at risk of flooding in the 1% annual probability river flood in this sub-area. Tables 8 and 9 detail flood risk to people and property in this sub-area.

**Table 8 Risk to people and property within the Grantham sub-area during a 1% annual probability river flood, taking into account current flood defences**

	Current	Future (2100)
Number of people at risk	14	14
Number of properties at risk	4	4

**Table 9 Risk to people and property within the Sleaford and Ancaster sub-area during a 1% annual probability river flood, taking into account current flood defences**

	Current	Future (2100)
Number of people at risk	52	64
Number of properties at risk	26	64

## The vision and preferred policy

**Policy option 3:** Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

The settlements in this sub-area have been built in the floodplain and as a result have a history of flooding. In the past flood defences have been constructed and maintenance work carried out to reduce flood risk. Although flood risk is not expected to increase significantly in the future, as there is a concentration of people and property within the floodplain, it is still feasible and effective to continue with the current level of flood risk management. This will be achieved by continuing with existing flood risk management activities.

Alternative measures may include reducing flood risk maintenance in parts of the sub-area where there is a low flood risk, or where benefits may arise in the future from upstream flood storage. Reducing the need for continued maintenance could bring opportunities to improve the environmental quality of local watercourses.

## The key messages

- The current level of flood risk management should be continued in these settlements.
- In some areas there may be alternative, more appropriate ways to manage flood risk at the current level.
- Any new development or re-development should be resilient to all sources of flooding.

## Proposed actions to implement the preferred policy

### General actions across the sub-area:

- Continue with the flood warning service including the maintenance of flood warning infrastructure (such as river flow gauging stations) and public awareness plans.
- Work with planners to influence the location, layout and design of new and redeveloped property. Ensure that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).

- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.

### Actions specific to Sleaford and Ancaster:

- Continue current maintenance activities through the towns.
- Work with our partners to develop a surface water and groundwater study for Sleaford.

### Actions specific to Grantham:

- Continue current maintenance activities through the town.
- Work with partners to develop an emergency response plan to manage flood risk from the defences failing or being overwhelmed.
- Work with our partners to develop a Surface Water Management plan for Grantham.



↑ Claypole, Grantham

# Outer Lincoln North, Outer Lincoln South and Outer Horncastle

## Our key partners are:

City of Lincoln Council

North Kesteven District Council

Lincolnshire County Council

West Lindsey District Council

Upper Witham Internal Drainage Board

Witham Third Internal Drainage Board

## The issues in this sub-area

The risk to people and property is low in this sub-area. There are currently 46 properties at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. Risk to agriculture is widespread and relatively frequent. Sections of the A1500, railway line and two Sewage Treatment Works are at risk in the 1% annual probability river flood. Tables 10, 11 and 12 detail flood risk to people and property in this sub-area.

**Table 10** Risk to people and property within the Outer Lincoln North sub-area during a 1% annual probability river flood, taking into account current flood defences

	Current	Future (2100)
Number of people at risk	44	44
Number of properties at risk	32	32

**Table 11** Risk to people and property within the Outer Lincoln South sub-area during a 1% annual probability river flood, taking into account current flood defences

	Current	Future (2100)
Number of people at risk	18	18
Number of properties at risk	9	9

**Table 12** Risk to people and property within the Outer Horncastle sub-area during a 1% annual probability river flood, taking into account current flood defences

	Current	Future (2100)
Number of people at risk	5	5
Number of properties at risk	5	5

The floodplain in this sub-area can provide areas to store water during flood events. The storage of floodwaters can reduce the impact of flooding to people and property in urbanised areas downstream. For example storage of water in Outer Lincoln North and Outer Lincoln South would reduce the future risk to people and property in the city of Lincoln, so that the risk does not increase from the current situation. Storage of water in Outer Horncastle would reduce the risk of flooding to people and property in Horncastle.



## The vision and preferred policy

**Policy option 6:** Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

In these largely rural areas the aim is to manage flood risk by maximising the potential of the floodplain to retain water to benefit locations elsewhere in the catchment. Storing water on these floodplains can reduce flood risk to settlements downstream. This approach may involve:

- restoring river channels, water meadows and the natural floodplain;
- reducing runoff from agricultural land;
- structural measures to control water levels and retain more water on the floodplains;
- engineered schemes to store floodwater.

Locally, the floodplain storage areas may provide long-term benefits for the river environment and wetland habitats. Within these sub-areas reducing bank and channel maintenance will increase the ability of the floodplain to store water by improving the flow between the river and its floodplain. However, where flood risk may be more concentrated, such as in towns and villages, existing actions to manage flooding may be continued. To be able to use the floodplain for flood risk management, planners must prevent development that affects the ability of the floodplain to retain water.

## The key messages

- Storing water on the floodplain in these areas can reduce flood risk to settlements downstream and provide environmental benefits.
- Development that affects the ability of the floodplain to retain water should be prevented.
- Maintenance work on rivers should aim to increase the capacity of the floodplain to retain water.
- Storing water on the floodplain could provide long-term benefits for the river environment and wetland habitats.

## Proposed actions to implement the preferred policy

### General actions across the sub-area:

- Produce flood storage studies for this sub-area to investigate the most appropriate storage options and locations for floodplain storage. The studies should also consider opportunities to enhance the environment by improving the natural state of the river and its habitat.
- Identify opportunities where bank and channel maintenance can be reduced to improve the flow between the river and its floodplain to increase water storage on the natural floodplain.
- Continue with the flood warning service including the maintenance of flood warning infrastructure (such as river flow gauging stations) and flood awareness plans.
- Encourage planners to prevent development within the floodplain. The floodplain should be maintained as an asset to make space for water.
- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.

### Actions specific to Outer Lincoln North and Outer Lincoln South:

- Continue with maintenance and inspection of the Till washlands and Witham/Brant washland.
- Encourage planners to prevent development within the floodplain. The floodplain should be maintained as an asset to make space for water.
- Work with partners to develop emergency response plans for critical infrastructure and transport links at risk from flooding.

# Lincoln

## Our key partners are:

City of Lincoln Council

West Lindsey District Council

North Kesteven District Council

Lincolnshire County Council

## The issues in this sub-area

The probability of river flood risk has been reduced in Lincoln by the construction of a major flood storage reservoir. Currently 112 properties are at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. There is a significant increase in the number of people and property at risk in the future in Lincoln. There is approximately 114 ha of grade three agricultural land and approximately 6 ha of grade two agricultural land at risk of flooding in the 1% annual probability river flood. There are sections of railway line and one electricity sub-station at risk. Table 13 details flood risk to people and property in this sub-area.

**Table 13 Risk to people and property within the Lincoln sub-area during a 1% annual probability river flood, taking into account current flood defences. This does not include flooding from IDB drains**

	Current	Future (2100)
Number of people at risk	243	3,687
Number of properties at risk	112	1,997

## The vision and preferred policy

**Policy option 4:** Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

Historically, defences were constructed to reduce the probability of flooding in this sub-area. However, flood defences can fail or be overwhelmed and may become less effective in the future. Flood risk is expected to increase in the future to people and property. It is therefore important to maintain the current level of flood risk into the future. The preferred approach is to manage the probability of river flooding by storing water on the floodplain upstream.

Different approaches are required for the different sources of flooding, as river defences do not reduce the risk from urban drainage issues and surface water flooding. Organisations need to work together to manage the urban drainage issues and surface water flood risk.

The urban environment needs to be adapted to make it more resilient to flooding, for example as commercial sites are redeveloped, the location and layout of buildings could be designed to help reduce flood risk. The risk of flooding cannot be reduced entirely, therefore flood awareness must continue to be promoted amongst the community.

## The key messages

- Where possible, flood risk should be managed by storing water on the floodplain upstream of settlements at risk.
- Any redevelopment of floodplain areas is an opportunity to increase their flood resilience.

- Organisations must work together to provide an integrated approach to urban drainage issues and surface water flooding.
- Flood awareness plans will be used to manage the consequences of flooding.

## Proposed actions to implement the preferred policy

- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be resilient to flooding and provide opportunities to improve river environments.
- Reduce the consequences of flooding by: improving public awareness of flooding; encouraging people to sign up to, and respond to, flood warnings; and by improving local emergency planning for critical infrastructure at risk.

- Work with partners to investigate the options for managing urban drainage issues and surface water flooding. Where strategies, including water cycle strategies have been developed, organisations need to work together to implement the recommendations made.
- Develop a flood storage study to investigate the feasibility of creating storage areas, natural or engineered, along the river corridor upstream of the city to manage future flood risk. The study should build on the options considered in the original Lincoln Flood Alleviation Scheme (1982).
- Continue current maintenance activities through the city.
- Work with partners to develop an emergency response plan to manage flood risk from the defences failing or being overwhelmed.
- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.



↑ Monsoon Street, Lincoln

# Limestone Ridge

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## Our key partners are:

South Kesteven District Council

North Kesteven District Council

## The issues in this sub-area

This sub-area is made up of arable farming land, with several small towns, villages and isolated properties. There is a very low population density. There are no flood defences in the sub-area and we do not undertake any flood risk management activities or provide a flood warning service. There are no people or properties at risk in the 1% annual probability river flood in this sub-area.

## The vision and preferred policy

**Policy option 1:** No active intervention (including flood warning and maintenance). Continue to monitor and advise.

There is currently no flood risk within this sub-area. Expenditure is already low and so ceasing the current maintenance activity will not significantly increase flood risk locally or downstream. This policy will enable

limited resources to be targeted to other areas of the catchment where the risks are greater, to ensure value for money. Having no ongoing maintenance activity in this sub-area will provide environmental benefits by allowing the river channel to return to its natural state. This policy will not increase the flood risk in this sub-area in the future, despite the impact of climate change.

## The key messages

- Where feasible, flood risk management activities will be reduced as the current activity to manage flooding is out of proportion with the level of flood risk.
- Reducing bank and channel maintenance will help naturalise rivers and improve the flow between the river and its floodplain.
- Maintain flood warning infrastructure (such as river flow gauging stations) to ensure that an effective flood warning service can be provided throughout the catchment.



## Proposed actions to implement the preferred policy

- Investigate options to cease or reduce current bank and channel maintenance and flood defence maintenance. In addition, changes in land use, development of sustainable farming practices and environmental enhancement should be investigated to mitigate an increase in flooding in the future.
- Continue with the flood warning service including the maintenance of flood warning infrastructure (such as river flow gauging stations) and public awareness plans.
- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be targeted to areas with the lowest flood risk, must not increase risk to existing development and should provide opportunities to improve river environments.
- Monitor this sub-area for any changes in flood risk.



↑ Carrs Dyke, Branston

# Horncastle

## Our key partners are:

Lincolnshire County Council

Horncastle Town Council

Anglian Water

East Lindsey District Council

## The issues in this sub-area

There is a high population density in this urban sub-area. Currently, there are 261 properties at risk from the 1% annual probability river flood. There are approximately 33 ha of grade three agricultural land and no grade two agricultural land at risk of flooding in the 1% annual probability river flood. Some parts of the A153 are also at risk. Table 14 details flood risk to people and property in this sub-area.

**Table 14 Risk to people and property within the Horncastle sub-area during a 1% annual probability river flood, taking into account current flood defences. This does not include flooding from IDB drains**

	Current	Future (2100)
Number of people at risk	374	488
Number of properties at risk	261	344

## The vision and preferred policy

**Policy option 5:** Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

Historically, defences were constructed to reduce the probability of flooding in this sub-area. However, flood defences can fail or be overwhelmed and may become less effective in the future. There is currently a high flood risk to people and property within this sub-area. Climate change will increase the flood risk in the future. It is important that we take further action to reduce this risk. The preferred approach is to manage the probability of river flooding by storing water on the floodplain upstream.

Different approaches are required for the different sources of flooding. As river defences do not reduce the risk from urban drainage and surface water flooding, organisations should work together to manage these risks.

The urban environment needs to be adapted to make it more resilient to flooding. For example as commercial sites are redeveloped, the location and layout of buildings could be designed to help reduce flood risk. However, the risk of flooding cannot be reduced entirely, therefore flood awareness must continue to be promoted amongst the community.

## The key messages

- Where possible, flood risk should be managed by storing water on the floodplain upstream of the settlements at risk.
- Any redevelopment of floodplain areas is an opportunity to increase their flood resilience.
- Organisations must work together to provide an integrated approach to urban drainage issues and surface water flooding.
- Flood awareness plans should be used to manage the consequences of flooding.



## Proposed actions to implement the preferred policy

- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be resilient to flooding and provide opportunities to improve river environments.
- Reduce the consequences of flooding by: improving public awareness of flooding; encouraging people to sign up to, and respond to, flood warnings; and by improving local emergency planning for critical infrastructure at risk.
- Work with partners to investigate the options for managing urban drainage issues and surface water flooding. Where strategies, including water cycle strategies have been developed, organisations need to work together to implement the recommendations made.
- Develop a flood storage study to investigate the feasibility of creating storage areas, natural or engineered, along the river corridor upstream of the town to manage current and future flood risk.
- Continue current maintenance activities through the town.
- Work with partners to develop an emergency response plan to manage flood risk from the defences failing or being overwhelmed.
- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.
- Work with our partners to develop a Surface Water Management Plan for Horncastle.



↑ Victoria Mill, Horncastle

# The Fens

## Our key partners are:

Boston Borough Council

East Lindsey District Council

North Kesteven District Council

South Holland District Council

South Kesteven District Council

Black Sluice Internal Drainage Board

Witham First District Internal Drainage Board

Witham Third District Internal Drainage Board

Witham Fourth District Internal Drainage Board

## The issues in this sub-area

These lowland areas are predominantly rural, where historically much of the land has been drained for agriculture. Embanked watercourses carry water from upstream across these areas to outfall along the coast. The probability of flooding is significantly reduced in these areas through various engineering works including those taken for land drainage purposes. There is a perception of little or no risk. However flood defences can fail or be overwhelmed which means that some areas have significant residual risk, and the consequences of flooding have the potential to be high. Currently 502 properties within this sub-area are at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. The properties at risk are located in small towns and villages scattered across the sub-area. There is approximately 1,475 ha of grade three agricultural land and approximately 600 ha of grade two agricultural land at risk of flooding in this sub-area in the 1% annual probability river flood. There is also risk to the high grade one agricultural land (approximately 260 ha). Some sections of the A153, railway lines, two electricity sub-stations and two sewage treatment works are also at risk. Risk from coastal flooding in this sub-area is considered in The

Wash Shoreline Management Plan (SMP). Table 15 details flood risk to people and property in this sub-area.

**Table 15 Risk to people and property within The Fens sub-area during a 1% annual probability river flood, taking into account current flood defences. This does not include flooding from IDB drains**

	Current	Future (2100)
Number of people at risk	1, 143	1,381
Number of properties at risk	502	619

There is a high standard of protection offered by the defences along these heavily managed watercourses. In the long term these defences will become less effective because of increased flooding caused by climate change.

## The vision and preferred policy

**Policy option 4:** Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

Historically, The Fens have been heavily managed by a number of organisations to reduce the probability of river and tidal flooding. Flood risk is expected to increase in the future to people, property and the environment. In the short term it will be feasible and effective to maintain the existing flood defences at the current level of flood risk management. However, in the future the protection given by these defences may decline as future flooding is expected to become more intense. It may be difficult to maintain the current level of flood risk management into the future for all low-lying areas. Where it is technically, environmentally and economically viable, the policy is to undertake further activities to maintain the current level of flood risk management into the future.



## The key messages

- In the short term, it is still feasible and effective to maintain the existing flood defences at the current level of flood risk management.
- Produce a strategy to develop a sustainable, integrated and long term flood risk management approach for The Fens.

## Proposed actions to implement the preferred policy

- Produce a flood risk management strategy for The Fens to investigate how flood risk varies across the area and the best approach to manage this risk.



↑ Hagnaby Beck, Fens

# Boston

## Our key partners are:

Boston Borough Council

Black Sluice Internal Drainage Board

Witham Fourth District Internal Drainage Board

## The issues in this sub-area

The probability of river and tidal flood risk has been reduced significantly in this sub-area through the construction of defences; however the area is still at substantial risk from tidal flooding due to the overtopping of these defences. There is also a flood risk network on inland rivers and drains. Flood risk measures rely heavily on raised embankments, tidal doors to prevent tidal waters entering inland and the Black Sluice Pumping Station.

Currently 23 properties within Boston are at risk from the 1% annual probability river flood. This does not include flooding from IDB drains. Currently 4,500 properties within Boston are risk from the 0.5% annual probability tidal flood. There is approximately 162 ha of grade two agricultural land and approximately 660 ha of grade one agricultural land at risk of flooding in this sub-area in the 1% annual probability river flood. Table 16 details river flood risk to people and property in this sub-area and Table 17 details the tidal flood risk to people and property.

**Table 16 Risk to people and property within the Boston sub-area during a 1% annual probability river flood, taking into account current flood defences. This does not include flooding from IDB drains**

	Current	Future (2100)
Number of people at risk	47	65
Number of properties at risk	23	28

**Table 17 Risk to people and property within the Boston sub-area during a 0.5% annual probability tidal flood, taking into account current flood defences**

	Current	Future (2100)
Number of people at risk	8,719	31,993
Number of properties at risk	4,491	16,156

## The vision and preferred policy

**Policy option 5:** Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

Historically, flood defences were constructed to reduce the probability of river and tidal flooding. In the future the standard of protection offered by existing defences may decline. For Boston, the most effective way to manage flood risk will be to improve the existing defences or create new ones. Investigation into the impacts of surface water flooding and urban drainage issues may also identify the need for further management.

For this policy to be sustainable it must be recognised that flood defences cannot completely remove the flood risk. There will be risk to people and property behind the defences, as they could fail or be overwhelmed. With people at risk from several sources of flooding, organisations should work together to develop flood awareness and emergency response plans. We must also work in partnership with the local planning authority to target future development to previously developed land.

## The key messages

- The most effective way to manage flood risk may be to improve the existing defences or create new flood defences.
- Emergency response and flood awareness plans should be used to manage flood risk from the flood defences failing or being overwhelmed.
- Within Boston, organisations need to take an integrated approach to managing river, tidal and surface water flooding.

## Proposed actions to implement the preferred policy

- Reduce the consequences of flooding by improving public awareness of flooding and encouraging people to sign up to, and respond to, flood warnings. Flood awareness plans will inform people about the risk of defences breaching and the actions they can take to protect themselves and their property.

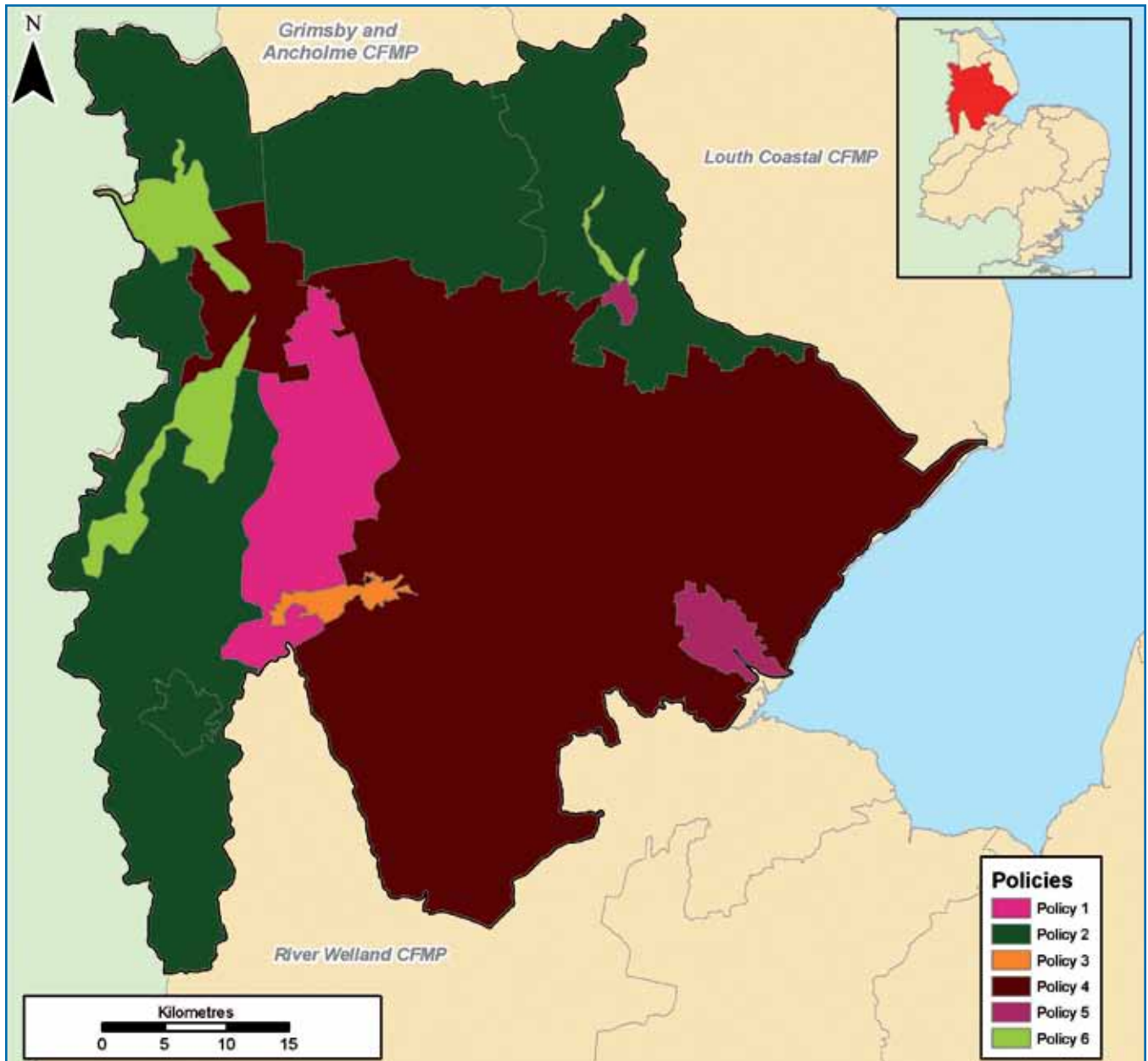
- Develop emergency response plans to manage flood risk from the defences failing or being overwhelmed, and work with partners to manage flood risk to critical infrastructure.
- Continue with the Boston Combined Strategy to construct a tidal barrier.
- Continue current maintenance activities through the town.
- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be resilient to flooding and provide opportunities to improve river environments.
- Work with the IDBs to gather information on IDB maintenance costs and activities and to re-assess the policy options after the inclusion of these costs and activities.
- Work with our partners to develop a Surface Water Management Plan for Boston.



↑ Boston Grand Sluice, Boston

# Map of CFMP policies

Map 4 The flood risk management policies for the River Witham CFMP area





# Notes

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# Notes

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