Environment Agency

Thames Catchment Flood Management Plan

Summary Report December 2009

We are the Environment Agency. It's our job to look after your environment and make it a better place – for you, and for future generations.

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The Environment Agency. Out there, making your environment a better place.

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Introduction

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

The Thames 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, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water 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.

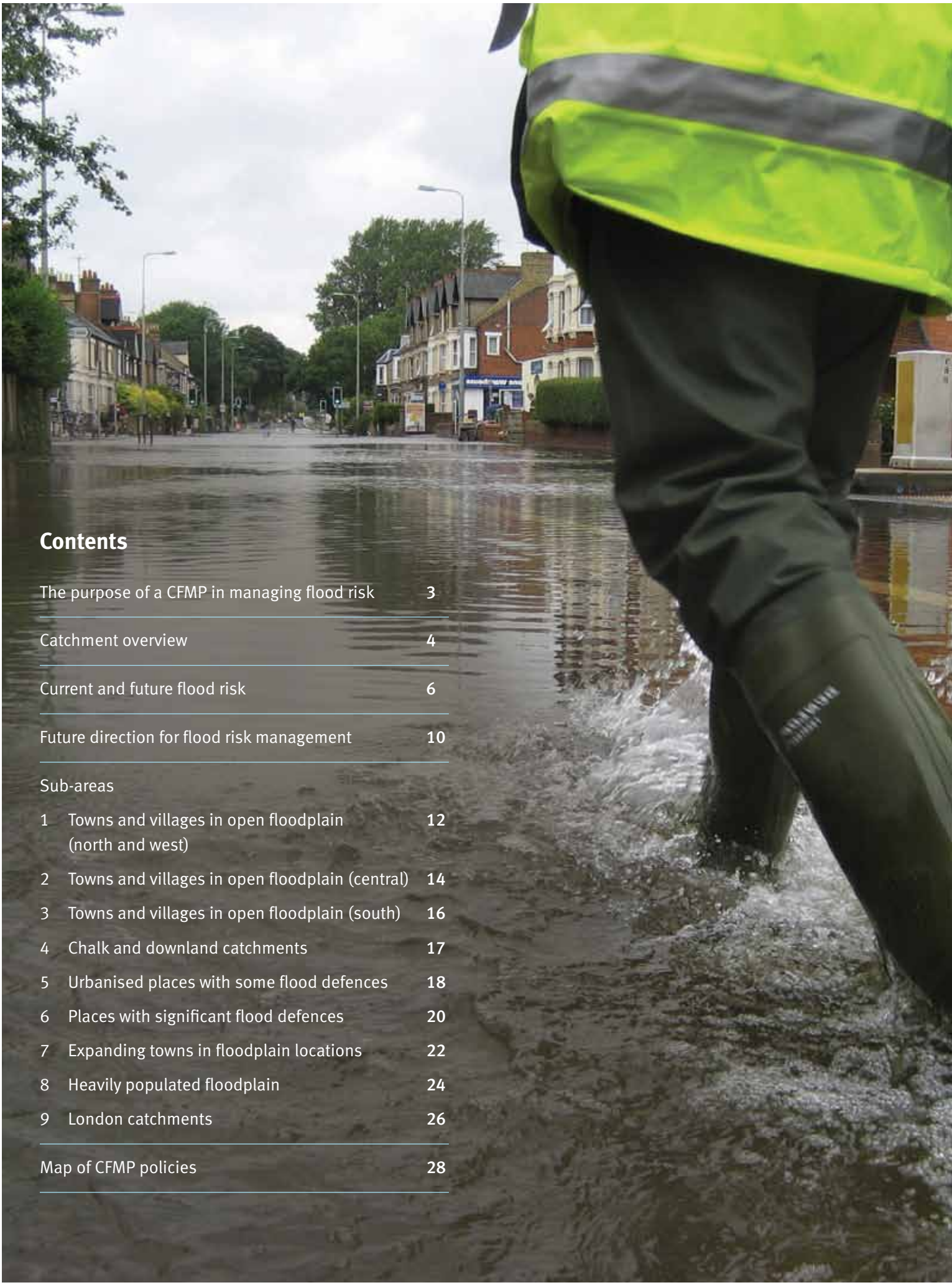
There are over 135,000 properties in the Thames CFMP area that are at risk of flooding from rivers.

In London, there are a further 300,000 properties at risk of flooding from the sea. There are many more properties at risk of flooding from other sources, such as groundwater and surface water run-off (especially in urban areas). The impact of climate change will continue to increase the risk of flooding in the future.

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 and agree the most effective way to management flood risk in the future. We have worked with a number of partner organisations throughout the development of this CFMP. They include: Local Authorities, Regional Government, Natural England, RSPB, English Heritage, academia and local interest groups.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing **enquiries@environment-agency.gov.uk**

Howard Davidson
Thames Regional Director



Contents

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;
- 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

Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The management of flood risk is influenced by the diverse physical features of Thames Region. Towards the west in Gloucestershire, Oxfordshire and Berkshire, the Thames and its tributaries flow through a rural landscape with rolling hills and wide, flat river floodplains. The rivers generally flow in a natural earth channel and there are extensive areas of rich floodplain habitat. Some areas of the floodplain are internationally designated environmental sites. Some of the most notable are the chalk rivers in the Kennet catchment and the Oxford meadows in the floodplain of the River Thames.

In contrast, towards the east, the region is more urban in character. Outside of London through Hertfordshire, Buckinghamshire and Surrey most of the rivers are still in a largely natural state. In London, the majority of rivers have been highly modified to carry water efficiently through artificial and straightened channels. There are nine major tributaries of the River Thames in London. Most of their floodplains have been heavily developed and flooding can happen very quickly.

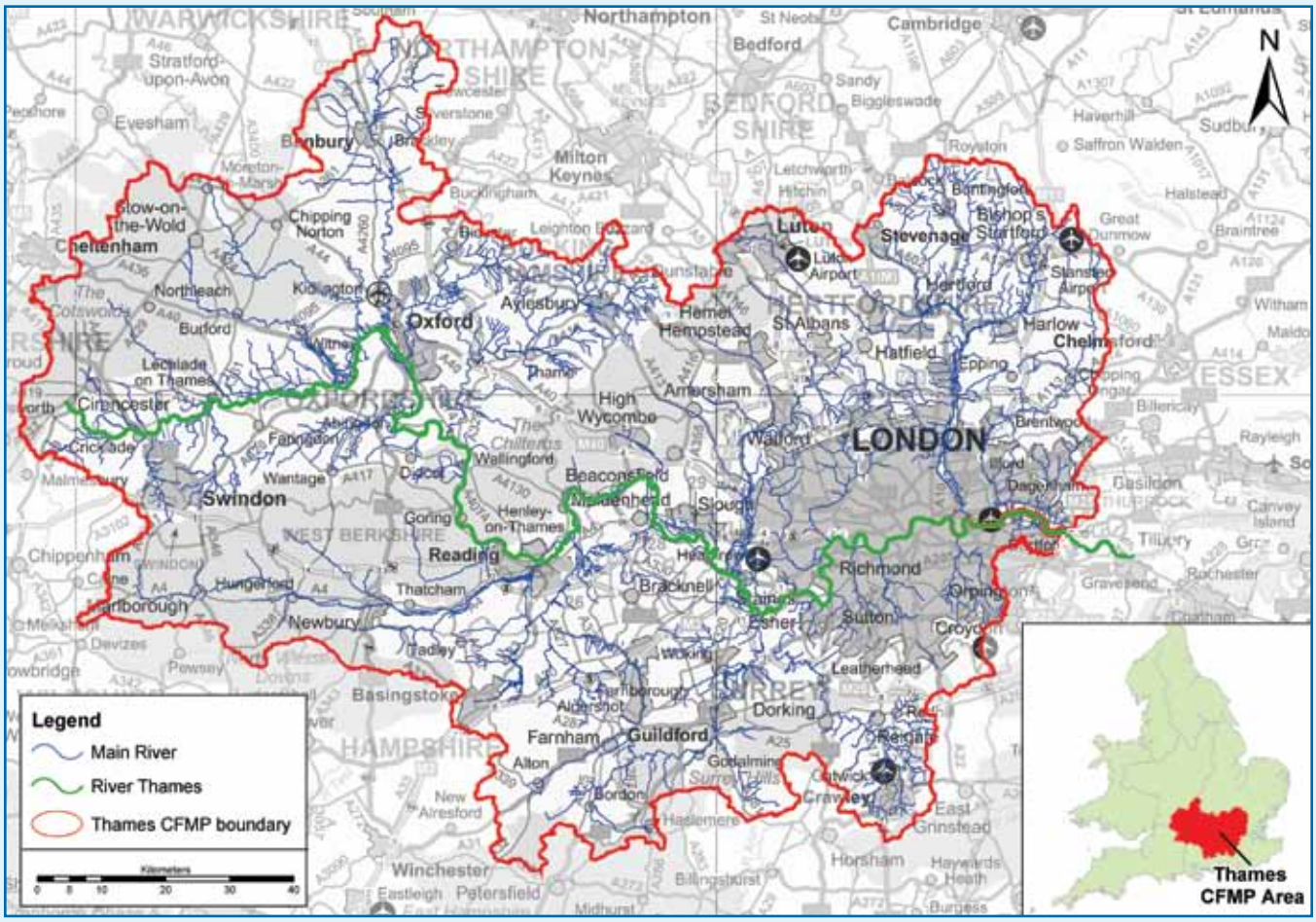
Thames has a mixed geology, consisting of chalk, limestone, gravel, sand and clay. In the chalk areas (for example Chilterns, Berkshire Downs) and limestone areas (Cotswolds) water soaks into the ground and is released at a slow rate into the rivers. In contrast to this, the clay catchments (London, Thame), respond much quicker. This is because clay is impermeable and more rainfall runs directly into the rivers, quickly affecting water levels.

Water levels in the River Thames rise slowly after rainfall. But the response of the smaller rivers that flow into the Thames varies depending on factors such as the size of the catchment area, geology, slope and land use.

The Environment Agency owns 44 lock and weir sites on the River Thames and one lock on the River Kennet. During normal flow conditions these structures help to maintain water levels between Cricklade and Teddington and ensure that the Thames is navigable for boats. When flows increase, these structures are fully opened to minimise any impact on river flow and level.

Within the Thames CFMP area there are 26 sites designated for their environmental importance: Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar Sites. There are also over 450 Sites of Special Scientific Interest (SSSIs).

Map 1. Location and extent of the Thames CFMP



↑ There are 44 lock and weir sites on the River Thames

Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) of a 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% flood has a 1% chance or 0.01 probability of occurring in any one year. The flood risks quoted in this report do not take account of flood defences.

Flooding can occur from a range of different sources. So we need to think about the type of flooding that could occur, and what might be affected by the flood (people, property and the environment).

Flooding in the Thames CFMP area can occur from: the rivers (fluvial flooding), urban drainage systems (surface water and sewer flooding) and rising groundwater.

The Thames CFMP focuses on the risks from river flooding, as there is limited data available at the current time about flooding from surface water and groundwater within the region.

The future management of tidal flood risk in London is being addressed through our Thames Estuary 2100 Flood Risk Management Plan.

The last major flood event in Thames Region was in July 2007. After a wet early summer, very heavy and intense rain fell on the 19 and 20 July. This caused immediate surface water flooding in many locations followed by river flooding in the upper parts of the Thames catchment. Over 5,000 flooded properties were reported to the Environment Agency; 2,000 of these were as a result of surface water. Numerous communities across Oxfordshire, Gloucestershire, Berkshire and Surrey were badly affected by the flooding. Many London Boroughs suffered extensive surface water flooding affecting properties and critical infrastructure.

Flooding was experienced on the Thames in 2003, across the whole region in 2000 from rivers and groundwater and in the Cherwell catchment in 1998. In most years surface water flooding and localised river flooding will occur somewhere in the region following heavy storms.

What is at risk?

Approximately 135,000 properties have more than a 1% chance of flooding in any one year from rivers.

In London there are also approximately 300,000 properties at risk from tidal flooding. However, the Thames Barrier and its associated defences provide a high standard of protection (up to 0.1% chance of flooding in any one year) to reduce the likelihood of tidal flooding.

Thirteen of the SACs and SPAs in the Thames CFMP area are within the 1% floodplain. 180 SSSIs are within the 1% floodplain. In some cases it is only a small part of the site that is affected by flooding. Flooding of these sites is often beneficial; indeed many of the sites such as the Oxford Meadows depend on regular flooding to sustain their habitat. It is important that the favourable water level conditions are maintained.

Where is the risk?

London and the Lower Thames have the greatest total number of people and property at risk. The number of properties in the floodplain in these areas represents 60% of the total at risk in the Thames CFMP area. This includes over 18,000 in the Lower Thames and over 19,000 in the Lower Lee. Other concentrations of flood risk include Oxford, Reading, the Blackwater Valley and the Upper Mole.

Table 1. Locations with 100 or more properties at risk in a 1% annual probability river flood within the Thames CFMP area

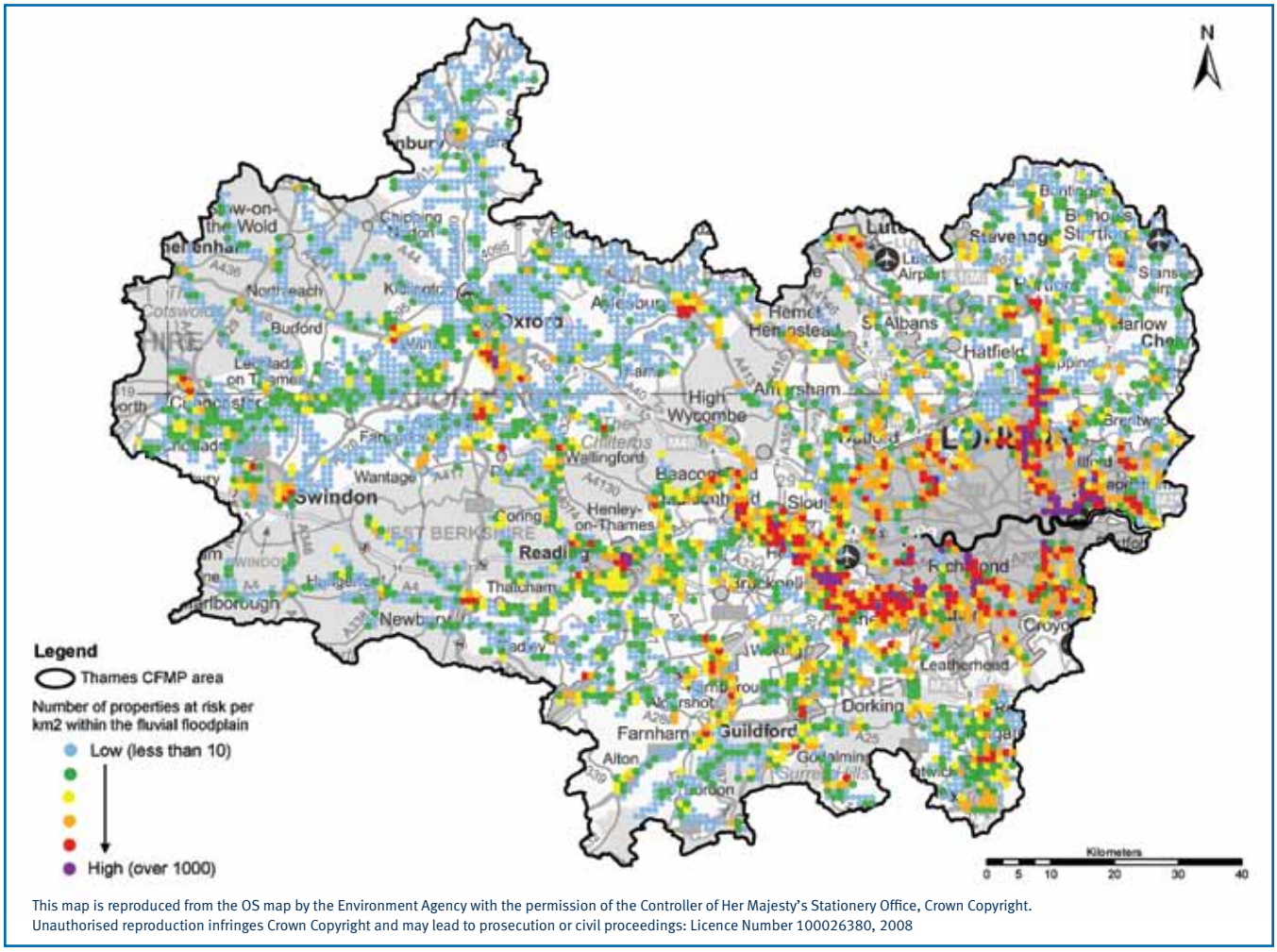
Number of properties at risk	Local Authority
Over 5,000	Merton London Borough, Newham London Borough, Runnymede, Windsor and Maidenhead
2,000 to 5,000	Lewisham London Borough, Oxford, Wandsworth London Borough, Croydon London Borough, Bromley London Borough, Elmbridge, Spelthorne, Redbridge London Borough, Waltham Forest London Borough, Kingston upon Thames London Borough, Sutton London Borough, Vale of White Horse, Epping Forest, Tower Hamlets London Borough, Reading, Slough
1,000 to 2,000	Cotswold, South Oxfordshire, Richmond upon Thames London Borough, East Hertfordshire, Waverley, Enfield London Borough, Havering London Borough, Guildford, Wycombe, Reigate and Banstead, Barking and Dagenham London Borough, Swindon, West Berkshire, Bracknell Forest
500 to 1,000	Barnet London Borough, Crawley, Cherwell, Epsom and Ewell, Lambeth London Borough, Hillingdon London Borough, Broxbourne London Borough, Dacorum, Aylesbury Vale, Basingstoke and Deane, Three Rivers, West Oxfordshire, Brent London Borough, South Bucks, St. Albans, Greenwich London Borough, Harrow London Borough, Wokingham
250 to 500	Woking, Chiltern, Hertsmere, Surrey Heath, Hart, Mole Valley, Tandridge, Wiltshire
100 to 250	Hackney London Borough, Harlow, Mid Sussex, Ealing London Borough, Watford, Brentwood, Welwyn Hatfield, East Hampshire, Uttlesford, Luton

Table 2. Critical infrastructure at risk:

Hospital	3	Railway station	38
School	120	Integrated Pollution Prevention and Control Sites (e.g. major landfill, incineration plants)	17
Care Home	56	Sites with Radioactive Substances	7
Camp/ Caravan Site	20	Sewage and Water Treatment	86
Emergency Response (fire, police and ambulance stations)	50	Motorway km	50
Power and Gas Stations	670	A class roads* km	280
Telephone Exchange	10	Main railway* km	270
Airport	1		

* Most of the railways and motorways in the floodplain are raised on embankments so are not always at direct risk of flooding.

Map 2. The distribution of properties at risk from flooding from rivers in the Thames CFMP area



How we currently manage the risk in the catchment

During the last 60 years many schemes to protect urban areas have been constructed; for example in the Lower Lee in North London. During this period, there has been a reduced emphasis in flood risk management on land drainage to improve agricultural production to one primarily focussed on flood defence in urban areas. Today we look to work with natural processes and mange the consequences as well as the probability of flooding. We will be far more dependent upon partnerships with communities, Local Authorities and utility companies to manage future flood risk.

Associated with urban growth, many rivers were modified and straightened to improve their capacity to convey water. These engineering schemes protect many urban areas against river flooding to between a 2% to 5% annual probability. Today we recognise that many of these defences are not suitable to cope with the impacts of climate change and we need more sustainable approaches to manage the risk in the future. A major challenge that this CFMP has addressed is how we adapt our management of the flood risk in these urban areas. This includes many London catchments, the River Lee and those towns that have grown rapidly in the last 50 years, such as Swindon and the new towns around London.

In some urban areas, particularly along the River Thames, there are no flood defences. The drift geology of the Thames valley, characterised in many areas by permeable gravels, makes the construction of flood embankments impractical. To protect these locations we either need to store very large quantities of water upstream, or convey very large quantities of water in flood alleviation channels. Both are expensive and technically

challenging. The Jubilee River flood relief channel now reduces flood risk to Maidenhead and Windsor. We are investigating similar options for the Lower Thames.

We undertake a wide range of work. The majority of expenditure is on actions to reduce the likelihood of flooding. Taking a risk-based approach, these include;

- Maintaining defences
- Maintaining watercourses
- Building new defences
- Working with Local Authorities to manage run-off from new development.
- Long-term strategic planning

Actions to reduce the consequences of flooding include:

- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared to take action in time of flood.
- Providing flood forecasting and warning services to those at risk.
- Improved incident and emergency response in combination with the emergency services and Local Authorities.
- Working with Local Authorities to ensure land use planning takes flood risk into account when determining the location, layout and design of development.
- Flood proofing properties and infrastructure to improve the resilience (reducing the damage from flood water) and the resistance (keeping flood water out) to avoid harm and economic damages.

The impact of climate change and future flood risk

Future flood risk will be influenced by a range of factors, most notably climate change and changes in land use from urban growth. Climate change is likely to have the largest impact; it will increase both the probability and consequences of flooding. Whilst we do not know exactly what will happen in the future, the following key trends have been assumed in this CFMP:

- Milder, wetter winters resulting in increases in peak river flows of 20%. This will mean that flooding will happen more often and large scale severe flooding will be more likely to happen.
- More frequent, short duration, intense storms in summer causing more widespread and regular 'flash flooding' from overwhelmed drainage systems and some rivers.

Using broad scale modelling, we have estimated that the number of properties at a 1% risk of flooding from rivers in the Thames CFMP area will increase by approximately 20%, as a result of climate change.

In general, where there are wide, flat floodplains more properties will be at risk of flooding. For example in the Thames valley, and catchments in Berkshire and Oxfordshire. In areas with a more constrained floodplain, for example in the upper reaches of the Lee in Hertfordshire and catchments in London flood depths will increase.

In many areas of the region, large-scale housing development is planned. For example in the Thames Gateway, Swindon, Aylesbury, the Blackwater Valley and the Crawley area in the Mole Valley. Providing development is located in the lowest areas of risk and run-off is managed; flood risk should not increase as a consequence of this development.

In many areas, most notably in London, large scale redevelopment is planned in flood risk areas. This is an opportunity to reduce the risk by ensuring that the new developments have a far better layout and design that recognises the current and future flood risk.

↑ Flooding in Oxford, July 2007.

Future direction for flood risk management

Approaches in each sub-area

The CFMP summarises how we need to manage future flood risk with four main messages:

- Flood defences cannot be built to protect everything.
- Climate change will be the major cause of increased flood risk in the future.
- The floodplain is our most important asset in managing flood risk.
- Development and urban regeneration provide a crucial opportunity to manage the risk.

To manage flood risk in the future we will need to use all of the likelihood and consequence actions available. The combination of these actions will vary according to the location of the flood risk and how much we can justify changing it. Successful delivery will be dependent on many partners working together to achieve our overall goal of managing flood risk in the Thames Region.

To help understand the diverse nature of the flood risk across the Thames CFMP area, we divided it into 43 sub-areas. These sub-areas generally follow river catchment or urban area boundaries. There are six policy options for the management of flood risk and we have applied one to each sub-area. These describe how we should change the level of our flood risk actions in different locations in the future. These range from implementing a big step reduction in the level of risk, to accepting that the risk will get worse as climate change increases the likelihood of flooding. These policies are described in Table 3. To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

The sub-areas that have similar physical characteristics, levels of risk and proposed actions have been grouped together in this document (see Map 3). Map 4 on Page 29 shows the actual policy selection.

Map 3. Sub-area grouping

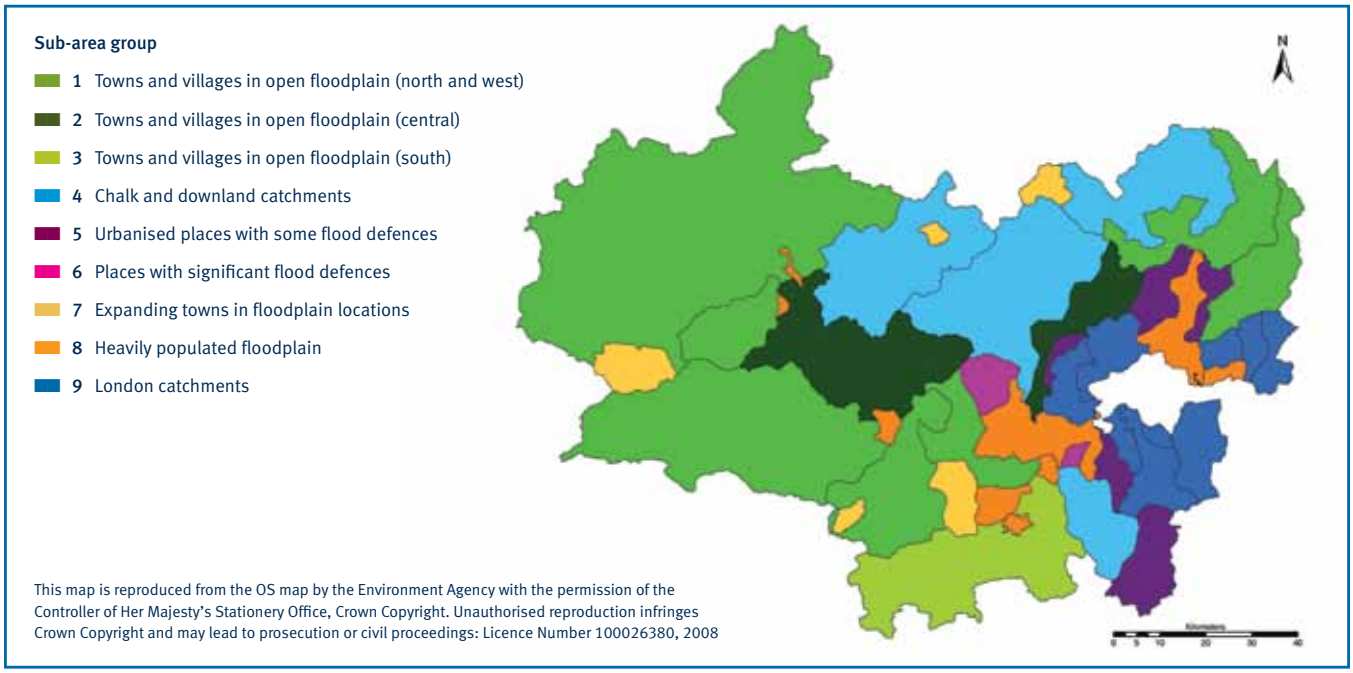


Table 3 Policy options

➜ 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.

➜ 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.

➜ 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.

➜ 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.

➜ 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.

➜ 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.

Towns and villages in open floodplain (north and west)

Sub-areas: Addlestone Bourne, Kennet, Loddon, Middle Lee and Stort, Ock, Upper Roding, Upper Thames

Our key partners are:

Local Authorities

Communities

Natural England

The issues in these sub-areas

These sub-areas cover large expanses of open undeveloped floodplain with villages and market towns. Winter flooding of the undeveloped floodplain is a regular occurrence and this floodplain provides a large area to store water which reduces the risk to more than 100 communities at risk.

These sub-areas contain 55% (900km²) of the area of floodplain in the Thames CFMP area. There are approximately 11,300 properties with a 1% risk of flooding from rivers. This represents 8% of the total properties at risk in the Thames CFMP. This figure is estimated to increase by between 10% and 30% in the future due to the impacts of climate change.

There are over 100 separate communities with more than 10 properties at risk of flooding from rivers. These are typically small clusters of properties where rivers meet or are crossed by bridges. While the total number of people and properties in any one location may be small, widespread flooding such as experienced in 2007 can have a considerable impact. This is because a large proportion of these communities can be directly affected by disrupted services and transport.

Table 4. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Addlestone Bourne, Emm Brook and The Cut	1170	No data
Kennet	1270	1630
Loddon	860	1110
Middle Lee and Stort	1600	2100
Ock	450	No data
Upper Roding	1970	2140
Upper Thames	3980	4660

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.

This approach will be increasingly important to mitigate impacts of climate change; in the Upper Thames, near Cirencester on the River Churn and upstream of Woodford in the Roding catchment the potential to store water to offset the impacts of climate change has been identified. As well as reducing the risk to communities, this has the opportunity to enhance existing designated environmental sites.

In these areas there are over 100 separate communities where there are 10 properties or more at risk of flooding. In general, these communities will not be a priority for funding of large scale flood defences. Examples of where we have been able to reduce the probability of flooding include the flood defences at Kidlington in Oxfordshire, and those

being planned in Banbury and Marlow. We will therefore continue with our activities to maintain the flow of water in the rivers that pass through developed areas. Throughout these areas we will continue with our flood warning and awareness work. This will ensure that those at risk have the guidance they need to prepare for and respond to flooding.

The scattered impacts of flooding means that managing the consequences will be an increasingly effective and sustainable approach to managing the risk. Community scale action related to flood resilience, flood awareness and watercourse maintenance similar to those in East Hanney, Oxfordshire and at Bourton on the Water, Gloucestershire will be encouraged.

Proposed actions to implement the preferred policy

- We want to maintain the existing capacity of the river systems in developed areas that reduces the risk of flooding from more frequent events.
- We will identify locations where the storage of water could benefit communities by reducing flood risk and providing environmental benefits (by increasing the frequency of flooding) and encourage flood compatible land uses and management. For example in the Roding catchment, planned flood storage will reduce the risk to local communities and larger urban areas downstream.
- We will work with Local Planning Authorities to retain the remaining floodplain for uses that are compatible with flood risk management and put in place polices that lead to long-term adaptation of urban environments in flood risk areas.
- We will continue to increase public awareness, including encouraging people to sign-up for the free Floodline Warnings Direct service.
- We will help communities and local authorities manage local flood risk. This could include flood resilience (for example in Witney and Bampton), community flood plans that identify vulnerable people and infrastructure and community based projects (for example in East Hanney).

↑ The natural floodplains in these areas reduces the risk to people and property

Towns and villages in open floodplain (central)

Sub-areas: Colne, Thames: Sandford to Cookham (does not include Reading)

Our key partners are:

Local Authorities

Communities

The issues in these sub-areas

The majority of the flood risk in these areas is focussed in towns such Watford, London Colney and Rickmansworth on the Colne and Marlow, Pangbourne and Henley on the Thames. There are however 40 other communities at risk of flooding across these areas. On the Thames especially, flooding can last for a long time as flood water rises and falls over many days.

These sub areas contain 12% (200 km²) of the total area of floodplain in the Thames CFMP area. The large wide and flat floodplains of the Thames and Colne store water naturally and reduce the risk of flooding to the communities at risk. In total, there are approximately 5,900 properties with a 1% risk of flooding from rivers. This represents 4% of the total number at risk in the Thames CFMP area. The broad scale modelling that we have carried out suggests that both the Thames and Colne are quite sensitive to climate change, with more properties at risk of flooding more frequently. The number of properties at risk is estimated to increase by between 12% and 30%.

There are major defences that protect the Lower Colne through Uxbridge and Yiewsley. Defences are being considered elsewhere, but we recognise that only a small number of the 45 communities at risk across these areas will benefit from defences in the foreseeable future.

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.

There will be considerable short-term and long-term challenges in achieving this. In some locations there are options to reduce the flood risk by building flood defences. However, they often prove to be more expensive than comparable locations elsewhere in the country. We cannot therefore depend on flood defences being provided in most communities in these areas. In the very long-term we need to adapt the urban environment to make space for water where possible and make it more resilient to flooding where it is not possible. As the urban landscape changes we will look to reduce the flood risk by ensuring that the location, layout and design of new and redevelopment takes flood risk into account. It is crucial that the existing undeveloped floodplain is safeguarded from development.

Recognising that change in urban environments will take a long time to happen and that flood defences cannot be provided to many communities, we want to make sure that people at risk are aware of the risk and are prepared to respond when a flood happens. We will continue with our flood warning and awareness work. This will ensure that those at risk have the guidance they need to prepare and are ready to respond to flooding.

Table 5. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Colne	2540	2840
Sandford to Cookham	3400	4440

The proposed actions to implement the preferred policy

- We will maintain the Lower Colne defences. Taking a risk-based approach we are investigating opportunities to reduce the probability of flooding through the construction of defence schemes in some locations (for example in Marlow, Watford and London Colney).
- We will review our maintenance to ensure that we are maintaining the channel capacity in the most efficient way.
- We will continue to promote the use of Planning Policy Statement 25 (PPS25) to create safe and sustainable development that positively reduces flood risk. We will also continue to make sure the recommendations in Strategic Flood Risk Assessments and Local Development Framework policies create the potential to reduce flood risk through regeneration in the longer-term.
- We will promote a greater awareness of flood risk amongst organisations and communities, building on our current flood warning work. This will focus on actions that can reduce the impact of flooding. Working with our partners, we will develop our emergency response planning to consider extreme floods.

↑ The wide, flat, natural floodplain of the River Thames, upstream of Reading

Towns and villages in open floodplain (south)

Sub-area: Rural Wey

Our key partners are:

Local Authorities

Communities

Natural England

National Trust

The issues in this sub-area

The sub-area covers the rural part of the River Wey catchment. The river has many structures, side channels and historical alterations along its length. The majority of the area is undeveloped floodplain. The water stored in this area during a flood is very important. It reduces the amount of water in built up areas, and helps to maintain some important habitats.

The sub area contains 2% (40km²) of the total area of floodplain in the Thames CFMP. There are approximately 2,600 properties with a 1% risk of flooding from rivers, which is 2% of the total at risk in the Thames CFMP area. This figure is estimated to increase by approximately 10% (to 2,800) in the future due to the impacts of climate change.

Many of the people and property at risk of flooding are dispersed across this large area. There are some floodplain towns such as Alton, Farnham and Godalming. Some of these have local flood defences. The strategy generally show little opportunity to reduce the likelihood of flooding and therefore local measures to reduce the consequence of flooding will be very important.

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.

We want to maintain, and where possible maximise, the flow of water in the rivers through the towns. However, in the undeveloped areas we will reduce the amount of maintenance that we carry out and allow the flood plain to flood more frequently. This will allow us to focus our effort where it is most beneficial.

Throughout the sub-area we will compliment any actions with our flood warning and awareness work. This will ensure that those at risk have the guidance they need to prepare and respond to flooding.

We want to build on the high levels of biodiversity in the sub area. We will work with others to create new and improved habitats. We also want to compliment these with opportunities for recreation and navigation. Our partnership with the National Trust will be important in achieving this.

The proposed actions to implement the preferred policy

- We will seek to maintain the capacity of watercourses in towns and villages through our ongoing annual maintenance programme. We will reduce levels of maintenance elsewhere.
- We will safeguard the natural floodplain from inappropriate development by working with our Local Authority partners. This will provide local social and economic benefits (by reducing flood risk) and environmental benefits (by allowing flooding)
- We will work closely with our Local Authority partners to ensure that plans are prepared to respond to flooding. This will help communities to work with local organisations and produce community flood plans.

Chalk & downland catchments

Sub-areas: Colne tributaries and Wye, Middle Mole, Thame and Upper Lee

Our key partners are:

Local Authorities

Communities

Natural England

The issues in these sub-areas

The major source of flooding is rivers, sometimes in combination with high groundwater levels. Many of the river valleys across the Chilterns and northern Hertfordshire are quite steep with narrow floodplains. In many of the urban areas the river channels have been modified. Pinch points such as bridges and culverts can contribute to localised flooding.

These sub-areas contain 11% (180km²) of the total area of floodplain in the Thames CFMP. There are approximately 4,000 properties with a 1% risk of flooding from rivers. This represents 3% of the total number at risk in the Thames CFMP area. This figure is estimated to increase by between 6% and 40% in the future due to the impacts of climate change.

The vision and preferred policy

Policy option 3: Areas of low to moderate flood risk where we are generally managing existing flood risk effectively, is indicative of the approach across most of these areas. This policy recognises the moderate level of flood risk in these areas.

There are over 50 separate communities where there are over 10 properties at risk of flooding. In general these communities will not be a priority for funding large scale flood defences. We will therefore continue with our activities to maintain the existing capacity of the rivers that pass through developed areas. Throughout these areas we will continue with our flood warning and awareness work. This will ensure that those at risk have the guidance they need to prepare and respond to flooding. More sustainable management of the risk will be achieved by opening up river corridors through town centres and increasing the resilience to flooding through redevelopment. However, redevelopment rates in these areas are quite low and we recognise that this will take a long time. It is nevertheless an important aim. In the meantime we will be reliant on our current management of the flood risk.

Table 6. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Colne tributaries and Wye	2060	No data
Middle Mole	210	No data
Thame	1030	1280
Upper Lee	670	710

The proposed actions to implement the preferred policy

- We want to maintain the existing capacity of the river systems in developed areas to reduce the risk of flooding from more frequent events. We will work with our partners to identify opportunities to make the existing systems more efficient (for example, where there are significant restrictions to flow from undersized culverts or bridges).
- We will work with Local Planning Authorities to retain the remaining floodplain for uses that are compatible with flood risk management and put in place polices that lead to long-term adaptation of urban environments in flood risk areas.
- We will continue to increase public awareness, including encouraging people to sign-up for the free Floodline Warnings Direct service.

Urbanised places with some flood defences

Sub-areas: Hogsmill, Lower Lee tributaries, Pinn, Upper Mole

Our key partners are:

Local Authorities

Greater London Authority (GLA)

Communities

The issues in these sub-areas

These places cover catchments which contain some urban areas, including Kingston, Uxbridge, Crawley, Enfield, as well as significant areas of natural river channel and floodplain. The channel and open spaces perform an important role in managing the probability of fluvial flooding. However, flooding can occur from a combination of sources, notably the surface water drainage systems which can be easily overwhelmed.

These sub-areas contain 2% of the total area of floodplain in the Thames CFMP area (approximately 40km²). There are approximately 6,600 properties with a 1% risk of flooding from rivers. This represents 5% of all properties at risk. Climate change could increase the number of properties at risk from river flooding by between 30% and 50% in these areas.

The communities at risk are often located in narrow riverside corridors throughout the catchment. There have been some river modifications and flood defences built in the past but some people remain at risk from multiple sources of flooding.

Table 7. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Hogsmill	3000	4080
Lower Lee tributaries	610	920
Pinn	600	No data
Upper Mole	2420	No data

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, is indicative of our vision of managing run-off, safeguarding open space and potential flood storage.

These are largely urban catchments, but ones where the river corridors have not been over-developed and there is not an over dependence upon flood defence structures that are difficult and expensive to maintain. This does mean that there are opportunities to manage the existing risk effectively and offset some of the impacts of climate change in the future.

The approach to flood risk management in these places uses the natural protection already provided by the river channel and the open spaces in the floodplain. We will maintain, and where possible improve, the flow of water in the rivers as they pass through built up areas. This needs to be complimented by improvements to other parts of the drainage network.

We also want to maintain and, if possible improve, the capacity of the floodplain to store water, making use of the open spaces available within the floodplain, and preventing the loss of open spaces. In all of these areas there are opportunities to store water to reduce flood risk; for example Cobbins Brook in North London and in the Crawley area in the Upper Mole catchment.

Redevelopment rates are quite high in some of these areas. It is vital we work with Planning Authorities in these areas to maintain the existing open space in the floodplain, manage urban run-off, take advantage of opportunities for flood storage and increase the resistance and resilience of buildings through redevelopment.

The proposed actions to implement the preferred policy

- We want to maintain the existing flow of rivers in urban areas that reduce the risk of flooding from the smaller, more frequent floods. We will work with our partners to identify viable opportunities to make the existing drainage systems more effective (for example, where there are significant restrictions to flow from undersized pipes, culverts or bridges).
- We will continue to make sure the recommendations in Strategic Flood Risk Assessments and Local Development Framework policies create the potential to reduce flood risk through adaptation of places at risk, managing run-off and retaining open spaces in the floodplain.
- We will identify locations where the attenuation of water could have local social and economic benefits (by reducing flood risk) and environmental benefits (by increasing the frequency of flooding) and encourage compatible land uses. Examples include Cobbins Brook and Salmons Brook in the Lower Lee and Crawley in the Upper Mole.
- We will develop our emergency response planning to deal with extreme events, including raising public awareness and working with key partners to identify critical infrastructure at risk.

↑ A view of the River Pinn near Uxbridge. In this urbanised catchment, the existing river corridor reduces flood risk and provides opportunities to make improvements in the future. In these types of areas safeguarding the existing floodplain is very important.

Sub-area 6

Places with significant flood defences

Sub-areas: Lower Mole, Windsor and Maidenhead

Our key partners are:

Local Authorities

Communities

The issues in these sub-areas

These sub-areas include the areas protected by two of the major flood defence schemes in the region, namely the Lower Mole Flood Alleviation Scheme and the Maidenhead Windsor and Eton Flood Alleviation Scheme (MWEFAS, which includes the Jubilee River).

These sub areas contain 3% (50km²) of the total area of floodplain in the Thames CFMP. There are approximately 7,300 properties with a 1% risk of flooding from rivers. This represents 5% of the total number at risk in the Thames CFMP area. Broad scale modelling shows a large increase in the number of properties at risk from climate change in the Lower Mole. This area is however protected by existing defences to a very high standard.

The schemes currently provide protection from a 0.5% and 4% annual probability flood respectively. There is little justification for us to increase the level of protection in these areas and so our work will now focus on maintaining these schemes.

Table 8. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Lower Mole	1740	3300
Windsor and Maidenhead	5530	8170

The vision and preferred policy

Policy option 3: Areas of low to moderate flood risk where we are generally managing existing flood risk effectively is indicative of this approach to managing the risk.

In both of these areas we have already taken significant action to reduce the likelihood of flooding through the construction of major schemes. We are committed to maintaining these schemes to ensure they perform well in to the future.

Currently there are no significant opportunities to further reduce the likelihood of flooding. Redevelopment in these areas, although generally quite slow, does offer the potential for reducing the risk through improving the location, layout and design of the new buildings.

There is still some significant residual risk in these locations and we will work with our Local Authority partners and communities to ensure that people are well prepared for the consequences of flooding in the future.

Throughout these areas we will continue with our flood warning and awareness work. This will ensure that those at risk have the guidance they need to prepare and respond to flooding, and the warning to prompt action.

The proposed actions to implement the preferred policy

- We will continue to maintain the Lower Mole and Maidenhead Windsor and Eton Flood Alleviation Schemes.
- We will work closely with Local Authorities to ensure that we are well prepared to respond to the consequences of flooding from other sources and extreme events.
- We will work with our partners to ensure that any future development in these areas results in a reduction in the overall flood risk.
- We will continue to make sure the recommendations in Strategic Flood Risk Assessments and Local Development Framework policies create the potential to reduce flood risk through adaptation of places at risk, and retaining open spaces in the floodplain.

↑ The Maidenhead Windsor and Eton Flood Alleviation Scheme (MWEFAS)

Sub-area 7

Expanding towns in floodplain locations

Sub-areas: Aylesbury, Basingstoke, Luton, Swindon, Upper and Middle Blackwater

Our key partners are:

Local Authorities

Communities

The issues in these sub-areas

These places are generally large urban areas that are located in and around fluvial floodplains. Many of these towns have been through a major period of expansion between the 1950s and 1980s that lead to some significant alterations to the watercourses. The sources of flooding are a combination of river, surface water and sewer systems. Many of the rivers in these areas have often been heavily modified as development has occurred. This includes some parts that are hidden underground in culverts. These locations are prone to flash floods and there can be a very short-time between rainfall and flooding.

These areas contain 2% (30km²) of the area of floodplain in the Thames CFMP. There are approximately 3,000 properties with a 1% risk of flooding from rivers. This represents 2% of the total number of properties at risk within the Thames CFMP. However this figure is estimated to increase by approximately 30% in the future due to the impacts of climate change. Working with Local Planning Authorities we will seek to avoid any increase in flood risk from the future urban expansion. In Aylesbury, Swindon and the Blackwater valley several thousand new homes are planned over the next twenty years.

Table 9. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Aylesbury	220	270
Basingstoke	480	No data
Luton	220	340
Swindon	1310	No data
Upper and Middle Blackwater	710	No data

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.

Managing the consequences of flooding will be the main feature of future flood risk management in these places. The proposed expansion of these places will need flood risk to be considered and inform the location, layout and design of new development. Local Authority Strategic Flood Risk Assessments (SFRAs) should ensure development is located with consideration of the flood risk. This can prevent the need for costly flood defences in the future. We will continue to influence and inform these decisions at the regional, county and local scales. We must avoid the need to manage flooding after the development has been built.

In the long-term we need to adapt the urban environment to make it more resilient to flooding. We want the rivers to become part of the urban landscape instead of being hidden away in culverts and revert to more natural conditions where possible.

We will be look at options to reduce the probability of flooding in some areas. The many sources of flooding mean it will not be possible to do this everywhere. Some interventions will rely on local opportunities; either to increase the flow of the watercourses by modifying or removing obstructions, or to store water. Some places are particularly susceptible to rapid flooding from heavy rainfall. We want to make sure that those at risk are aware and prepared to respond.

The challenge is to ensure that the urban expansion in these areas does not lead to an increase in flood risk, work with partners to bring about gradual improvements in modified watercourses and put in place policies that bring about long-term adaptation of the urban environment.

The proposed actions to implement the preferred policy

- Development should be located in areas of lowest flood risk and incorporate a layout and design that is resilient to flooding. Strong recommendations in SFRAs and policies in Local Development Documents (LDDs) will help to ensure this. We will identify with our partners opportunities to reduce flood risk by recreating river corridors in urban areas. New and re-development should allow space for water, wildlife and recreation in their site layout and design.
- We want to make sure other sources of flooding are considered. We will support partnerships to identify those areas that are most vulnerable to other types of flooding, for example through Surface Water Management Plans (SWMPs) and encourage initiatives to manage these risks.
- We want to maintain the existing capacity of the river system by keeping the channels clear and free from obstruction to reduce the impacts of more frequent flood events.
- We will promote a greater awareness of flood risk amongst organisations and communities. This will focus on actions to reduce the impact of flooding.

↑ New development that is set back from the river allows flooding of the natural floodplain to occur

Heavily populated floodplain

Sub-areas: Abingdon, Byfleet and Weybridge, Guildford, Hoe Stream, Lower Lee, Lower Roding, Lower Thames, Oxford, Reading

Our key partners are:

Local Authorities

Greater London Authority (GLA)

Communities

The issues in this sub-area

These places include some of the most populated floodplain in Thames region. For instance, the Lower Thames sub-area, with 18, 000 properties with a 1% risk of flooding, is recognised as the largest concentration of properties not protected by flood defences in the country.

These sub-areas contain 10% (170km²) of the total area of floodplain within the Thames CFMP but have 40% (56,000 properties with a 1% risk of flooding from rivers) of the properties at risk. This figure is estimated to increase by between 5% and 25% in the future due to the impacts of climate change as most of these areas are in wide flat floodplains of major rivers. More recent investigations show that in the Lower Thames the number of properties at risk from flooding could increase by 50% as a consequence of climate change.

The flood risk is concentrated in known locations and problems with flooding from rivers are well documented. Large scale interventions will be expensive and difficult to build and maintain. Adaptation of the places at risk and of people's behaviour has the potential to manage risk. However, this will take time and will not always meet the expectations of partners and the communities at risk.

Table 10. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Abingdon	1350	1420
Byfleet and Weybridge	1240	1540
Guildford	590	690
Hoe Stream	250	No data
Lower Lee	19420	22530
Lower Roding	7650	8760
Lower Thames	18170	21800
Oxford	4000	4660
Reading	3750	4040

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. We recognise the challenge of this policy and that we will not be able to reduce the risks everywhere.

In the Lower Lee and Lower Thames we are assessing the costs and benefits of large scale interventions to reduce the probability of flooding. In all of these locations there are major technical obstacles which mean any solutions will be expensive, provide different levels of protection and not benefit everyone in the affected communities. We are confident however, of being able to bring forward proposals that will reduce the risk to many people.

In all of these areas, but especially in those areas where major flood defences are not a realistic option in the foreseeable future, the most sustainable way of reducing flood risk will be through floodplain management. In areas of redevelopment; resilience and resistance measures can be incorporated into new buildings. Our partnership work with Guildford Borough Council shows how this can be developed to achieve sustainable and flood compatible floodplain use. Flood awareness and emergency response will have an important role to play in all areas.

The proposed actions to implement the preferred policy

- We will deliver the actions recommended in Flood Risk Management Strategies for Oxford, the Lower Lee, the Wey and Lower Thames once they are approved.
- In the short-term, we will encourage partners to develop policies, strategies and initiatives to increase the resistance and resilience of all new development at risk of flooding. We will also look at protecting land that may be needed to manage flood risk in the future, and work with partners to identify opportunities for this and to recreate river corridors in urban areas.
- In the longer-term, we need land and property owners to adapt the urban environment to be more flood resilient. This includes the refurbishment of existing buildings to increase resilience and resistance to flooding.
- We need to promote the management of flood consequences. By working with our partners we will improve public awareness and local emergency planning, for example identifying critical infrastructure at risk and producing community flood plans.

↑ Aerial photo of Oxford flooding from Janurary 2003

London catchments

Sub-areas: Beam, Beverley Brook, Brent, Crane, Graveney, Middle Roding, Ingrebourne, Ravensbourne, Wandle

Our key partners are:

Local Authorities

Greater London Authority (GLA)

Communities

The issues in these sub-areas

In large parts of these catchments we manage the risk of flooding from rivers by conveying water in concrete channels, especially through urban areas. This approach relies on a lot of river structures, culverts and trash screens (which prevent blockages inside culverts). These will become increasingly ineffective against storms which are expected to be more frequent and intense in the future.

These large urban areas are located in and around fluvial floodplains. They contain 3% (50km²) of the area of floodplain in the Thames CFMP. They contain approximately 38,000 properties with a 1% risk of flooding from rivers. This represents almost 30% of the total number of properties at risk within the Thames CFMP. This figure is estimated to increase by between 6% and 16% in the future due to the impacts of climate change.

Other water sources can cause flooding in these places: the overflow of surface drains, the inundation of sewers, and large areas of impermeable surfaces. Often these types of flooding happen together, which can make it difficult to determine the cause. The density of urban development adds to these problems. The amount of development along the edge of watercourses means that structural solutions to the problems are limited.

Table 11. The number of properties with a 1% risk of flooding from rivers

Sub-area	Current	Future (2100)
Beam	1190	1630
Beverley Brook	6010	No data
Brent	1920	2260
Crane	200	230
Graveney	4200	4570
Middle Roding	4240	4880
Ingrebourne	310	330
Ravensbourne	9440	10960
Wandle	10720	11860

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.

The most sustainable approach to managing future flood risk will be to bring about adaptation of the urban environment. There are some major opportunities to reduce flood risk through the appropriate location, layout and design of redevelopment. This will make properties more resilient or resistant to flood water, therefore reducing the consequences of flooding.

We recognise that this will need a strategic and open-minded approach to planning regeneration in flood risk areas. We want to reduce flood risk through regeneration but also recognise that land in these areas is scarce and that sustainable and vibrant communities need to be maintained and created.

We will continue to maintain the existing defences where it is appropriate to do so. Where this is not possible we want to replace flood defences in conjunction with redevelopment and as part of an overall catchment scale plan. Opening up culverts and re-creating river corridors through redevelopment will result in more space for the river to flow, more floodplain where water can be stored and reduced flood risk. Strategic scale planning is key to achieving the needs of the community and managing the risk in a more sustainable way.

A complimentary part of the approach in this area will be the emergency planning for extreme floods. Although the flood risk is reduced in many places by defences, there is limited time for warning or action. It is important for local communities to be aware and prepared for a flood. Our work with other organisations and the communities at risk will focus on these issues.

These are areas where our strategic messages and approach are challenging for ourselves and partners.

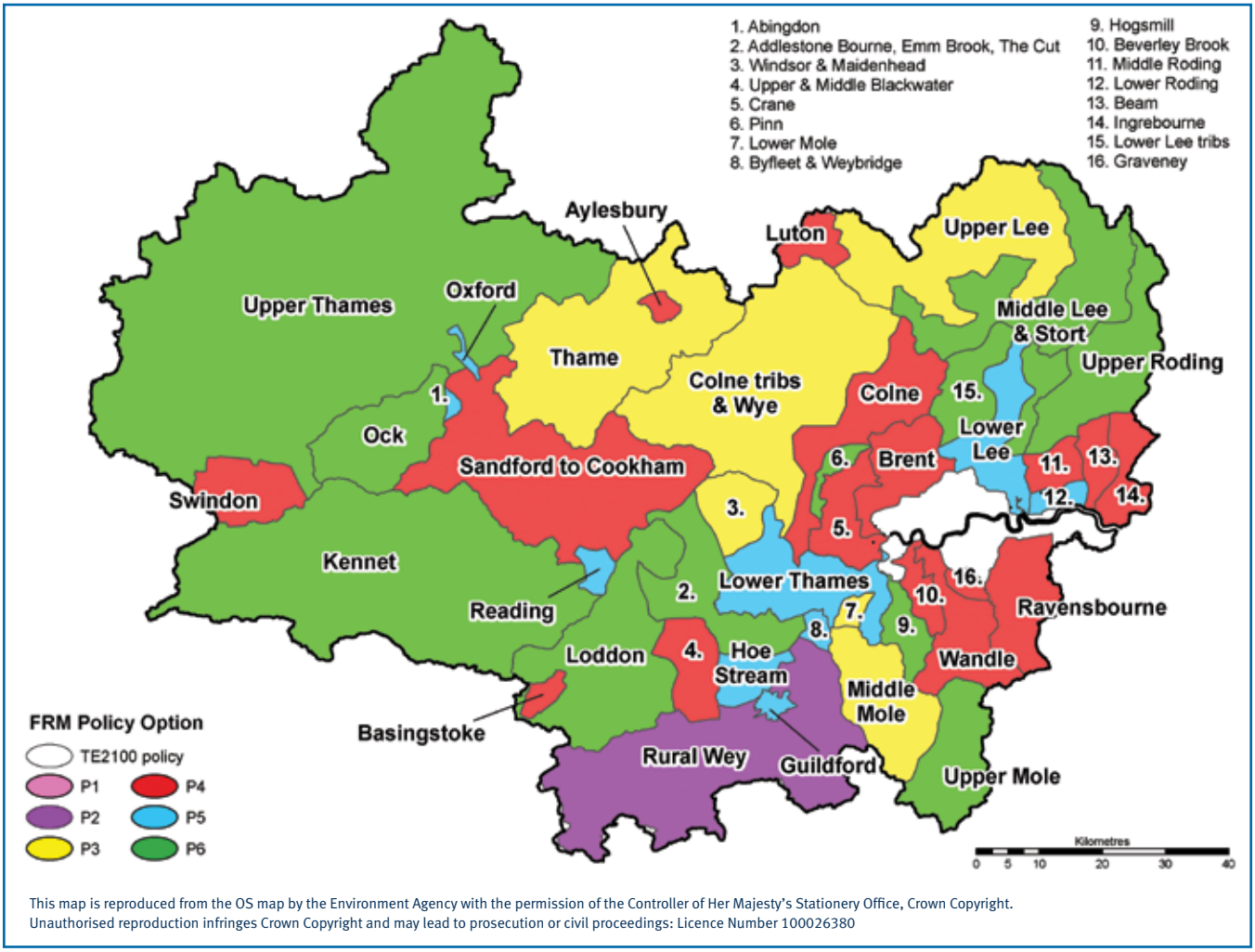
The proposed actions to implement the preferred policy

- We will continue to make sure the recommendations in Strategic Flood Risk Assessments and Local Development Framework policies create the potential to reduce flood risk through regeneration.
- We will play our part in adopting a strategic approach to planning so that wider community objectives as well as flood risk objectives can be met.
- We will develop our emergency response planning to deal with extreme floods, including raising public awareness and working with key partners to identify critical infrastructure at flood risk.
- We want to continue to maintain the existing flood defences and when redevelopment takes place, replace and improve them so that they are more effective against the impacts of climate change. We will be looking to remove culverts and other structures that cause significant conveyance problems. An example of this is our work in the Ravensbourne catchment.
- With our partners, we will look for opportunities to reduce flood risk by recreating river corridors in urban areas. We will influence people who shape the urban environment and harness these opportunities, allowing space for water, habitat, wildlife and recreation.

↑ Aerial view of the Brent River Park project, Wembley, north London. Restoring this river has improved the level of protection provided and enhanced the environment for the local community.

Map of CFMP policies

Map 4. CFMP policy for each sub-area within the Thames CFMP



- **P1:** Areas of little or no flood risk where we will continue to monitor and advise
- **P2:** Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions
- **P3:** Areas of low to moderate flood risk where we are generally managing existing flood risk effectively
- **P4:** 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
- **P5:** Areas of moderate to high flood risk where we can generally take further action to reduce flood risk
- **P6:** 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

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