



National Audit Office

**REPORT BY THE
COMPTROLLER AND
AUDITOR GENERAL**

**HC 1521
SESSION 2010–2012**

28 OCTOBER 2011

**Department for Environment, Food and Rural Affairs
and Environment Agency**

Flood Risk Management in England

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National Audit Office

**Department for Environment, Food and Rural Affairs
and Environment Agency**

Flood Risk Management in England

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Report by the Comptroller and Auditor General

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Amyas Morse
Comptroller and
Auditor General

National Audit Office

26 October 2011

This report considers the progress, since we last reported on the subject in 2007, that the Environment Agency has made in identifying the risk of flooding, examines how well investment has been targeted at risk, and assesses how well the Department for Environment, Food and Rural Affairs and the Agency are managing the reform of flood risk management.

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The National Audit Office study team consisted of:

Sue Heard, Jonathan Mackay and Mandy Burrows with support from Max Tse, Tristan Buckley and Shibani Patel under the direction of David Corner.

The report also includes evidence from our independent expert, Professor Paul Bates, Director of the Cabot Institute, University of Bristol.

This report can be found on the National Audit Office website at www.nao.org.uk/flood-management-2011

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Key facts

£1.1bn

estimated annual cost
of flood damage

5.2m

number of properties
currently at risk
from flooding

£664m

Department spending on
flood risk management
in 2010-11

182,000

Number of households provided with improved flood protection as a result of the Environment Agency's investment, April 2008 to March 2011

£101 million

Local authorities' spend on flood and coastal risk management, 2010-11

£20 million

The Environment Agency's estimate of the average annual increase in flood risk investment to 2035 necessary to sustain current levels of protection

10 per cent

Reduction in Environment Agency's budget over the 2011-12 to 2014-15 period compared with previous four years

8:1

£8 in benefits per £1 spent on Environment Agency's flood defence capital programme

Summary

1 Over 5.2 million (one in six) properties in England are at risk of flooding from rivers, the sea, or surface water. Flooding from the sea and rivers occurs when water overtops or breaches river banks and other defences. Flooding from surface water occurs when drainage and the sewerage systems cannot cope with rainfall or run off from roads and other hard surfaces. The annual costs of flood damage in England are estimated to be at least £1.1 billion and this is expected to rise as the risk of flooding increases with climate change.

2 The Department for Environment, Food and Rural Affairs (the Department) has policy responsibility for flood and coastal risk management. In 2010-11, it spent £664 million and gave 95 per cent of this (£629 million) to the Environment Agency (the Agency). The Agency has operational responsibility for flood risk management. In addition, local authorities spent £101 million supported by formula grant from central government on flood risk management activity.

3 The Agency estimates that an average annual increase of £20 million needs to be invested in flood defences between 2010 and 2035, to sustain current levels of protection as risk increases due to climate change. If the extra £20 million was invested each year of this spending review period, it would equate to an overall percentage increase of 9 per cent. The Agency's funding over the period from 2011-12 to 2014-15 will actually reduce by 10 per cent compared with the previous four years budget. It is important therefore that risk is identified as accurately as possible, investment in defence targeted appropriately and alternative sources of funding are secured.

4 In response to the major flooding of 2007, the Department initiated reforms to clarify local responsibilities and reduce risk. These reforms include giving upper-tier local authorities (unitary and county councils) the lead responsibility for managing local risks, encouraging greater local engagement and decision-making on investment and stronger partnership working. In addition to managing risk from rivers and the sea, the Agency has a strategic overview role for all sources of flooding including surface water.

5 Our 2007 report examined the performance of the Agency and focused on its flood and coastal defence programme. This report considers the progress since then in identifying the risk of flooding, examines how well investment has been targeted at risk, and assesses how well the Department and Agency are supporting and managing reform. It covers England only and does not address flood incident response or coastal erosion.¹

¹ The Environment Agency paid out £24 million in respect of coastal erosion projects, studies and coastal monitoring in 2011-12.

Key findings

Identifying the risk of flooding

6 The Agency is an international pioneer in developing a national model covering the long-term risk of flooding from rivers and the sea, but work is required to make it more effective. The purpose of the model is to provide national and regional risk assessment to guide large-scale investment decisions. The Agency considers the model is fit for this purpose. Estimating the magnitude of long-term flood risk can never be an exact science. However, the available evidence for the accuracy of key elements of the model is mixed and the Agency does not routinely analyse the impact that data uncertainties may have on its risk assessment, making it less effective than it could be.

7 The Agency's national flood risk assessment and its flood map currently do not present consistent information. The purpose of the flood map is to raise the awareness of flood risk particularly amongst those who live or work in those areas. It is also used by property owners and local authorities for development planning purposes. Unlike the national flood risk assessment, the map does not take into account any flood defences and does not show the distribution of the level of risk within the areas potentially affected. By 2015, the Agency intends to use the national flood risk assessment as the primary method of showing flood risk.

8 Flood risk management authorities have developed information over the years on a piecemeal basis, with the result that users of this information can find it inaccessible and difficult to understand. The Agency recognises that flood risk information needs to be brought together and made clearer and simpler. In particular, local authority mapping and modelling of surface and ground water flood risk is far less advanced than the Agency's approach for rivers and the sea. It is not known how the different sources of flood risk combine and interact. The Agency intends to develop a tool that combines information about flood likelihood from all sources by 2013 although this tool will not consider how the different sources of flood risk interact.

9 England's flood defence infrastructure for smaller rivers and surface water is not fully known and approaches to build up this knowledge are not integrated. Features such as boundary walls, culverts (tunnels carrying a stream under a road or railway) and embankments help to reduce the likelihood of floods. Knowledge of features that prevent flooding from smaller rivers or from ground and surface water is far less developed than that of features that prevent flooding from main rivers and the sea. From 2011, lead local flood authorities are required to develop registers, detailing the ownership and condition of all features that they deem likely to significantly affect flood risk. It is for each local authority to decide what information to record, including what 'significant' means, and the systems they use to record this data, although the Department and the Agency have provided guidance. Local authorities will also decide how quickly to populate registers. The systems local authorities use may not be compatible with other local or national systems, hampering information-sharing.

Targeting investment towards risk

10 Since our last report, the Agency has improved its knowledge of the condition of existing sea and river defences and this has helped effective targeting of maintenance funding on defences classified as high consequence if they fail. The Agency must continue to invest in its existing flood defences to maintain current levels of protection. It is progressively targeting its limited funding on defences classified as high consequence if they fail based on the potential impact on people and property. In some regions, however, it is finding it more difficult to withdraw funding from the maintenance of low consequence defences because landowners have historically depended on these defences for land drainage purposes. The distribution of maintenance spend within regions is increasingly influenced by maintenance need, however, it also depends on ensuring its workforce can deliver a timely response to flood incidents.

11 Ninety-eight per cent of the Agency's high consequence flood defences are at or above the target condition. The Agency uses a systems approach to manage flood risk as a number of flood defence features work in combination; damage to one could have a serious impact on the effectiveness of the entire system. In 2008-09, the Agency started to measure the proportion of individual defence features that are at target condition in high, medium and low-consequence systems. Since it started reporting this measure, the percentage of Agency maintained features in high consequence systems at or above the required condition has improved from 96.4 per cent to 98.2 per cent. In absolute terms, this equates to 577 features that are now below the required condition compared with 1,117 two years previously.

12 Central government capital investment has been driven by a range of targets including to achieve a high average benefit to cost ratio overall whilst better protecting as many households at risk as possible. The Agency appraises investment in flood defence schemes by comparing the benefits and costs of the damage prevented. The Agency achieved a positive ratio of 8:1 compared to a target of 5:1. Over the last spending review period, the Agency's investment provided improved protection to 182,000 households against a target set by the Department of 145,000 households.

13 Reform of the way in which the flood defence programme is funded is intended to allow greater local input and flexibility. Under the new approach all flood risk management schemes including surface water, which were previously ineligible, will potentially be offered central investment according to the benefits they expect to deliver. Potential grants for projects will be based on the levels of benefits and outcomes that will be delivered rather than some projects being fully-funded or not supported at all. Under this approach, many projects will remain fully-funded by central government. In other cases, projects that attract sufficient local funding, and where the benefits are greater than the costs, will proceed part-funded by the general taxpayer if supported for funding over other projects by both the Agency and the relevant Regional Flood and Coastal Committee.

14 If central government funding does not increase after 2014-15, maintaining and improving current levels of flood defence will increasingly depend on significant additional funding being secured locally. During the current spending review period, the Agency has targeted 85 per cent of its investment on priority schemes to ensure current national protection levels continue despite the 10 per cent reduction in its budget. After this period, unless central government funding increases, local public and private bodies will increasingly be called upon to raise the levels of investment locally that the Agency considers necessary in their long-term investment strategy published in 2009.

15 The prospect of local bodies contributing additional funding is unknown. While contributions from other sources have tripled from 2008-09 to 2010-11, this has contributed only £13 million compared with overall capital investment of £1.02 billion from central government. The private sector contributed 20 per cent of this external contribution but, under the new funding arrangements, the Department expect the majority of contributions to come from this source. Local authorities we consulted voiced considerable concern about securing sufficient local funds, especially in the current economic climate.

Barriers to effective flood risk planning

16 Legislation has clarified the responsibilities of bodies for local flood risk management, but effective partnership working in practice will be challenging. County and unitary councils are now required to take the lead in local flood risk management activity. Other bodies with an interest such as district councils, internal drainage boards, water and sewerage companies and the Agency are under a statutory duty to cooperate. Water companies must have regard to local flood risk strategies rather than act consistently with them, which risks undermining the mutual trust required to share data and collaborate effectively. The Department has not yet made it clear how they will influence and monitor the water and sewerage companies' response to their new responsibilities.

17 Strategic planning on a catchment scale has a relatively weak influence on local flood risk planning. The Agency has catchment flood management plans in place for all river catchments, setting out a strategic and risk-based approach to investment for the next 50 to 100 years. However, it has made variable progress in developing and agreeing these plans locally. Data on surface and ground water flood risk is weaker than for rivers and the coast reflecting the lack of detailed modelling available for the former sources of flooding. Shoreline Management Plans have generally been regarded as a success. They were developed in partnership by groups made up of maritime councils and the Agency and ownership generally rests with maritime councils.

18 Regional Flood and Coastal Committees have a fundamental role in bringing national, sub-national and local priorities together. The Committees bring Agency and local authority representatives together to make the final decisions about national investment in their catchments. Lead local flood authorities make up the majority of members but representation and engagement varies by region. Committee members we consulted told us they would require more robust, objective and consistent information from the Agency to exercise their role effectively. At the time of our visit, it was not clear how Committees will work across neighbouring catchments and shorelines, in particular, where inland rivers and coastal areas meet.

19 Local decision-making is hampered by the need to cross-refer to different plans that impact on local flood risk management. We identified 19 separate sets of wider plans and strategies that could impact on planning for risk in each locality. There is considerable overlap in content. The Department expects new local flood risk strategies to provide more coherence, but it will be a considerable challenge for authorities to align plans.

20 Stopping inappropriate development on the flood-plain is key to risk management but there is uncertainty over how the planning and flood risk management systems will interact in the future. The Agency has to be consulted by planning authorities. From April 2008 to March 2011, it influenced proposals for 165,000 units, which have been refused permission or modified in some way. The proportion of new development, built on the flood-plain, some 9 per cent, has been static over this period. The proposed new planning framework still requires authorities to prevent inappropriate development but there is local concern over the uncertain planning law status of local, sub-national and national flood risk plans.

National support and oversight

21 Local resourcing and capacity are key risks to the effective delivery of flood risk management. Local authorities are experiencing difficulty in recruiting and retaining appropriately qualified flood risk staff. Of the local authorities we spoke to, only 30 per cent thought they had requisite technical expertise. The Department has provided £1 million capacity funding in 2010-11 and has committed to fund lead local authorities' additional costs in meeting their new responsibilities. Local authorities' dispute some of the Department's assumptions underpinning anticipated costs and the Department has established a joint working group with the Local Government Group to review and monitor these.

22 To deliver the efficiency savings required as a result of the spending review, the Agency is implementing a change programme. It is planning for the number of full-time equivalent posts to decrease by 300 by 2014, having already reduced by 500 over the past year. The Agency has identified a number of key risks which include not having the right skills match for future business needs and accepting greater risk and uncertainty in the planning and execution of some activities. It will take time for changes to be embedded and output in some areas may dip for a period. The management of these risks will be crucial if the Agency is to maintain current levels of performance and perform its strategic overview role for all sources of flooding.

23 Since 2007, the Department has embarked on an ambitious programme of reform. It has successfully put in place the majority of institutional and legislative changes required to deliver the reforms. However, there is some local uncertainty about key aspects of the reform, including the operation and prioritisation of new funding arrangements, the implementation of sustainable urban drainage systems and the development of asset registers.

24 The Department is introducing a new funding system and some projects will require local funding, bringing risks that will need to be managed by the Agency, Department and Regional Flood and Coastal Committees. The new method used for calculating central funding of some projects does not depend on the benefit-cost ratio of the project but depends on the ratio of benefits to central spending. The Department believe that this will be compensated for by an increase in the level of overall investment in flood defences and result in more cost-effective options being developed. Projects with lower benefit-cost ratios that have attracted local funding could displace schemes with higher benefit-cost ratios that have been unable to attract local funding. In the new system it will be important for the Agency and the Regional Flood and Coastal Committees to work closely to ensure that projects enabled solely through contributions do not unjustifiably postpone more beneficial projects.

25 It is not yet clear how the Department will provide national assurance that lead local flood authorities have appropriate flood risk management arrangements in place. The Department is considering how to monitor performance of lead local flood authorities at an appropriate level. At the same time, it wants to maintain an emphasis on local accountability for local decisions and minimise the burden of national reporting on local authorities.

Conclusion on value for money

26 Since our last report the Agency has improved its knowledge of the condition of its flood defences, and targeted investment more effectively. Giving greater responsibility and discretion to local authorities to identify risks, and raise and target funding, brings some significant challenges, outlined in this report, especially during a time of local authority budget cuts and newly devolved responsibilities. If these challenges are not overcome, the Department's reforms will have failed to fulfil their potential to increase levels of investment in flood management and value for money to the taxpayer.

Recommendations

- a** While the Department has made good progress in implementing the programme of reform, there is still some local uncertainty over how some key measures will be realised. The Department needs to clarify and more effectively communicate the steps needed to address these outstanding areas.
- b** The new delivery arrangements will create tensions between increased local decision-making and the national accountability and performance framework. The Agency should assure itself that local flood risk management arrangements are not undermining strategic approaches to manage risk at the catchment and national scale. In consultation with Ofwat, the Department should assess the effectiveness of the water and sewerage companies' response to their new duties.
- c** The new approach to investing in schemes will lead to a greater number of projects with more than a single funding partner. While the new system introduces incentives on funding partners to keep development costs to a minimum, the Agency should, by April 2012, develop protocols to govern more joint-funded work. These protocols should identify actions needed to sustain the reduction in development costs the Agency has achieved.
- d** The Agency's support to the Regional Flood and Coastal Committees currently varies across the country. Learning from the best performing regions, the Agency should review the quality of the management information it provides to all Committees so decisions taken are robust.
- e** The Agency needs to improve further the verification process of its National Flood Risk Assessment to provide greater confidence in its results. The Agency should introduce procedures by 2015 to systematically test the separate components of its national risk model and define clear performance targets against which their effectiveness can be assessed.
- f** The Agency needs to communicate, to the public and organisations that rely on flood risk information, that there is uncertainty in its longer-term modelling and mapping data so people can make more informed decisions. The Agency should work to develop an approach to communicating this uncertainty to those who use this information.
- g** The Agency needs to develop a plan to improve its understanding of how the different sources of flood risk interact. The Agency plans to develop a tool that will combine information on flood risk from different sources by 2013. It needs to plan how it will use this tool, and other sources of data, to improve its own understanding of the interaction between different sources and support local authorities.

Part One

The importance of flood risk management

1.1 The government regards maintaining and strengthening England's flood defence capability as a national priority.² Some 5.2 million properties in England, one in six, are at risk of flooding. Over two million properties are at risk of flooding from rivers or the sea and nearly three million are susceptible to surface water flooding alone. One million properties are threatened by both.

1.2 The estimated average annual cost of flood damage in England amounts to more than £1.1 billion. Insurance claims for surface water flooding from the 2007 floods outnumbered claims for river or tidal flooding by 6:1.³ Despite this, if flooding from the sea or major rivers occurs, it has the potential to cause much bigger losses overall.

1.3 The risk of flooding is likely to increase owing to climate change, ageing flood defence infrastructure, development in flood-prone areas and more impermeable areas (such as concrete paving), which increases the volume of water running off the ground. Under the worst case scenario, the United Kingdom's annual flood damage bill could rise to £27 billion by 2080.⁴

National funding to manage flood risk is declining

1.4 The Agency estimates that investment in defences needs to annually increase by around £20 million on average between 2010 and 2035 to sustain current levels of protection as risk increases due to climate change.⁵ If the extra £20 million was invested each year of this spending review period, it would equate to an overall percentage increase of 9 per cent. **Figure 1** demonstrates that government funding to the Agency will reduce to £2 billion between 2011-12 to 2014-15 from £2.2 billion between 2007-08 to 2010-11. Levels of central government investment to the Agency have reduced by 10 per cent overall.

² Department for Environment Food and Rural Affairs Business Plan 2011-2015, November 2010.

³ Association of British Insurers. In 2008, the insurance industry came to an agreement with Government to provide standard flood cover to as many customers as possible so that domestic properties and small businesses at a risk of flooding of less than one in 75 years and to provide cover for those at greater risk providing the Environment Agency had plans to reduce their risk over five years. This agreement ends in 2013 and the Department are currently discussing with the industry what future arrangements might apply.

⁴ *Foresight Future Flooding*, Office of Science and Technology, 2004.

⁵ *Investing for the future: flood and coastal erosion risk management in England: a long-term investment strategy*, the Environment Agency, 2009.

Figure 1

Environment Agency Flood and Coastal Risk Management Grant-in-Aid
Funding: 2007-08–2014-15

**NOTE**

1 Figures are presented in cash terms.

Source: Department for Environment, Food and Rural Affairs and Environment Agency

The impetus to reform in 2007

1.5 In our report in 2007,⁶ we identified a number of weaknesses including inconsistency in managing defences, the high proportion of funds spent developing proposals for investment and gaps and weaknesses in management information.

1.6 In his review of the major summer flooding of the same year, Sir Michael Pitt made 92 recommendations aimed at clarifying the roles and responsibilities of the flood risk management authorities and to improve delivery.⁷

⁶ Report by the Comptroller and Auditor General, *Building and maintaining river and coastal flood defences in England*, Session 2006-07, HC 528, National Audit Office, 15 June 2007.

⁷ *Learning lessons from the 2007 floods*. The Pitt Review, June 2008.

Many national, sub-national and local bodies are responsible for flood risk management

1.7 **Figure 2** outlines the responsibilities of the principal flood risk management authorities in relation to different sources of flood risk. All these bodies have permissive rather than mandatory powers to undertake work to prevent floods.

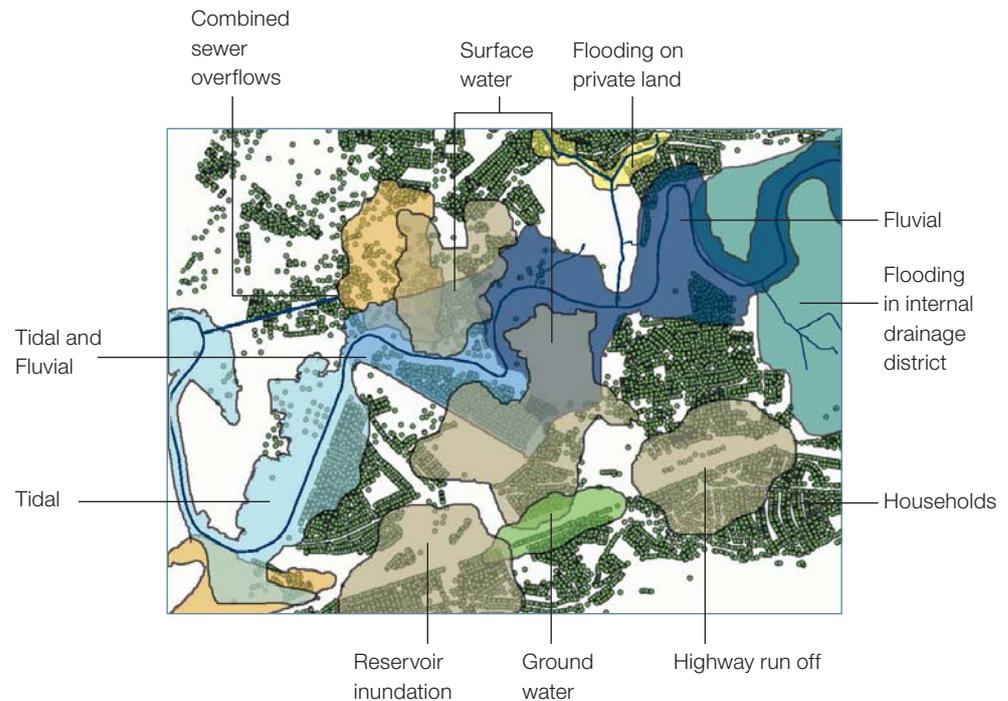
1.8 The Department has national policy responsibility and the Agency national operational responsibility. The Agency has statutory powers for providing defences from main rivers and the sea.

1.9 Local bodies have statutory powers for managing flood risk from smaller rivers, streams, ground and surface water. In areas with two-tiers of local authorities, there is a division of roles for different types of flooding. Internal drainage boards do not follow local authority boundaries but are established in areas of special drainage need in low-lying areas primarily in East Anglia, Yorkshire, Somerset and Lincolnshire.

1.10 The Flood and Water Management Act 2010 (the Act) clarifies responsibilities and aims to facilitate more effective partnership working. The Act:

- made the Agency the responsible body nationally for the strategic overview of flood and coastal erosion risk management from all sources of flood risk;
- placed new responsibilities on the 152 upper-tier local authorities (unitary and county councils) to strategically manage and coordinate local flood risk from groundwater, surface water run-off and ordinary watercourses (watercourses other than main rivers and reservoirs). These local flood authorities must produce a strategy for managing local flood risk; and
- placed a duty on defined flood risk management authorities to cooperate and act consistently within the framework of local and national flood risk strategies. Arrangements must be put in place to enable local authority scrutiny of flood risk management activity.

Figure 2
Responsibilities of principal flood risk management authorities



Flood Risk Management Authority

Responsibilities

Environment Agency

Strategic national overview role for all sources of flood risk. Operational management of flood risk from main rivers, the sea and large reservoirs.

Internal drainage board

Operational management of ordinary watercourses (watercourses other than main rivers) and maintaining drainage infrastructure in internal drainage districts.

Lead local flood authority and where appropriate district council/highway authority

Operational management of flood risk where not covered by the Agency or the internal drainage board including from surface water, ground water, highway run off, small reservoirs, ordinary watercourses and coastal protection works. Strategic overview role for all sources of local flood risk.

Water company

Operational management of flood risk from the public sewerage systems, including sewers carrying surface water away from impermeable surfaces.

Private – Riparian owner

Maintain own flood defences.

NOTE

1 Hypothetical town only for illustration of number and responsibilities of bodies involved.

Source: Environment Agency

1.11 **Figure 3** shows a timeline of the key initiatives that have or are planned to take place between 2007 and 2015 to improve flood risk management in England.

Scope of the report

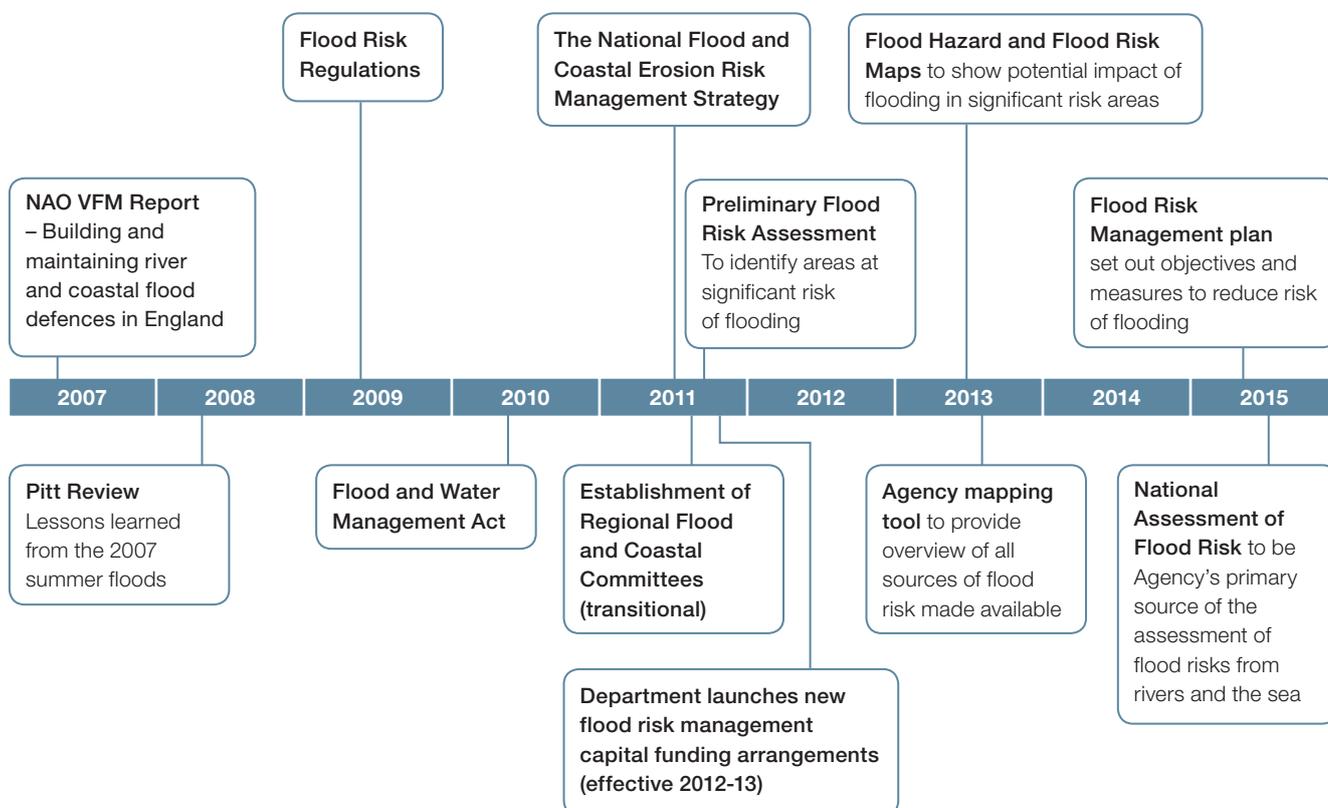
1.12 This report examines flood risk management, including investment in flood defence, but not flood incident response arrangements or coastal erosion. In particular it examines:

- Identifying the risk of flooding, Part Two;
- Targeting investment towards risk, Part Three;
- Barriers to effective flood risk management planning, Part Four; and
- National support and oversight, Part Five.

1.13 Appendix One summarises our methodology and a full version is available on the website at www.nao.org.uk/flood-management-2011.

Figure 3

Timeline of key publications and reforms for flood risk management in England



NOTE

1 The Agency is responsible for producing flood risk assessments, maps and plans for main rivers and the sea. Lead local flood authorities have responsibility for local sources of flooding.

Part Two

Identifying the risk of flooding

The Agency is at the forefront internationally in modelling the threat of flooding from rivers and the sea but more work is required to validate the results of the model

2.1 Effective targeting of investment requires a good understanding of where floods are most likely to occur and their impact. The Agency spends £19 million per year in modelling and mapping flood risk from rivers and the sea and £16 million in gathering and processing supporting data. The Agency is recognised as being at the forefront internationally in developing national scale flood risk assessment models.

2.2 The Agency's medium to long-term national flood risk assessment underpins its policy and investment priorities, and helps insurers in setting premiums and excesses. The model shows the distribution of the likelihood of flooding within an area and partially accounts for uncertainty in its assessment. It also considers the impact of flood-defence structures that reduce risk. It is based primarily on catchment-level data sets and national assumptions on water flows, which can mean that quality varies locally.

2.3 The Environment Agency considers that the model is fit for the purpose of guiding large scale investment decisions and is not intended to provide a definitive assessment of flood risk at a more detailed scale. However, there is insufficient evidence to assess the reliability of the Agency's national flood risk assessment as this is extremely difficult to verify for low probability events such as floods. A solution would be to verify the individual components of the model separately but we found that the Agency has not yet done this systematically and the available evidence for the accuracy of key components is currently mixed. The Agency has not defined clear performance targets against which the effectiveness of key components of the model can be assessed. It also does not routinely analyse the impact that typical uncertainties with the data might have on its risk assessment.

2.4 **Figure 4** overleaf shows the best estimate of the number of properties in England at various degrees of risk from flooding from rivers and the sea according to the national flood risk assessment. **Figure 5** overleaf shows, by region, the number of properties at the different levels of flood risk.

Figure 4

The number of properties at risk of flooding from main rivers and the sea according to the Agency's national flood risk assessment, 2010

Low: less than a 0.5 per cent chance	1,155,000
Moderate: less than 0.5 per cent to 1.3 per cent chance	788,000
Significant: more than a 1.3 per cent chance	486,000
No result	24,000
Total	2,453,000

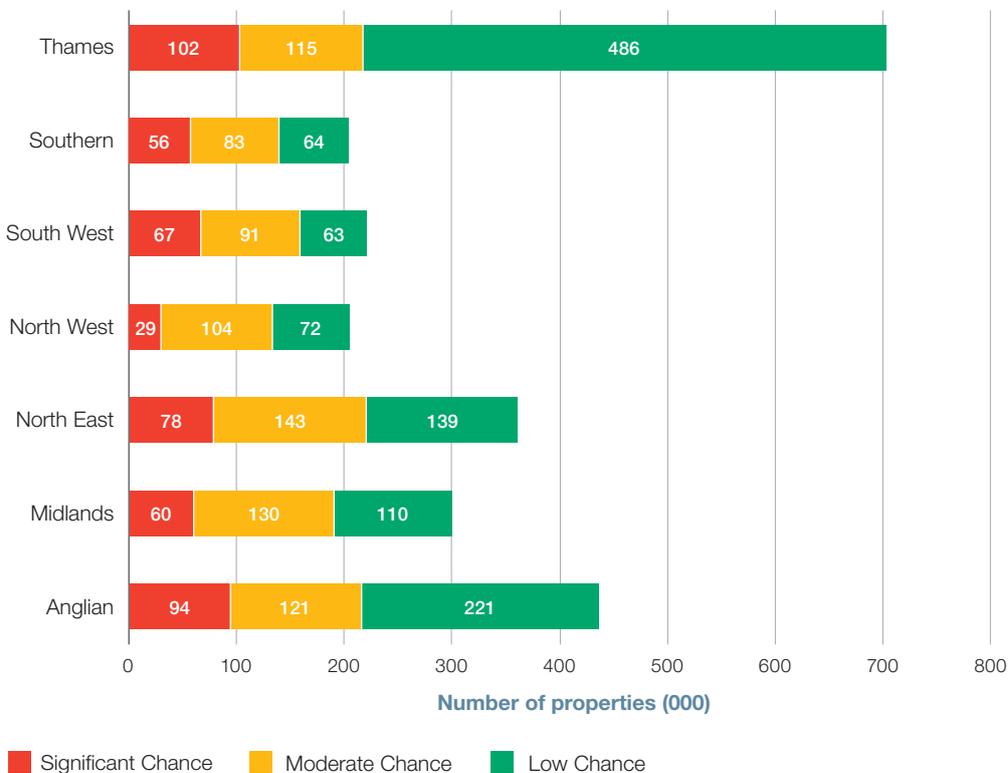
NOTES

- 1 Properties include both residential and non-residential properties and are rounded to the nearest 1,000.
- 2 The 'no result' figure is the number of properties for which it was not possible for the assessment to make a classification of significant, medium or low.

Source: Environment Agency

Figure 5

The number of properties at risk of flooding from main rivers and the sea in each Agency region, 2010



NOTES

- 1 Properties includes both residential and non-residential properties and are rounded to the nearest 1,000.
- 2 The Agency combined the Thames and Southern Regions in April 2011 to form the South East region.

Source: Environment Agency

The way in which flood risk is assessed and communicated is not consistent

2.5 The Agency's flood map is primarily designed to raise the awareness of flood risk. It is used by property owners and local authorities for development planning purposes. Based on a combination of local and national information, the map shows the extent of areas that could be affected by flooding. Unlike the national flood risk assessment, the map does not take into account the presence of any local defences and does not show the distribution of the level of risk within the areas potentially affected. The categorisation of the level of risk is not the same as that of the Agency's national flood risk assessment.

2.6 The bespoke models that produce the output for the flood map rely on local knowledge that is not easily transferable to the national flood risk assessment. Conversely, the catchment-scale results of the national assessment require regular reasonableness checking and adjustment before they can be used locally. The Agency aims to use the national flood risk assessment as the primary source of data to assess and communicate local flood risk from rivers and the sea by 2015.

2.7 We found the Agency use a number of different ways to describe levels of risk. These include the likelihood of flooding in a given period (such as a one in a hundred year event), the annual percentage probability, or broad categories such as low or high risk. Practice varies between different internal models and maps and also in documents made available to the public. The Agency is looking to rationalise its flood risk information but, without clear and consistent categories, it is currently difficult for the public to understand levels of risk or uncertainty.

The mapping of local flooding risk including from smaller rivers, surface and ground water and sewers is limited

2.8 Mapping and modelling of the risk of flooding from smaller rivers and drainage sources is far less advanced than from main rivers and the sea. In November 2010, the Agency produced a new national surface water map but this has limitations, particularly because local drainage capacities are unknown. Local authorities will need to work with their partners to review, agree and record how surface, ground, and sewer water flood data best represents local conditions. However, our interviews with local authorities suggested that the availability of data, especially from water and sewerage companies, is a barrier.

2.9 The Agency intends to develop a tool that combines information about flood likelihood from all sources by 2013, although this tool will not consider how the different sources of flood risk interact. The Agency cannot fully perform its strategic overview role for all sources of flood risk effectively until it has a good understanding of this interaction. To date, no country has this capability.

England's flood defence infrastructure is not fully known and approaches to gaining this knowledge are not integrated

2.10 Features such as boundary walls, culverts (tunnels carrying a stream under a road or railway), ditches, sustainable drainage systems and embankments help to reduce the likelihood of floods even though they are not necessarily designed for flood defence purposes.

2.11 The Agency has a good understanding of more than 35,000 defence features on main rivers and the coast. Knowledge of features that prevent ground and surface water flooding is far less developed. Lead local flood authorities are required to develop registers detailing the ownership and condition of all features that they deem likely to significantly affect flood risk. It is for each authority to decide what information to record including what 'significant' means, although the Agency has provided guidance.

2.12 The Department expects local authorities to start populating registers by December 2011 and using a risk-based approach. The majority of staff from lead local flood authorities we interviewed expressed concern in meeting this deadline mainly owing to resource constraints. Also, despite Government guidance, there is confusion about what information to include and the recording system to use.

2.13 The Agency is improving the quality of its database of the defence features on rivers and the coast in response to weaknesses we previously identified. However, owing to its link to other technology developments within the Agency, local authorities will not be able to access the Agency's system until at least summer 2012. Local authorities are under no obligation to use the Agency's database. In the absence of a common methodology, they are expected to develop their own systems, which may not be compatible with other local or national systems, hampering information-sharing.

2.14 Some 55 per cent of river and coastal defences are maintained by third parties. This is challenging because of the Agency's limited enforcement powers. The Act will give the Agency, local authorities and internal drainage boards new powers to formally designate important flood risk assets. Designation will require the owner to obtain consent before altering, removing or replacing the defence, but it does not in itself impose a maintenance requirement.

Part Three

Targeting investment towards risk

The Agency has improved its knowledge of the maintenance costs of its defences and brought a higher proportion up to target condition

3.1 Since our last report, the Agency has progressively improved its knowledge of the condition of existing sea and river defences and this has helped effective targeting of maintenance funding on defences classified as high consequence if they fail. In April 2011, the Agency completed mapping of each flood risk management defence system⁸ and now has a national database of their condition and whole-life costs.

3.2 The Agency has introduced new standards governing the quality and costs of maintenance work. However, cost data is based on previous year forecast costs. Further work is required to include all relevant outturn costs, which would allow the Agency to better benchmark regional performance.

3.3 The Agency assesses its flood defence systems as high, medium or low consequence based on the potential impact of flooding on people and property if breached. In 2008-09, the Agency started to measure the proportion of individual defence features at target condition in high, medium and low consequence systems and began to report performance the following year. Since it started reporting this measure, the percentage of Agency maintained features in high consequence systems at or above the required condition has improved from 96.4 to 98.2 per cent. In absolute terms, at April 2009, 1,117 features in these systems were below the required condition. At the end of March 2011, this number nearly halved to 577.

3.4 The Agency must continue to invest in its existing flood defences to maintain current levels of protection and is progressively targeting its limited funding on high consequence defences. We previously found that the Agency spent a relatively high proportion of its maintenance effort on low consequence defences. Funding allocated to high consequence systems is projected to increase from 61 per cent in 2007-08 to 77 per cent in 2014-15.

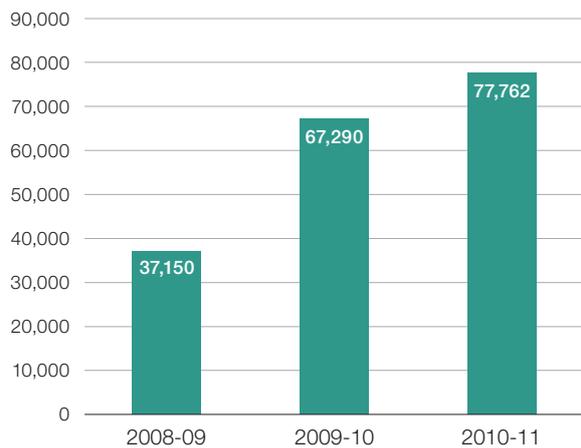
⁸ The Agency uses a systems approach to manage flood risk as a number of flood defence features work in combination. Damage to one could have a serious impact on the effectiveness of the entire system.

3.5 There continues to be significant regional variation in the proportion of Agency spend devoted to high consequence systems. For example, in 2010-11, the Midlands allocated 90 per cent and the Southern region 53 per cent. The Agency is finding it more difficult to withdraw funding from low consequence defences in some regions because landowners have historically depended on these defences for land drainage purposes. While the distribution of maintenance spend within regions, both for work directly undertaken by the Agency or that it contracts out, is increasingly influenced by maintenance need, this also depends on the Agency ensuring its workforce can deliver a timely response to flood incidents.

National targets have driven Agency investment in new defence schemes

3.6 Since 2008-09, the Department has set a range of economic, social and environmental targets for the Agency’s investment programme in new or improved flood defences. The Department set these targets by comparing the Agency’s performance in programme delivery with its investment plans for the spending review period. **Figure 6** shows that, by the end of 2010-11, over 182,000 households were given improved flood protection against a target of 145,000.

Figure 6
Number of households with improved protection from flooding, 2008-09 to 2010-11



Source: Environment Agency

3.7 The Agency uses data from completed defence projects to measure its performance against the targets. The national estimate of properties at risk is calculated from the national flood risk assessment. There is, therefore, no single consistent set of data to demonstrate how the Agency's investment is reducing national flood risk. The Agency told us that to fully reconcile the different systems would not be cost-effective. Comparison of the data sets suggests that over three years the work has reduced the risk for about 10 per cent of the current number of households at risk of flooding from rivers and the sea.

The benefit-cost ratio is an important value-for-money test of central investment in new defences

3.8 The Agency conducts appraisals of potential investment in new flood defence schemes based on a comparison of the costs of the proposed scheme and the benefits of the damage prevented. For the last spending review period, the Department has required the Agency to achieve an average benefit-cost ratio of at least 5:1. The Department based this target on a historical review of the Agency's performance. The Agency achieved an 8:1 ratio.

3.9 The Agency's approach to calculating the benefit of its investment leads it to maximise the reduction in flood risk, and its previous approach to prioritisation led to improved protection for the greatest number of households rather than necessarily reducing the residual risk of flooding. **Figure 7** overleaf shows the Agency tended to distribute more of its capital funding budget to the regions that have a higher number of households at risk.

3.10 As a consequence, less densely populated areas were ranked a lower priority for funding because the number of households affected, or the economic loss, is relatively small compared with the cost of a new or improved defence. While some stakeholders such as the National Farmers Union and the Association of Drainage Authorities have expressed concern over this tendency, the Agency's appraisal guidance includes a wide range of methodologies in an attempt to assess the wider value of a project and incorporates Treasury guidance. The Agency lacks a longer-term evaluation process that looks at the wider benefits of its defence schemes ten years or more after completion, which could feed into future appraisal criteria.

A new Department funding formula allows any project with a benefit-cost ratio of greater than one to attract at least some government funding, if the remainder is met locally

3.11 The Department has not set national targets for the current spending review period, as it now believes that central, short-term targets do not always lead to the best long-term outcome. It is introducing more local choice within a new funding framework, which it hopes will increase overall investment in flood risk management. Ministers still expect that at least a further 145,000 households will be better protected by 2014-15.

Figure 7

Capital funding allocated to each region from 2008-09 to 2010-11 and Agency estimate of number of households at risk



	CSR07 capital allocation (£m)	Total households at risk
Anglian	208	300,000
Midlands	80	209,000
North West	73	156,000
South West	56	148,000
Southern	102	154,000
Thames	123	591,000
Yorkshire and North East	113	267,000

NOTE

1 The Agency combined the Thames and Southern Regions in April 2011 to form the South East region.

Source: Environment Agency

3.12 Under the new approach, introduced on a transitional basis in 2012-13, all projects including schemes that manage surface and ground water flood risk or improve property resilience, which were previously ineligible, may be offered government funding according to the benefits they are expected to deliver. How much a project gets will be calculated using defined payment rates scaled to prioritise households at significant risk, especially in deprived areas, and to deliver statutory environmental obligations. Local funding contributions are encouraged for all potential projects but, where benefits significantly outweigh the costs, projects can be fully funded by government. In all other cases, local stakeholders will have to contribute funds if they wish the scheme to proceed.

3.13 The Department expects that this greater choice should gradually lead to the Agency part-funding projects with lower benefit-cost ratios than on average it would have previously supported. The Department expects that these projects may deliver better value for money in the longer-term, for example, by protecting fewer households against more severe levels of risk. It wants the new system to incentivise greater local financial contributions, and create competition for the available government funding each year.

3.14 Much of the Agency's investment (63 per cent) over the spending review period is committed on existing schemes. The Agency is delivering the Department's objectives by prioritising the remaining 37 per cent for new schemes on maximising the number of households moved to lower categories of risk. The supply of such schemes, which have sufficiently high benefit-cost ratios to make them eligible for 100 per cent national funding, is likely to match the national funding available to 2014-15. However, some schemes with lower benefit-cost ratios, but which have secured external funding contributions, are being brought into the programme from 2012-13. These schemes are displacing new schemes with higher benefit-cost ratios, which the Agency will start in subsequent years. The Department told us that the order of schemes gaining investment is less important than the overall long-term benefit being delivered.

If central government funding does not increase in the longer term, improving current levels of flood defence will depend on significant additional funding being secured locally

3.15 Over the last spending period, the Agency has had some success in raising external contributions for its own investment programme. These contributions have risen from just over £2 million in 2008-09 to nearly £13 million in 2010-11. This compares with overall capital investment of £1.02 billion from central government. The private sector contributed 20 per cent of this external contribution but, under the new funding arrangements, the Department expect the majority of contributions to come from this source. The Agency anticipates that, in 2011-12, it will secure £9.5 million and, in 2012-13, it will secure £16.9 million. It expects that 70 per cent of the total external contributions over the two years will come from the private sector.

3.16 During the current spending review period, the Agency has targeted 85 per cent of its investment on priority schemes to ensure current national protection levels continue despite the 10 per cent reduction in its budget. If central government funding does not increase after 2014-15, maintaining and improving current levels of flood defence from rivers and the sea will increasingly depend on significant additional funding being secured locally. More funding will also be required for schemes that protect against surface and ground water flooding.

3.17 Local authorities we consulted were generally supportive of the rationale behind the new funding arrangements. However, they also voiced considerable doubts over their ability to raise additional funds locally unless there was a strong recent awareness of flood risk. Regional Flood and Coastal Committees are able to raise money from their local authority members, which is reimbursed by formula grant from central government. Around £30 million a year is raised nationally in this way. In 2010-11, the amount of levy per Regional Committee's council tax base ranged from £0.64 to £3.14. We were unable to identify any relationship between these amounts and level of flood risk.

3.18 We also found local concern that the joint-funding approach could become complex. Projects with more than one funder, and partners with varying skills sets take time to set up and organisations may not engage with the approach if it becomes an overly bureaucratic exercise. Over the last three years, the Agency has reduced the costs of developing new flood defence projects. In our 2007 report we found these costs averaged 30 per cent of the total cost of the scheme but, by April 2011, the Agency had reduced this proportion to 23 per cent and are on target to reduce this to 20 per cent by April 2013. Local Agency staff felt sustaining this improvement would be challenging under the new approach as scoping and agreeing projects would require more time and resources. The Department believes the system will create incentives for all partners to keep development costs to a minimum.

Part Four

Barriers to effective flood risk management planning

Effective local flood risk management requires a number of bodies to work together but this is challenging due to the different regulatory pressures faced by these bodies

4.1 The Flood and Water Management Act designated upper-tier authorities responsible for local flood risk planning. It also imposed a new duty of cooperation on these authorities, the Agency, internal drainage boards, water and sewerage companies and, where relevant, lower-tier authorities. Significant challenges will need to be overcome. Organisations face different policy and regulatory requirements, which can run counter to effective partnership-working. For example, internal drainage boards are tasked with securing clean water drainage and manage water levels so they work more to minimise rather than manage flood risk.

4.2 Water companies face particular difficulties in working with sufficient flexibility to support partnerships, largely owing to commercial and regulatory restrictions. Under the Act, water companies must have regard to local flood risk strategies rather than act consistently with them. This risks undermining the mutual trust required to share data and collaborate equally. Some bodies, such as Network Rail, that own flood defence features also have a role to play but are not under a duty to cooperate. The Department does not have any formal arrangements in place to monitor the effectiveness of these partnerships but is developing plans to provide some form of national assurance.

Planning at a catchment-scale is vital but so far has had limited impact on local flood risk planning

4.3 In 2004, the Agency began developing Catchment Flood Management Plans for 68 defined river catchments in England. These are long-term (50 to 100 years), strategic plans through which the Agency seeks to work with other decision-makers to identify and agree policies for sustainable flood risk management.

4.4 By December 2007, the original deadline set by the Department, the Agency completed 40 out of 68 plans. The remainder were completed by December 2008. The Agency then re-consulted on eight of the plans which were completed by October 2010. The Agency stated that the delays were due to the unexpected complexity of developing plans, and the time it took to consult with communities and build a common understanding of the issues.

4.5 The Department evaluated the plans in December 2010, and concluded that they were an important step in helping stakeholders fully understand the Agency's strategic intentions. However, a number of respondents considered the documents too strategic and unlikely to influence the majority of the work undertaken by their organisation, voicing concern that the plans would result in an unacceptable reduction in the level of the Agency's flood management activity.

4.6 Despite a small number of lead local flood authorities taking steps to join up their local strategies across administrative boundaries, long-term strategic planning on a catchment scale has weak influence overall on local flood risk planning. While the catchment plans consider all sources of flooding, data on surface and ground water is significantly weaker reflecting the lack of detailed modelling available for these sources of flooding.

4.7 Recognising that more work is required to increase local awareness and engagement with the catchment approach, the Agency has published summary reports of all the catchment flood management plans. It will be publishing an annual report detailing overall progress in delivering the agreed actions in the plans.

4.8 The equivalent strategic plans for a defined length of coastline, Shoreline Management Plans, have generally been regarded as a success. They were developed in partnership by seven coastal groups, made up of maritime councils and the Agency. Maritime councils have lead responsibility for 18 of the 22 plans and the Agency lead on four. These plans are currently being updated to provide a more consistent and realistic approach to managing coastal defences.

Aligning the many risk management plans will be challenging

4.9 The Agency and the Department have published a national strategy for flood and coastal erosion risk management in England.⁹ The strategy provides the framework for a plan-led approach to flood risk management. **Figure 8** sets out the relationships expected between the different plans. We identified 19 individual policy and planning documents that sit behind these plans.¹⁰

4.10 There is considerable overlap in these plans and local decision-making is hampered by having to cross-refer to different content to fully understand local flood risk. The Department expects that local flood risk management strategies, which lead local flood authorities will develop, should eliminate the need to refer to the underlying plans. However, no formal timetable has been given for preparing local strategies.

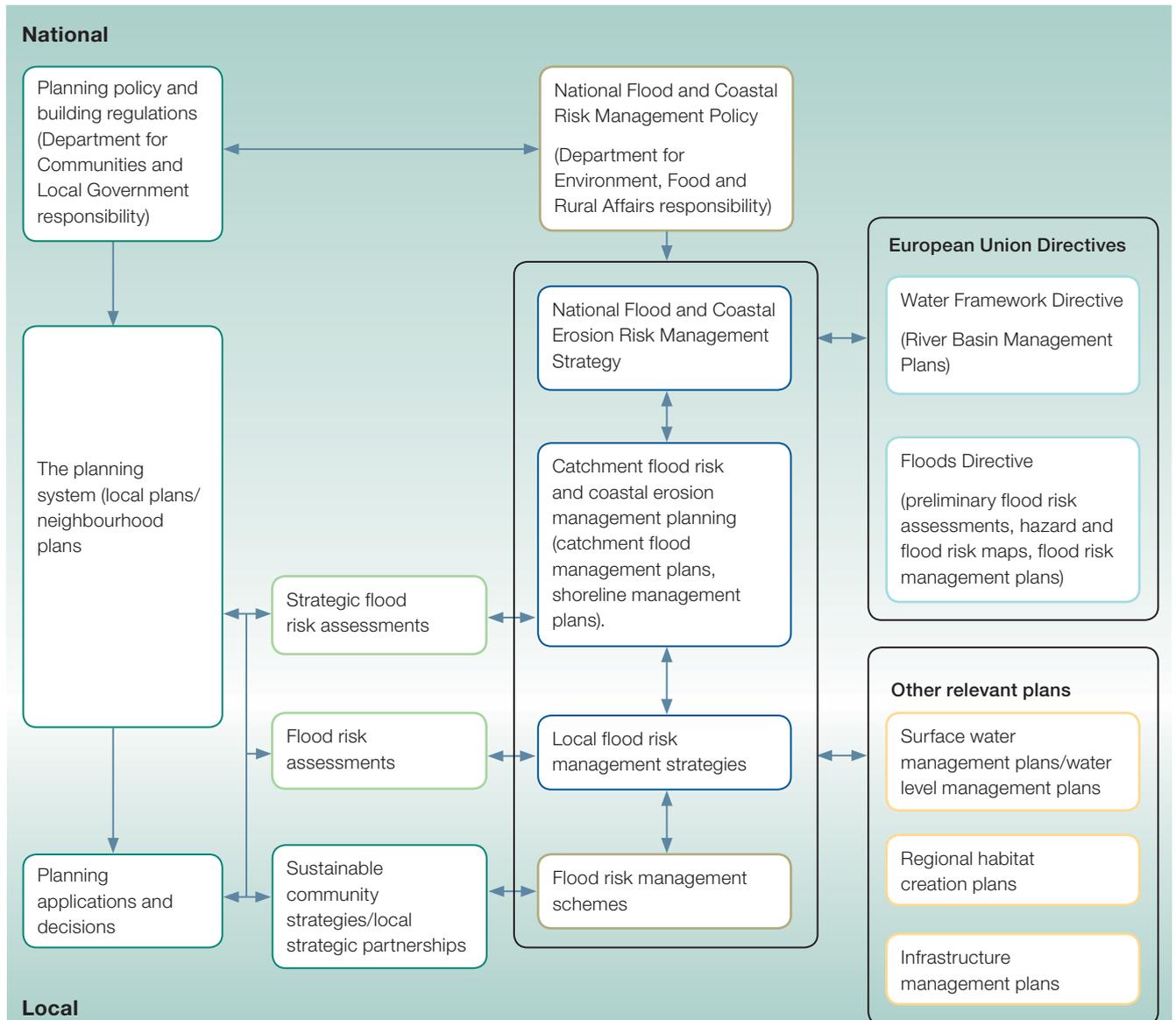
4.11 Lead local flood authorities have a duty to ensure their local strategies are consistent with the national strategy. The Department will not approve these strategies, rather local authorities must establish suitable local accountability arrangements.

⁹ *Understanding the risks, empowering communities, building resilience: The National Flood and Coastal Erosion Risk Management Strategy for England*, Environment Agency, May 2011.

¹⁰ *Preliminary Framework to assist the Development of Local Strategies for Flood Risk Management*, Local Government Group, February 2011.

Figure 8

Relationship between strategic plans for managing flood risk



Source: Environment Agency

4.12 The Department and the Agency are developing plans to provide national assurance over local flood risk arrangements. They want to maintain an emphasis on local accountability for local decisions and minimise the burden of national reporting on local authorities. The Department is working with the Department for Communities and Local Government to develop appropriate measures. The Agency intends to perform its strategic overview role by nationally reporting on lead local flood authority progress in developing their local strategies. It also aims to help authorities by sharing good practice, tools and techniques, and has contributed to the production of guidance developed by the Local Government Group.

Regional Flood and Coastal Committees are fundamental to aligning national and local priorities

4.13 The national strategy identifies Regional Flood and Coastal Committees (the Committees) as having a key role in balancing local priorities and ensuring that planning is coordinated at the catchment and shoreline scale. Their administrative boundaries, as shown in **Figure 9**, follow catchment boundaries.

4.14 The Committees include members appointed by the Agency and elected members appointed by lead local flood authorities. Feedback from Committees we attended suggests that local authority engagement with catchment issues varies considerably and is weaker where there is shared representation or where the authorities have little history of flooding.

4.15 The Committees provide the mandate for local involvement in investment decisions on central government funding. They make the final decisions on where this funding goes in their catchments. Some Committee members told us they needed more robust and objective information to perform their role effectively. At the time of our visit, greater clarity was needed on how Committees will work across neighbouring catchments and shorelines, in particular where inland rivers and coastal areas meet.

Stopping inappropriate development on the flood-plain is also key to risk management

4.16 Local planning authorities are responsible for regulating development on the flood-plain. Planning Policy Statement 25 (2010) covers flood risk issues throughout the planning process. The Statement seeks to ensure that flood risk is considered at all stages to avoid inappropriate development and to direct development away from areas at greatest risk.

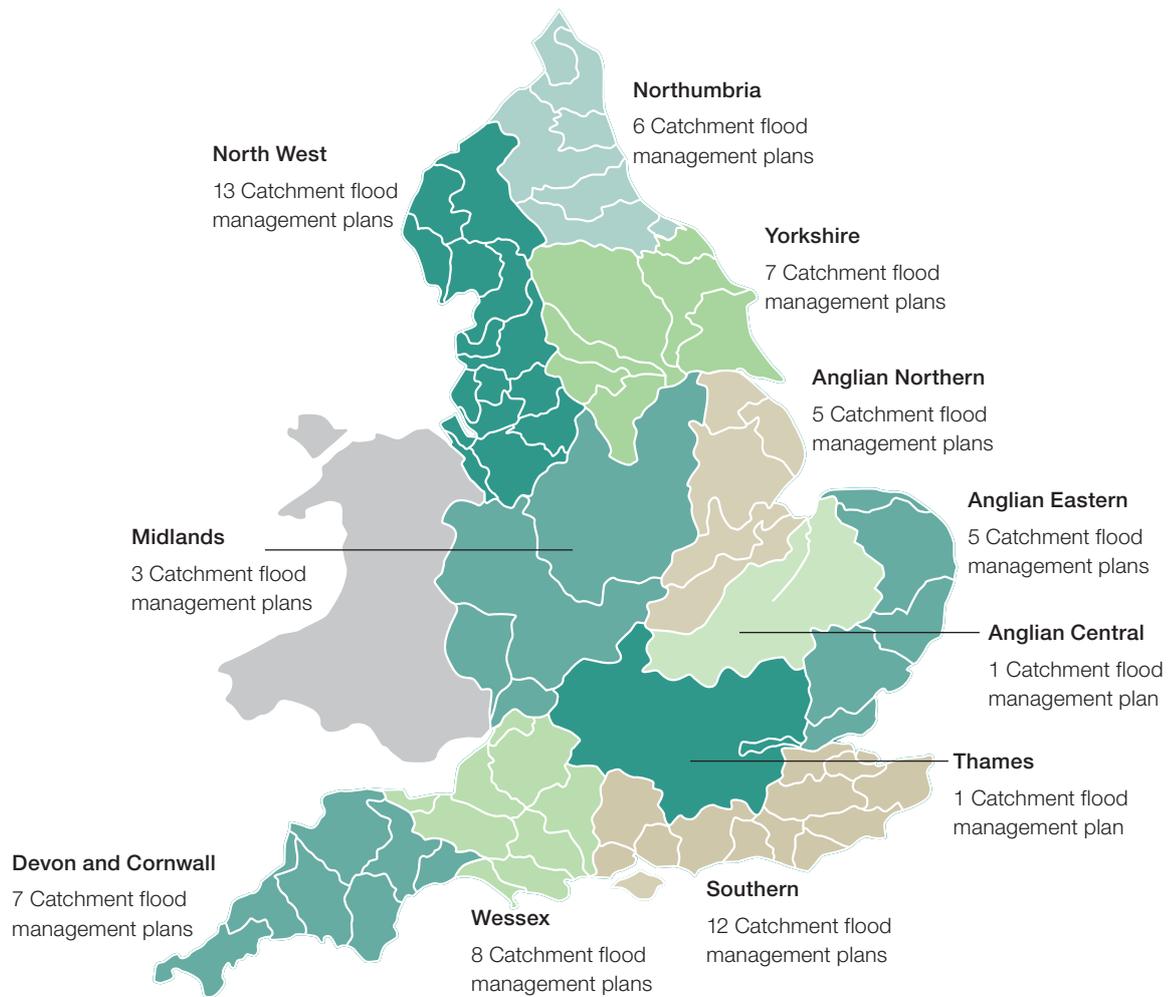
4.17 Between April 2008 and March 2011, the Agency's advice influenced planning applications for just under 98 per cent of residential units proposed on flood-plains on which it was consulted. Applications for some 165,000 units were either refused planning permission or needed changes to be acceptable. Partly as a result of the Agency's involvement, the proportion of new dwellings built on the flood-plain has been around 9 per cent for the last three years.¹¹

4.18 The proposed new national planning framework plans to remove Planning Policy Statement 25. While the proposed framework acknowledges the Agency's statutory consultee role the framework does not explicitly acknowledge the role of local, sub-national and national flood risk management strategies.

¹¹ *Land Use Change Statistics (England)*, Department for Communities and Local Government, 2010.

Figure 9

Regional Flood and Coastal Committee Regions and number of catchment flood management plans in each Committee region

**NOTE**

1 The Agency combined the Thames and Southern Regions in April 2011 to form South East region.

Source: Environment Agency

Part Five

National support and oversight

The Department and Agency have given some support to lead local flood authorities but local resourcing and capability are key risks to effective delivery

5.1 Local authorities are funded for their ongoing flood risk functions through the Department for Communities and Local Government formula grant settlement. The revenue grant is not ring-fenced. Local authority spending on flood risk management in 2010-11 was £101 million.

5.2 The Department committed to fund the costs of developing strategies and plans for lead local flood authorities. Based on an assessment of current local flood risk, these authorities received a total of £21 million in 2011-12 rising to £36 million in subsequent years. From 2012-13, the value of these grants will vary from £110,000 to £750,000.

5.3 Local authorities have expressed concerns about the expected costs of their new responsibilities and dispute some of the Department's funding and saving assumptions. This included the anticipated savings that authorities would make from transferring private sewers to water companies and lower spending through better flood risk management. Local authorities also estimated they will need to increase spending on staff related to flood risk management by 30 per cent to meet their new responsibilities.¹² In response, the Department has set up a joint working group with the Local Government Group to review and monitor costs as the legislation is implemented.

5.4 Local authorities are also concerned about the funding of their new role in approving, adopting and maintaining the sustainable drainage systems developers must construct for new development. The Department has yet to confirm when this provision will begin or how longer-term maintenance, beyond 2018, will be funded.

5.5 Local government is experiencing difficulties in recruiting and retaining flood risk management experts including qualified engineers. This is widely acknowledged as a key risk.¹³ Such skills will be needed for local authorities to implement its new responsibilities effectively. Of the local authorities we spoke to, only 30 per cent felt they had the requisite technical expertise available.

¹² *Survey of Local Authorities*, Local Government Group, December 2010.

¹³ *Flood Risk Management: A local issue of national importance*, Institution of Civil Engineers, March 2011.

5.6 The Department funded a £1 million capacity building programme in 2010-11 to help local authorities take on their new responsibilities and is planning a second phase of this programme. The funding has so far supported 38 workshops, which representatives from 95 per cent of lead local flood authorities attended. The Department and the Agency have also developed a suite of associated e-learning tools and, by July 2013, will have supported the development of over 65 local authority trainees on the Agency sponsored river and coastal engineering foundation degree course.

5.7 All but one lead flood authority was able to submit their preliminary flood risk assessment to the Department by the government deadline of June 2011. This suggests they are managing to fulfil the basic requirements of their new role. It was too early, however, for us to review the quality of these assessments.

The Agency must systematically prioritise, to deliver against expectations with fewer staff

5.8 The Agency has calculated that it will need to reduce its staff numbers by around 300 full-time equivalent posts by 2014-15, having already reduced by 500 in the past year, in the light of the 18 per cent reduction in its revenue budget. The Agency has developed and is currently consulting on a change management programme and has identified a number of risks including; the timescales to embed these changes and make them effective, outputs dipping for a period, not having the right skills match for future business need and accepting greater risk and uncertainty in the planning and execution of some of their activity. The management of these risks will be crucial if the Agency is to be effective in maintaining its existing operational responsibility and perform its strategic overview role for all sources of flooding.

The Department's ambitious programme of reform has potential to improve value for money but not without some risk

5.9 Following the summer 2007 floods, the Department has embarked on an ambitious programme of reform, to make the improvements in flood risk management it wants to see. This involves:

- developing, consulting on and securing new legislation in the Flood and Water Management Act 2010;
- providing new guidance and support;
- flood emergency response;
- developing and implementing new funding models; and
- seeking new ways of working and cultural change, especially within the Agency and locally.

5.10 Out of the 92 Pitt Review recommendations, the Department and the Agency have taken steps to implement 85 per cent, including passing the Flood and Water Management Act and publishing the national strategy. The Department told us implementation of the remainder depends in part upon policy decisions and legislative opportunities.

5.11 The Department's senior management board for its flood risk management programme oversees the delivery of the reform programme. Separate project teams advise the board on progress in implementing the required institutional and funding changes. The board's membership includes representation from the Agency and, in a non-executive capacity, the Local Government Group. At the time of our review, the Board was considering broadening the membership to include either internal drainage board or Regional Flood and Coastal Committee representation.

5.12 The Department's new approach to capital funding aims to encourage greater national investment in flood risk management and is expecting to significantly improve the overall value for money delivered by the programme. The method used for calculating central funding does not depend on benefit-cost ratio of the project but depends on the ratio of benefits to central spending. The Department expects that this greater local choice should gradually lead to the Agency part-funding projects with lower benefit-cost ratios than on average it would have previously supported. The Department believe that this will be compensated for by an increase in the level of overall investment in flood defences. Projects with lower benefit to cost ratios that have attracted funding could displace schemes with higher benefit to cost ratios that have been unable to attract funding. The new system places greater reliance on the Regional Flood and Coastal Committees working with the Agency to ensure that projects which optimise value for money are taken forward.

Appendix One

Methodology

The main elements of our fieldwork, which took place between May and August 2011, were:

Method	Purpose
<p>Interviews</p> <p>We conducted semi-structured interviews with the Department, and the Agency.</p>	<p>To understand the Department's approach to, and rationale behind, the new delivery and funding model. To discuss in more detail with the Agency progress against recommendations in our previous report.</p>
<p>Document review</p> <p>We examined a number of documents from the Department and the Agency including performance monitoring information, project evaluations, programme management guidance and risk registers.</p>	<p>To assess the Agency's progress on strengthening its governance and management information since our previous report. To assess the progress made on implementing changes needed for the new delivery model.</p>
<p>Stakeholder consultation</p> <p>We conducted semi-structured interviews with key stakeholders involved in flood risk management, including lead local flood authorities, Regional Flood and Coastal Committees, district local authorities, internal drainage boards, Association of Drainage Boards, and Association of British Insurers.</p>	<p>To understand the issues and the implications of the new delivery model on stakeholders and partners.</p>
<p>Financial analysis</p> <p>We examined the financial data used by the Agency for its capital and maintenance programme. We examined the level of commitments for the mid-term plans and the amount of capacity funding provided by the Department for the lead local flood authorities.</p>	<p>To gather the opinions of stakeholders on the new funding and delivery model, the risks associated with the new models and the level of partnership working.</p>
<p>Consultant</p> <p>We appointed an external flood risk management expert from the University of Bristol.</p>	<p>To advise on the Agency's collation and use of flood risk science, quality assurance and effectiveness.</p>



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