Inland Flood Defence

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
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executive summary

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Overview

1 The floods in England in 2000 demonstrated the serious consequences which flooding can have for people and their property. 11,000 people were requested to evacuate their homes or businesses. Some 10,000 properties were flooded, out of at least 150,000 in areas which were directly at risk. The rainfall in autumn 2000 was the greatest since records generally began in 1766. In York, river levels rose higher than the previous record of 1625. Forecast changes in climate, storminess and rainfall patterns during this century are expected to lead to an increased risk of flooding. Many houses and business premises in this country have been, and more are likely to be, built in flood plains.

2 The policy aim for flood defence is to reduce the risk to people and the developed and natural environment from flooding. Flood defences are designed to protect against flood events of a particular magnitude, expressed as risk in any one year. For example, defences in urban areas may be built to provide protection against flood events of a size which might occur on average once in one hundred years or less.

3 The Ministry of Agriculture, Fisheries and Food (the Ministry) has responsibility for establishing flood and coastal defence policy in England. It administers the legislation that permits flood defence works to be carried out by others. It maintains an overview of flood defence investment across England. It has established investment priorities and high level targets for the Environment Agency (the Agency), local authorities and Internal Drainage Boards. The Ministry grant-aids some capital works. Other capital works by the Agency and maintenance activities are funded mostly by levies on local authorities, who also fund directly their own work on ordinary water courses. The Agency has a duty to exercise a general supervisory role over all flood defence matters. It is the largest single authority carrying out flood defence work in England. However, the Agency is not responsible for all flood defences. Its powers to disseminate flood warnings, to monitor water levels and to build and maintain defences are only permissive; and these permissive powers are exercised almost exclusively on main rivers. Permissive powers in respect of ordinary watercourses lie mainly with local authorities and Internal Drainage Boards established in certain low-lying areas. Private landowners also have powers to act on their land, subject to relevant consents.

4 Our main conclusions are:

i) Up to 2 million homes and buildings are in areas at risk of flooding. As seen in late 2000, flood defences can reduce the risk or extent of damage; they cannot prevent all flooding. Awareness of the risk and actions necessary before and during a flood - among those responsible for new developments, for flood defence activity and those who live or work in areas at risk - can be the single most important defence against the worst effects of flooding.

ii) The extent of joined-up working required in all aspects of flood defence to protect those at risk represents a massive challenge. The number of bodies involved and the fact that they have separate budgets rather than a single flood protection programme causes confusion and absorbs energy and resources that might otherwise be devoted to planning and implementing flood defences.

iii) Some £300 million is spent each year by all operating authorities in building and maintaining inland flood defences. This requires careful prioritisation of capital and maintenance programmes based on an assessment of risk. The results of a condition survey of the Agency's flood defence assets, completed in 2000, showed some 43 per cent of structures and 36 per cent of linear barriers in England are categorised as only fair, poor or very poor.

iv) In reviewing the lessons learned from flooding in late 2000, the Agency and the Ministry should consider whether the division of responsibility for provision of flood defences and the operation and permissive nature of powers increased the risks of suffering flood damage for some citizens. They also need to do further work to explore whether the basis on which watercourses are currently categorised between main rivers and non-main (ordinary) rivers leads to inadequate and inconsistent levels of flood defence service across different parts of the country.

5 By early 2000, our concern about flood protection had been motivated by the significant amount of work still to be completed by the Agency and others in producing a comprehensive record of the condition of flood defences in England, and in strategic planning of river and water management and provision of flood defence systems in the face of finite resources. Our interest was heightened by the potential threat from changes in rainfall patterns and from building more homes in areas at risk from flooding. And so, at the time the flooding occurred in late 2000, we had already commenced an examination of the issues facing the Environment Agency, the Ministry of Agriculture, Fisheries and Food and others in the provision of flood warning and defence. This report contains our findings, conclusions and recommendations in respect of three main areas:

- Flood warning and public awareness
- Building new defences
- Performance and maintenance of defences

6 The Agency's own review following the floods in late 2000 examines the causes and effects of that flooding; the accuracy of weather forecasting; how the response was managed, including emergency and flood warning arrangements; and lessons that can be learned from flooding that tested the quality of defences to or beyond their design limit. Our report considers more generally the actions taken by the Agency in recent years to protect the public from flooding, and our recommendations and conclusions should contribute to the Agency's and the Ministry's considerations about future action in the wake of recent flooding.

7 In carrying out this examination we explored the scope for international comparisons. However, we found that differences in geography - such as terrain, climate and amount of land and people at risk from flooding - made this difficult. The scale and regularity of flooding in parts of Asia, for example, do not bear comparison. Even in Europe there are significant differences in the size of main rivers and severity of flooding compared with England. For example, although the low-lying land and land drainage in the Netherlands have some similarity with the geography of East Anglia, the rest of England, including those regions affected by severe flooding in Easter 1998 or late 2000, is very different. In terms of severity, we note that in Poland, 54 people died and over 160,000 people were evacuated in floods of 1997; in Italy in October and November 2000 flooding caused more than 30 deaths and over 4,000 people to lose their homes

Building temporary flood defences at Barlby, Yorks - photo courtesy of the British Army

permanently. On the other hand, comparisons of the arrangements for administering flood protection show some similarities between countries. These include the sharing of responsibilities for flood defence between central and local government, and increasing attention being given towards seeking to plan flood defence, management of water supplies and environmental concerns on the basis of river catchment plans, such as in the Netherlands and France.

Our detailed findings

8 Flood forecasting, warning, protection and flood risk information form the basis of risk management by the individual citizen and relevant authorities. Since 1996 when the Agency was established, it has improved the quality and coverage of flood risk mapping for local authorities, emergency services and others. As at mid 2000, the Agency was still working on some 70 per cent of the maps it had expected to produce to assist local authorities in deciding on planning applications in areas at risk of flooding. However, flood risk maps covering the whole of England using the best information available to date were published in 1999 and updated towards the end of 2000.

9 In areas where a flood warning facility exists, the Agency has, on behalf of flood defence committees, increased the percentage of people who receive at least two hours notice of flooding from 13 per cent in the early 1990s to 65 per cent in 1998 and has targets to increase this further to 80 per cent over the next 10 years. The Agency continues to carry out flood awareness campaigns on behalf of flood defence committees, to ensure the public recognises the risks and takes appropriate action. Research by the Agency (which predated flooding across many parts of England in October and November 2000) showed that 19 out of 20 people in flood risk areas did not take the possibility of flooding seriously.

10 The organisational arrangements for the provision and funding of flood defence are acknowledged to be very complex and were already under review by those responsible prior to flooding in late 2000. Responsibility spans the Ministry, the Agency, all local authorities and district councils, 9 Regional and 11 Local Flood Defence Committees, and 235 Internal Drainage Boards. While complex, these arrangements do have some benefits in terms of identifying and attempting to address local needs and priorities for flood defence.

11 The Ministry estimates that existing defences reduce the annual cost of damage as a result of flooding by over £2 billion. To that extent, therefore, the annual investment by operating authorities of some £400 million on flood defences, more than half of which is managed by the Agency, represents good value for money. However, even before the floods in late 2000, there was pressure to build more defences, to maintain existing defences in good condition, to take more account of environmental issues and of the changes which can occur in flood risk areas as a result of new development. We suggest there are a number of areas, such as strategic planning of flood protection, benchmarking and economic appraisal of maintenance, where more progress is needed to enhance the effective allocation of resources in the longer term.

12 The condition survey of the Agency's flood defences completed in October 2000 showed significant variations across regions. In the North East region, for example, some 85 per cent of linear barriers were assessed as fair, poor or very poor, and the Midlands and South West regions had around 54 per cent of their linear defences in these categories. These contrast with the North West and Thames regions which had, respectively, 84 per cent and 74 per cent of their linear defences assessed as in good or very good condition. The number of structures categorised as fair, poor or very poor ranged from 18 per cent in the North West region to 50 per cent in the Southern region. The Agency sees this as the result of different policies and practices from individual flood defence

Chinook transport helicopter dropping sandbags - photo courtesy of the British Army

committees, the cumulative effect of local funding decisions by them, and the availability of grant-aid. Agency staff offer advice to Flood Defence Committees but they may or may not accept such advice. Work by the Agency to analyse the results of a similar survey of flood defence assets built and maintained by other public bodies must be completed urgently so that remedial action can be identified and prioritised.

Our specific recommendations

On flood warning

13 The Ministry estimates that eight per cent (around 10,000 square kilometres) of land area in England is at risk from flooding from rivers, tidal rivers and estuaries. The Agency has in recent years made progress in preparing priority area flood risk maps to assist local planning authorities but of the 821 maps in its programme only 200 had been produced at June 2000, with 376 in progress and a further 245 not started. The original programme commenced in 1995. The Agency also seeks to provide map based information on indicative flood risk which is intended to inform the emergency services, via local authorities, and the public, about areas at risk. These two sets of maps have now been merged and made available on CD-ROMs and the Agency's website. It is not clear whether all users fully understand the purpose and contents of these maps, or are satisfied with their quality (paragraphs 2.4-2.14). We recommend:

- The Agency and the Ministry should work with the Department of the Environment, Transport and the Regions, and the Local Government Association to develop a strategy for the way ahead for priority area information on the maps. This is necessary to ensure that the appropriate information is available to local authorities in applying new guidance on building development in areas at risk, which is being revised in early 2001.
- In the light of this, the Agency should review progress by its regional offices in producing this information, and set targets for its completion. For example, in Southern Region - one of the first areas to be hard hit by flooding in late 2000 - only one out of the 40 maps planned had been completed.
- The Agency should establish a programme for consulting all groups of users of the maps to ensure their purpose is clearly understood and the maps are meeting their intended purposes. The feedback obtained can be used to improve any maps still to be produced, and be taken into account when existing maps are due for revision.
- The preparation and maintenance of maps is expensive, and has been largely funded through local authorities by Regional Flood Defence Committees. It would seem appropriate for developers and other beneficiaries of the maps to contribute towards their cost, especially when such users require more information on the risk of flooding in specific locations. The Agency has suggested that in certain circumstances the onus should be on developers to provide detailed assessments of risk.

14 Since Easter 1998 when flooding in England revealed scope for improvement, the Agency has made significant progress in developing a strategy for flood warning, in establishing a national centre to identify and promote best practice, and in developing the techniques for disseminating flood warnings. The most effective warning mechanism can vary depending on, for example, the extent of urbanisation and the time of day when flooding is imminent. The Agency aims to provide one direct and one indirect method of disseminating flood warnings to the areas for which it offers a service. Less than five per cent of the 1.5 million properties at specific risk are connected to automated voice messaging, which provides one method of direct warning via telephone or fax when flooding may occur. The highest percentage, 16.4, is in Southern region where the service was

piloted and was used extensively during floods in October 2000. This compares with only 1.3 per cent in the North East. Other direct methods include the use of locally recruited flood wardens. Sirens and vans with loudhailers can augment radio and television bulletins and have benefits too as indirect methods (paragraphs 2.15 to 2.26). We recommend:

- The Agency, through the flood defence committees, should examine the reasons for the variations between regions in the number of properties in areas at risk which have access to different direct warning methods, especially automated voice messaging. They should consider the effectiveness of the methods and whether a consistent service exists across the country. Experiences from the floods in late 2000 may prove useful in this respect.

15 The reasons for current classifications of watercourses as main rivers or ordinary watercourses are largely historical. For example, the North West region has the second highest length of watercourses classified as main river after Anglian region, although it is one of the smaller regions in terms of size and properties at risk. The designation of a stretch of water can have important implications for the level of flood warning and defence services, and existing classifications may lead to inconsistencies in the standard of service provided (paragraphs 2.27 to 2.35). We recommend:

- The Agency should consider, in conjunction with other operating bodies, whether clearer principles for classifying watercourses are needed to provide a more balanced approach to service provision across regions. The Ministry would also need to be involved in setting a framework for consideration of these issues.
- The incidents of flooding in October and November 2000 should be examined to determine whether the lack of clear criteria for classifying watercourses as main or ordinary impacts on the overall prioritisation of flood defence measures across the country, and on the quality of service to the public.

On building new defences

16 Guidance issued by the Ministry in 1993 stresses the importance of a strategic approach to planning river and water management, which considers the impact of building flood defences and the interrelationship between watercourses, land use and development by river catchment. The preparation of strategic river catchment plans would assist in balancing the differing interests of environmental groups, users of the land and others, and help create a more joined-up approach between relevant organisations at local and regional levels. However, progress towards comprehensive river catchment planning of this sort is a long-term commitment. In the four years of the Agency's existence, it has focused first on strategies for flood warning and coastal shorelines, in line with the Ministry's priorities. The first versions of these shoreline management plans are now in place. The flooding of late 2000 has reinforced the need for catchment planning (paragraphs 3.3 to 3.10). Additional funding announced by the Government in November includes provision for development of the methodology and piloting of catchment flood management plans. We recommend:

- The Agency should seek the agreement of flood defence committees to make progress with the proposed catchment flood management plans to improve the identification and prioritisation of the need for flood defences. Preparation of such plans requires joined-up working between those responsible for planning, building and maintaining defences. Consistent with its supervisory duty, the Agency should consult with them and establish a programme and timescales for its regional offices to develop these plans.

17 On a scheme by scheme basis the Ministry has established a system for prioritising projects to assist in effective allocation of the overall funds available. The Agency and the Ministry also use benefit:cost analysis to help them choose the most cost-effective option for providing flood defences, and they take account of environmental factors (paragraphs 3.11 to 3.17, Appendix 5). We recommend:

- The Ministry's follow up to its recent consultation exercise on the present scoring system for ranking individual projects should consider whether relative affluence or other local factors inappropriately influence prioritisation of projects.
- The benefit:cost appraisal process should be strengthened by reviews of outturn costs of all elements of the project after the project is complete. This would better inform the process of assessing likely costs at the initial and tendering stages of a scheme.

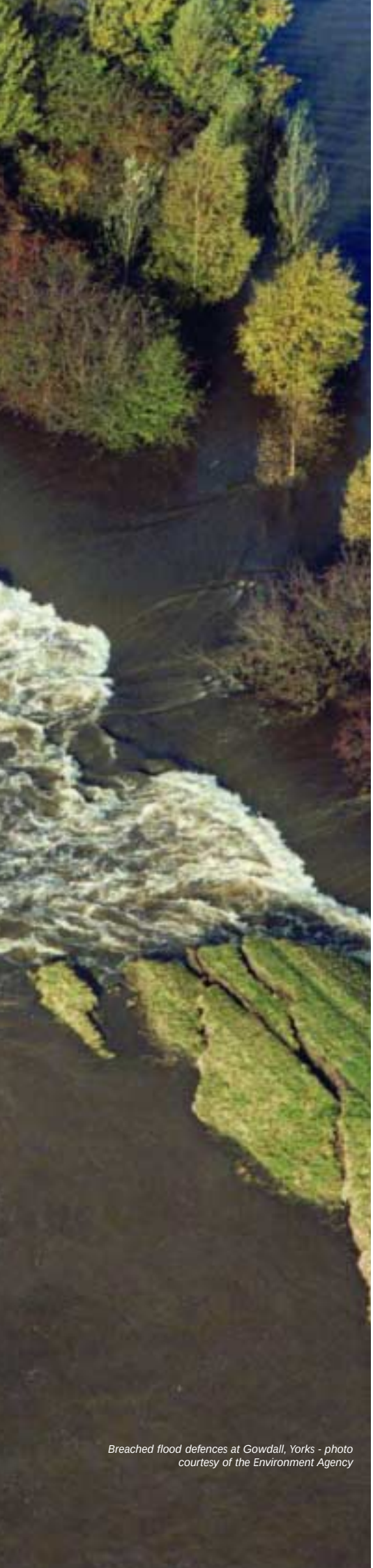
18 For the 168 new flood defence schemes between 1996 and 1999, for which we compared outturn costs with original contract price, the overall aggregate cost overruns were 7.6 per cent. However, larger projects were the most likely to overrun and by a significant amount (13 per cent on schemes over £500,000). Unforeseen ground conditions and extra works identified by the contractor were the most common contributing factors in cost overruns in the past. This suggested to us that scheme design could be improved, for example, by more thorough site investigation procedures. The Agency has adopted a new policy for the amount invested in such investigations, based on an assessment of risk and experience from past projects. The Agency has also modernised its approach to managing the risks involved in construction contracts, in line with construction industry initiatives and best practice, for example by the use of target cost contracts and arrangements for sharing risk with contractors. The Agency monitors the performance of all construction contracts by benchmarking and the use of performance indicators measuring the delivery of projects to time, cost and quality criteria (paragraphs 3.18 to 3.25). We recommend:

- The Agency should monitor the application and impact of its recent initiatives, to ensure best practice in procurement and project management is applied across its regions, and to disseminate lessons from reviews of completed schemes to help ensure the best use of resources.

On the performance and maintenance of defences

19 The quality of flood defences is difficult to assess as they protect against the risk of relatively severe and unusual weather conditions. Many will not have been tested by the extent of flooding they were designed to withstand or reduce. Post-incident reviews of lesser events demonstrate that defences stand up to their tasks and that flooding is most often the result of extreme events rather than failures in defences. Events in late 2000 have highlighted that defences generally reduce rather than eliminate extreme flooding, which reinforces the importance of public awareness of living in areas of risk. Until 2000, there had been no national record of individual incidents of flooding. Since floods in Summer 2000 in the North East of England, the format and content of the lessons learned report prepared for those incidents have been adopted as the best practice standard for use by all Regions. These reports will now be shared nationally via the Regional Flood Defence Managers Group (paragraphs 4.2 to 4.9). We recommend:

- The Agency needed to collect more information nationally on the success of schemes in coping with lesser flood incidents. The reports for this purpose introduced in 2000 should be used to help in evaluating the effectiveness of flood defences and to ensure that lessons arising and good practice are disseminated across the Agency's regions and also to other operating bodies such as local authorities.



Breached flood defences at Gowdall, Yorks - photo courtesy of the Environment Agency

20 The Agency has been carrying out visual surveys on the condition of flood defences, in part to indicate where maintenance work, and in some cases capital work, is required. For the first time there will be a central record of the location and condition of all flood defences, whether the responsibility of the Agency or other operating authorities. The surveys of main river defences have revealed that the condition of around 40 per cent of the Agency's flood defence assets is fair, poor or very poor and giving cause for concern. The Agency has experienced difficulties in obtaining the assistance of up to 135 local authorities in completing surveys of non-main river defences. 27 of these were assessed by the Agency as having significant lengths of critical ordinary watercourses in their area (paragraphs 4.10 to 4.17). We recommend:

- The Agency's regional maintenance and capital programmes submitted to flood defence committees for approval are being reviewed to take account of the results of the surveys of Agency assets. Where defences are still intended to serve some useful purpose, work should be put in hand on those 400 structures and 165 kilometres of flood defences which have completely failed.
- The analysis of the condition ratings for other flood authorities' assets should be completed quickly, particularly in view of the severe flooding in late 2000 and of the results from the survey of the Agency's own flood defences. Additionally, the Agency should confirm the accuracy of its own condition survey in those cases where defences were tested in the recent flooding.
- The Agency should monitor centrally progress by its regions, flood defence committees and by local authorities and other operating bodies. The aim would be to encourage the undertaking of appropriate action, maintenance and other works with the prospect in the long term of appropriate and more broadly consistent standards of flood protection across the country, taking account of economic benefits.
- Variations between regions in the condition of assets should be investigated by the Agency, with a view to establishing whether the criteria for assessment have been applied consistently, and ultimately with the aim of developing a strategy with local authorities and others for improving the condition of defences in the poorer rated regions.

21 The Agency employs a workforce of 1,570 across England to provide an emergency response to flood events. As flood emergencies occur infrequently, the Agency seeks to employ these staff throughout the year on its maintenance programmes. Reviews commissioned by the Agency suggest that the in-house workforce provides an effective emergency response and carries out a high standard of maintenance work (paragraphs 4.18 to 4.35). We recommend:

- The Agency should monitor the proportion of time spent by its in-house staff on emergency response across areas and over time. Such data might assist the Agency in confirming whether the need for resources is matched to maintenance requirements and whether there is scope for more efficient use of resources.
- In one region where maintenance or other work was insufficient to keep the in-house staff usefully employed, they were awarded, without competition, a contract to build a new defence estimated to cost £1.2 million. The cost of the work overran by 74 per cent. The Agency has assessed the lessons arising from this contract and is implementing a new approach across the regions. The Agency should ensure full compliance with this new policy and approach.

- The Agency should consider establishing common standards and best practice in maintenance to be applied across regions and seek the agreement of flood defence committees to these. It should consider the need for closer monitoring by its regional offices and headquarters to ensure maintenance is efficient and targeted to the standards of service required.

Flooding in late 2000: and the way forward

22 Prior to flood events of late 2000 the Agency had asked us to indicate whether future actions we identified in our report were of primary or secondary significance. Relative priorities and resource implications are mainly matters for those responsible for delivering services and for their customers. In the case of flood defences, the Agency has to secure approval from flood defence committees to provide funding and agree priorities. Priorities will also depend on the outcome of the reviews by the Agency and others of funding and organisational matters already underway in 2000 and the review of lessons from the flooding in late 2000. Of our main findings listed above, we regard the following as high priority, although it will be for flood defence committees, with the advice of the Agency, to determine the speed of progress.

- The development of strategic plans for all river catchments is of pressing importance. Whilst these will take several years to complete, the setting and agreement of targets for the Agency's regions to produce such plans and the close monitoring of progress is a priority. These plans are fundamental to the long-term upgrading of flood defences to take account of local conditions, existing risks and defences, and the impact of changes in sea level, climate and rainfall.
- The Agency's mapping of areas at risk to meet local planning authority needs has been underway for some years now. The recent floods have raised concerns that further or inappropriate development in flood plains will lead to more frequent and extensive flooding. In view of this, and new guidance to local authorities on this matter which is to be issued in early 2001, completing and modifying these maps must be a high priority.
- Urgent action is needed in response to the condition surveys of flood defences. Until the need for remedial work is clarified and advice given to local authorities and others in respect of their assets, defences in areas of risk may not provide the level of safety the Agency and residents believe. Monitoring progress in improving the condition of defences, whether belonging to the Agency, a local authority or an Internal Drainage Board, will be a priority for the Agency.
- During the course of our work, the Agency had already started work on benchmarking and economic evaluation of maintenance. This too is important because of its contribution to the quality of flood defences and the possible scope for identifying savings and releasing resources for other flood defence work.