

# Planning Policy Guidance 25: Development and flood risk

## Contents

<b>Foreword</b> .....	<b>2</b>
<b>Introduction</b> .....	<b>3</b>
<b>Purpose And Scope Of The Guidance</b> .....	<b>4</b>
<b>Sustainable Development And The Precautionary Principle</b> .....	<b>6</b>
<b>Responsibilities Of The Parties In The Development Process</b> .....	<b>8</b>
<b>Flooding And Land-Use Planning - General Considerations</b> .....	<b>10</b>
<b>Regional Planning And Development Plans</b> .....	<b>18</b>
<b>Development Control</b> .....	<b>22</b>
<b>Further Information And Advice</b> .....	<b>27</b>
<b>Conclusion</b> .....	<b>28</b>
<b>Appendix A - Causes Of Flooding And The Impacts Of Climate Change</b> .....	<b>29</b>
<b>Appendix B - Some Relevant Publications On Development And Flood Risk</b> .....	<b>32</b>
<b>Appendix C - Some Relevant Statutory And Non-Statutory Plans</b> .....	<b>36</b>
<b>Appendix D - Role Of The Environment Agency And Other Operating Authorities</b>	<b>40</b>
<b>Appendix E - Sustainable Drainage Systems</b> .....	<b>43</b>
<b>Appendix F - Guidance On Requirements For Undertaking A Flood Risk Assessment</b>	<b>46</b>
<b>Appendix G - Warning Notices/Signs At Caravan And Camping Sites And Other Developments At Risk Of Flooding</b> .....	<b>48</b>

## Foreword

This guidance explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and loss of life. It sets out the importance the Government attaches to the management and reduction of flood risk in the land-use planning process, to acting on a precautionary basis and to taking account of climate change. It summarises the responsibilities of various parties in the development process. The planning system should ensure that new development is safe and not exposed unnecessarily to flooding by considering flood risk on a catchment-wide basis and, where necessary, across administrative boundaries. It should seek where possible to reduce and certainly not to increase flood risk. It should help ensure that flood plains are used for their natural purposes, continue to function effectively and are protected from inappropriate development. The guidance also outlines how flood risk issues should be addressed in regional planning guidance, development plans and in the consideration of planning applications.

This guidance applies to England and replaces Department of the Environment Circular 30/92 (MAFF Circular FD1/92), which is hereby cancelled.

This guidance states that:

- the susceptibility of land to flooding is a material planning consideration;
- the Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;
- policies in development plans should outline the consideration which will be given to flood issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change;
- planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- planning authorities should recognise the importance of functional flood plains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended flood plains
- developers should fund the provision and maintenance of flood defences that are required because of the development; and
- planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not be restricted to flood plains.

## **Introduction**

**1.** Flooding from rivers and coastal waters is a natural process that plays an important role in shaping the natural environment. The damage that results to people and property is a consequence of previous human decisions about the location and nature of settlement and land use. Such damage cannot be prevented entirely, although its effects can be reduced. The causes of flooding and the potential future impacts of climate change are briefly described in Appendix A. Flooding can cause substantial damage to property and threaten human life. For example, the Easter 1998 floods caused 5 deaths, £400M damage and resulted in 1,500 people being evacuated from their homes. Damage caused by the autumn/winter 2000 floods has not yet been fully assessed but approaching 10,000 properties were flooded.

**2.** The Government's policy is to reduce the risks to people and the developed and natural environment from flooding. It therefore looks to local planning authorities to ensure that flood risk is properly taken into account in the planning of developments to reduce the risk of flooding and the damage which floods cause. This guidance sets out the Government's policy on the positive role of land-use planning in achieving these aims and the lead responsibilities of local planning authorities and other bodies. It provides guidance to planning authorities, developers, the public and the Environment Agency on a wide range of planning and other measures so that decisions on plans and applications in areas of both existing and future development take full account of flood risk, whether inland or on the coast.

**3.** Approximately 10,000km<sup>2</sup> (or 8% of the total area) of land in England is at risk from river flooding, including tidal rivers and estuaries. Approximately 30% of the coastline is developed and some 2,500km<sup>2</sup> of land (1.5% of the total area) is at risk of direct flooding by the sea. As a result, about 1.7 million homes and 130,000 commercial properties worth over £200 billion and 1.3M Ha of agricultural land worth about £7 billion are at risk from flooding. This equates to about 10% of the population and 12% of the agricultural land, including 61% of Grade 1 agricultural land.

**4.** The experience of recent years suggests that the incidence of problems due to river flooding may be getting worse, both in frequency and in scale. This arises from changes in river hydrology due to human activity, changes in land management, variations in the intensity of rainfall and the increase in development in areas at risk. In addition, climate change is expected to increase the risk of both coastal and river flooding as a result of sea-level rise and more intense rainfall. On both a national and global scale, it is already the case that damage from flooding is greater than that from any other natural disaster. Local authorities should bear these considerations in mind in framing their planning policies and in determining applications for planning permission.

**5.** At present there are gaps in our understanding of how the changing climate will affect the areas currently at risk of flooding. Although climate change is expected to increase risk significantly over time, there is a lack of quantified and robust information available to be more specific. To address this, the Government intends to undertake further work to assess the additional risk and its implications for developments in areas at risk of flooding. It will review this guidance 3 years after publication in the light of further evidence then available on climate change and emerging experience of its implementation and effectiveness. Until further advice on climate change becomes available, planning authorities and the Environment Agency should take account of the potential effects reported by the UK Climate Impacts Programme (See Appendix B for some references to information on climate change).

## Purpose And Scope Of The Guidance

6. This guidance applies to England. It aims to strengthen the co-ordination between land-use and development planning and the operational delivery of flood and coastal defence strategy. It also aims to strengthen the links between land-use planning, land management and the Building Regulations. It replaces the guidance previously given in the joint Department of the Environment/Ministry of Agriculture, Fisheries and Food Circular *Development and flood risk* (DOE Circular 30/92; MAFF Circular FD 1/92), which is hereby cancelled. It takes account of legislative and policy developments since 1992 and of the reports (1998) of the *Independent review of the Easter 1998 floods*<sup>1</sup> and of the Agriculture Select Committee on *Flood and coastal defence*, and of the Environment, Transport and Regional Affairs Committee on *Development on, or affecting, the flood plain*, published on 20 December 2000. It covers flood risks arising from both river and coastal flooding and from additional run-off from development in any location.

7. Local planning authorities should use their existing powers to guide, regulate and control development in accordance with the guidance set out below and, in particular, the sequential test in paragraph 30. They should consider the issues raised by flooding on the wider scale (of the river catchment<sup>2</sup> and the coastal cell<sup>3</sup>) and the need to work with natural processes in planning future development. This is consistent with the requirements of the EC Water Framework Directive in respect of river basin management plans. They should also consider how a changing climate is expected to affect the risk of flooding over the lifetime of developments. This will vary depending on the type of development. The complex range of issues involved requires a concerted effort to co-ordinate the activities of local authorities across their boundaries and with other agencies and to integrate policies in the various non-statutory plans that operate within coastal and flood-prone areas<sup>4</sup>.

8. Reducing the vulnerability of the country to the dangers and damage caused by unmanaged floods contributes to the achievement of a better quality of life and the objectives of sustainable development. Local planning authorities should, therefore, address the problems which flooding can cause by:

- recognising that the susceptibility of land to flooding is a material planning consideration;
- giving appropriate weight to information on flood-risk and how it might be affected by climate change in preparing development plans and considering individual proposals for development;
- consulting the Environment Agency, which has the lead role in providing advice on flood issues at a strategic level and in relation to planning applications, and other relevant organisations;
- applying the precautionary principle to decision-making so that risk is avoided where possible and managed elsewhere;
- improving the information available to the public about the risks of locating human activities in areas susceptible to flooding;

---

<sup>1</sup> References to all reports mentioned in the text are contained in Appendix B

<sup>2</sup> A river catchment is the total area that is drained by that river, including areas away from the watercourse network.

<sup>3</sup> A coastal cell is a subdivision of the coast based on the movement of coarse sediments from source through areas of transport to areas of deposition.

<sup>4</sup> Details on the range of plans are in Appendix C.

- taking into account the responsibility of owners for safeguarding their own property as far as is reasonably practicable;
- recognising that flood plains<sup>5</sup> and washlands<sup>6</sup> have a natural role as a form of flood defence as well as providing important wildlife habitats and adding to landscape value; and
- recognising that engineered flood reduction measures may not always be the appropriate solution, since they can have economic and environmental costs and impacts on the natural and built environment, need maintenance and replacement and cannot eliminate all risk of flooding.

---

<sup>5</sup> All land adjacent to a watercourse, as defined in the Land Drainage Act 1991, or the coast over which water flows in time of flood or would flow but for the presence of flood defences where they exist.

<sup>6</sup> Area of flood plain where water is stored in time of flood. Such an area may have its effectiveness enhanced by the provision of structures to control the amount of water stored and the timing of its release to alleviate peak flood flows downstream.

## **Sustainable Development And The Precautionary Principle**

**9.** Historically, development has taken place in both river and coastal flood plains. The advantages of flat, fertile land, which is easily developed and managed and close to transportation routes/river crossings have outweighed the disadvantages of intermittent flooding. However, the growth of built development within flood plains over the centuries has increasingly required engineering works to defend properties against the risk of flooding. The currently projected increase in the number of households in parts of England is likely to lead to increased pressure to build in areas at risk of flooding. Flood risk is clearly identified in PPG 3 *Housing* (paragraph 31) as a specific material consideration in the allocation and release of sites for new housing. It should also be recognised that climate change is expected to increase flood risk and some existing development in more exposed locations may not be sustainable in the longer term and may need to be replaced in safer locations. Local planning authorities should consider ways in which the planning system might be used positively to help tackle the legacy of past development in unsustainable locations, although the Government recognises that this will usually be a longer-term process than the other action recommended in this guidance note.

**10.** Flood risk involves both the statistical probability of a flood occurring and the scale of the potential consequences. The impacts vary in their nature, scale and extent. Development constructed without regard to flood risk can endanger life, damage property and require wasteful expenditure on remedial works. While flood defence works can reduce the risk of flooding, they cannot eliminate it. For example, a flood bank designed to contain a particular level of flood will be overtopped by one that is more severe. Flood risk is also expected to increase over time as a result of climate change. It is important that those who plan and occupy development in flood risk areas are aware of the remaining risk, despite the presence of flood defences, and the steps that they should take in the event of a flood. Local authorities and owners and occupiers of premises in flood-risk areas should consult the Environment Agency, the emergency services and other relevant agencies in drawing up their emergency plans for dealing with flooding.

**11.** Continued construction of hard-engineered flood defences to protect development in areas exposed to frequent or extensive flooding may not be sustainable in the long term. Soft engineering techniques such as creating, preserving and enhancing natural flood meadows and washlands or salt marshes and mud flats can be of great value in attenuating flooding as well as contributing to biodiversity. A sustainable approach to flood risk will involve avoiding additional development in some areas. Where this is not possible, development needs to be of a design and with an appropriate level of protection to ensure that the risk of damage from flooding is minimised, while not increasing the risk of flooding elsewhere.

**12.** The threat of flooding needs to be managed in an environmentally sensitive way. Flooding is part of the natural cycle of events that helps to sustain biodiversity. In extreme circumstances, however, and sometimes when human activity has worsened its impact, flooding can destroy ecosystems and habitats, wash away soil and destroy the buildings and infrastructure on which the economy and society are dependent. Potential damage from flooding is both uncertain and unpredictable but it can be significant and, in the case of soil loss, potentially irreversible. Because of this the Government considers that the objectives of sustainable development require that action through the planning system to manage development and flood risk should be based on the precautionary principle.

*The precautionary principle*

**13.** "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." This precautionary principle, stated in the Rio Declaration in 1992, is particularly relevant to dealing with the hazard of flooding. Its application acknowledges the uncertainty inherent in flood estimation and, by proceeding from the known facts and taking a precautionary approach to uncertainties, enables more open and better-informed decisions to be made. This can reduce the environmental impact and improve the safety of people and property, despite the existence of risk that may change with time. For example, shoreline management plans aim to identify sustainable approaches to reducing risks over the next 50 years, as well as looking at the longer-term implications. Similarly, guidance on project appraisal for flood and coastal defence includes allowances for sea-level rise and recommendations for sensitivity testing in the design of river defences. In accordance with the precautionary principle, local planning authorities should, therefore, follow the sequential approach set out in paragraph 30 and Table 1. When preparing development plans and considering applications for planning permission, they should consult and take into account advice from the Environment Agency, which should incorporate the latest information on climate change.

**14.** The Government's strategy for sustainable development makes it necessary to consider the forms of development that would be inappropriate in areas of flood risk. While there remain uncertainties, the importance of acting on a precautionary basis in relation to development and flood risk has increased in recent years by:

- the growth in knowledge of the likely impacts of climate change and their effect on flood risk over time;
- more sustainable alternatives to conventional drainage systems, which can assist in reducing downstream flooding;
- advances in management planning in relation to both river catchments and coastal cells.

## Responsibilities Of The Parties In The Development Process

**15.** The primary responsibility for safeguarding land and other property against natural hazards such as flooding remains with the owner. There is no statutory duty on the Government to protect land or property against flooding but it has recognised the need for action to be taken to safeguard the wider social and economic well-being of the country. Operating authorities<sup>7</sup> have permissive powers but not a duty to carry out flood defence works in the public interest (Further details on the role of operating authorities and the Environment Agency are given in Appendix D). Individual property owners are also responsible for managing the drainage of their land in such a way as to prevent, as far as is reasonably practicable, adverse impacts on neighbouring land.

**16.** Government policy for flood and coastal defence is set out in the Ministry for Agriculture Fisheries and Food (MAFF) *Strategy for flood and coastal defence* (1993). This aims to reduce the risks to people and the developed and natural environment from flooding by:

- encouraging the provision of adequate and cost-effective flood warning systems;
- encouraging the provision of adequate and technically, environmentally and economically sound and sustainable flood defence measures; and
- discouraging inappropriate development in areas at risk from flooding.

**17.** The Department for Environment, Food and Rural Affairs (DEFRA, formerly MAFF) provides national strategic guidance and specialist help, supported by a comprehensive DEFRA/Environment Agency research and development programme. It contributes significantly to the funding of defence measures. Individual flood and coastal defences are designed, constructed and maintained by operating authorities. The then MAFF introduced in 1999 a series of high-level targets for flood and coastal defence to provide a framework for ensuring and demonstrating delivery of the stated policy aims and objectives. Target 12 requires the Environment Agency, in partnership with local planning authorities to report annually to MAFF (now DEFRA) and DETR on:

- local authority development plans on which the Agency have commented, identifying plans which do, and do not, have flood risk statements or policies; and
- the Agency's response to planning applications, identifying cases where the Agency sustained objections on flood risk grounds and final decisions, by the local planning authority or on appeal, were in line with or contrary to Agency advice.

These reports will be summarised in the Environment Agency's Annual Report and made available to interested parties on request. They will be used by Government in monitoring the implementation and effectiveness of the policies contained in this PPG and the achievement of the Government's objectives for flood and coastal defence. They will provide the basis for determining whether any further legislation might be required.

**18.** The Environment Agency has a supervisory duty for all matters relating to flood defence. It is the principal operating authority, with responsibility for main rivers<sup>8</sup> and sea defence. It has the

---

<sup>7</sup> An operating authority is the Environment Agency, Internal Drainage Board, Local Authority, or any other body having power to make or maintain works for the drainage of land.

<sup>8</sup> Watercourses designated as such on main river maps.

lead role for managing the dissemination of flood warnings. Under Section 105 of the Water Resources Act 1991, the Agency has a duty to survey matters relating to flooding, including the identification of areas where flood defence problems are likely. Section 105 surveys should help to identify the extent of flood plains, washlands and other land liable to flood. As part of its pollution control duties, the Agency is also responsible for drainage consents from premises under Part II of the Environmental Protection Act 1990.

**19.** Local authorities are the operating authorities for ordinary watercourses<sup>9</sup>, except in internal drainage districts<sup>10</sup>, where the powers rest with Internal Drainage Boards (IDBs). Local planning authorities are responsible for preparing development plans and controlling development, principally in relation to location and amenity, both in the flood plain, where it may be directly affected by flooding or affect flooding elsewhere, and elsewhere in river catchments, where changes in run-off characteristics may increase flooding downstream. Together with approved inspectors, local authorities are responsible for administering the Building Regulations 2000, which set out requirements for the functional design of and drainage from buildings. Highways authorities are responsible for road drainage. The private-sector sewerage undertakers are generally responsible for surface-water drainage from development, where this is via adopted sewers.

**20.** Within this administrative context, those proposing particular developments are responsible for:

- providing an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and of the measures proposed to deal with these effects and risks; and
- satisfying the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect, to ensure that the site can be developed and occupied safely.

It is in the developers interests to deal with these matters, since they may well affect the value of land and the cost of developing it. It is then for the local planning authority, advised as necessary by the Environment Agency and other relevant organisations, to determine an application for planning permission taking account of all material considerations, including the issue of flood risk and how it might be managed or mitigated.

---

<sup>9</sup> All those watercourses not designated as main river.

<sup>10</sup> Statutory areas of lowland Britain with special drainage needs.

## **Flooding And Land-Use Planning - General Considerations**

21. Flood issues have long been recognised as being material planning considerations and this has been reflected in successive Departmental Circulars. However, in view of the apparently increased frequency and severity of river flooding in recent years, particularly since 1998, the Government is looking for a step-change in the responsiveness of the land-use planning system to the issues of flood-risk management as they affect the development process. This guidance reflects the importance the Government attaches to these issues. Local planning authorities should carry through that priority into the preparation and review of development plans at all levels and into the process of development control. The Government recognises and welcomes the fact that many authorities are already responding in this way but it expects all planning authorities to give the matter early and serious attention, regardless of whether their areas have experienced major flooding in recent years.

22. In particular, as part of its strategy for sustainable development, the Government wishes to avoid an unnecessary increase in the requirement to provide artificial defence against flooding. Local planning authorities should, therefore, consider the information available on the nature of flood risk and its potential consequences and accord it appropriate weight in the preparation of development plans and in determining applications for planning permission and attaching conditions where permission is granted. They should apply the sequential approach in paragraph 30 and Table 1 to their plan-making and development control functions.

### **The functional flood plain**

23. Flood plains are generally flat-lying areas adjacent to a watercourse, tidal lengths of a river or the sea where water flows in times of flood or would flow but for the presence of flood defences where they exist. Functional flood plains are the unobstructed or active areas where water regularly flows in time of flood. Areas of flood plain that are defended are passive until such time as a flood greater than that for which the defences were designed occurs. In these functional flood plains, the Government considers that built development should be wholly exceptional and limited to essential transport and utilities infrastructure that has to be there. Such infrastructure should be designed and constructed so as to remain operational even at times of flood, to result in no net loss of flood-plain storage, not to impede water flows and not to increase flood risk elsewhere. Local planning authorities should give due weight to the need to avoid adding to the risk of flooding or restricting the ability of an operating authority to construct, operate and maintain flood control works.

### **Flood-plain maps**

24. The Environment Agency's *Policy and practice for the protection of flood plains* (1997) aims to assist local authorities in their control of development. The Agency has provided flood plain maps to all local authorities and, in December 2000, made them available on the Internet (Figure 1). The limits of the flood plain shown are indicative of the area, which could be affected by flood events, overtopping or breaching of flood defence structures. They are based on the approximate extent of floods with a 1% annual probability of occurrence for rivers and a 0.5% annual probability of occurrence for coastal areas under present expectations or, where this is greater, the extent of the highest known flood. Where a flood defence exists that protects to a higher standard than those defined, the flood plain is the area that is defended to that standard. However, these maps do not differentiate between defended and undefended areas or take account of the likelihood that flood risk will be increased by climate change. It is important to recognise that a 1% flood has a 26% probability of being equalled or exceeded at least once in 30 years (the duration of a typical

mortgage) and a 49% probability of being equalled or exceeded at least once in 70 years (a typical human lifetime). The maps represent the best available current information on the extent of flood risk. They will be revised and updated over time. However, it should be noted that these maps are indicative only, to be used as a basis for consultation and not as the sole basis for decisions on where planning policies apply. Authorities and others involved in the planning process should ensure that they are using the latest available version.

**25.** In addition to the indicative maps referred to in paragraph 24, a national programme was adopted by the Agency in 1996 for the collection of data and preparation of maps for priority areas, ie areas at risk of flooding where building development is proposed or is likely to occur. Where available, these will provide more precise information in those priority areas, although local planning authorities should be aware of the realistic limits to accuracy and precision in all predictions of flood events. Such assessments do not absolve local planning authorities and developers from making their own assessments of risk when proposing sites for development but should provide additional information when considering such proposals.

**26.** By 2002, the Environment Agency aims to indicate for most areas of England an outer flood area showing the likely extent of extreme floods (probably of 0.1% annual probability or less). Outside these areas, major flooding due to watercourses can be effectively discounted but local authorities and developers should recognise that intense rainfall may still cause localised flooding almost anywhere due to surface flow exceeding the capacity of the existing drainage system.

### **Risk-based approach and the sequential test**

**27.** Local planning authorities should adopt a risk-based approach to proposals for development in or affecting flood-risk areas. The assessment of risk should take account of:

- the area liable to flooding;
- the probability of it occurring, both now and over time;
- the extent and standard of existing flood defences and their effectiveness over time;
- the likely depth of flooding;
- the rates of flow likely to be involved;
- the likelihood of impacts to other areas, properties and habitats;
- the effects of climate change; and
- the nature and currently expected lifetime of the development proposed and the extent to which it is designed to deal with flood risk

**28.** For example, there could be areas with a moderately high probability of flooding where, because of the topography, any flood waters would rise only slowly and be relatively shallow and slow flowing. In such cases, provided they do not impede flood flows or reduce flood storage capacity, mitigation measures might be relatively straightforward, and of moderate financial and environmental cost. Raising floor levels (while ensuring that appropriate access is maintained for disabled people) or other simple design features, such as keeping electrical circuits above levels likely to be affected by flooding, can enable buildings to resist and cope with flooding better and, when flooded, recover faster. The Department is currently preparing supplementary design guidance on flood-resistant construction techniques. In other areas, such as behind sea walls or in steep river catchments, the risk to life is higher because flooding may develop swiftly and be fast-

flowing. Mitigation in such cases is likely to be both more difficult and more expensive and flood-resistant construction techniques alone are unlikely to provide a satisfactory solution.

**29.** Because of such local variability and uncertainties, it is difficult to be prescriptive about the levels of risk. It has to be recognised that there is a continuum from virtually no to high risk. As noted above, all parts of the country could, because of local topography, contain areas subject to flash flooding at times of intense prolonged rainfall, which can only be identified locally. However, MAFF (now DEFRA) *Flood and coastal defence project appraisal guidance* (1999) gives indicative standards of protection for existing development against river flooding of 0.5-2.0% annual probability of failure for typically intensively developed urban areas and 1-4% for less intensive urban areas (ie they defend against a flood with that probability of occurring). For coastal and tidal flooding the relevant indicative standards are 0.3-1.0% and 0.5-2.0% respectively. It is, therefore, reasonable on present evidence to regard areas with an annual probability of river flooding of 1% or above or with an annual probability of coastal or tidal flooding of 0.5% or above to be zoned as at significant risk of flooding. An outer zone for extreme flooding can be defined arbitrarily by an annual probability of flooding of 0.1%. The appropriateness of these general standards will be reviewed in the light of experience in future revisions of this guidance. Meanwhile, local planning authorities should have regard to them in drawing up policies in development plans and in their development control decisions, alongside any more specific information obtained from other sources, including the Environment Agency.

**30.** The Government expects local planning authorities to apply a risk-based approach to the preparation of development plans and their decisions on development control through a sequential test. Developers seeking sites for housing and other development should also have regard to this test. Accordingly, in drawing up or revising policies in development plans and in considering applications for development in cases where plans do not yet reflect the following, local planning authorities should give priority in allocating or permitting sites for development, in descending order to the flood zones set out in Table 1, including the sub-divisions in Zone 3. When allocating land in development plans or deciding applications for development at any particular location, those responsible for the decision would be expected to demonstrate that there are no reasonable options available in a lower-risk category, consistent with other sustainable development objectives. It is important to note also that these zones cover only river, tidal and coastal flooding. Locally in all zones, an assessment may be needed of the risk of groundwater flooding or local flooding due to overland sheet flow or run-off exceeding the capacity of drainage systems during prolonged or intense rainfall. Flood-resistant construction may be required in all areas, depending on the results of that assessment. The run-off implications of development should also be assessed for all zones and controlled, where possible, through the use of sustainable drainage systems.

**Figure 1:** Indicative flood plain map of England (after Environment Agency, 2000)

**Table 1: Planning response to sequential characterisation of flood risk**

Flood Zone (see Note a)	Appropriate Planning Response
<b>1. Little or no risk</b> Annual probability of flooding: River, tidal & coastal <0.1%	No constraints due to river, tidal or coastal flooding.

<p><b>2. Low to medium risk</b> Annual probability of flooding: River 0.1-1.0% Tidal &amp; coastal 0.1-0.5%</p>	<p>Suitable for most development.</p> <p>For this and higher-risk zones, flood risk assessment appropriate to the scale and nature of the development and the risk should be provided with applications or at time of local plan allocation. Flood-resistant construction and suitable warning/evacuation procedures may be required depending on the flood risk assessment.</p> <p>Subject to operational requirements in terms of response times, these and the higher-risk zones below are generally not suitable for essential civil infrastructure, such as hospitals, fire stations, emergency depots etc. Where such infrastructure has to be, or is already, located in these areas, access must be guaranteed and they must be capable of remaining operational in times of emergency due to extreme flooding.</p>
<p><b>3. High risk</b> (see note b) Annual probability of flooding, with defences where they exist: River 1.0% or greater Tidal &amp; coastal 0.5% or greater</p>	<p><b>a. Developed areas</b> These areas may be suitable for residential, commercial and industrial development provided the appropriate minimum standard of flood defence (including suitable warning and evacuation procedures) can be maintained for the lifetime of the development (see paragraph 31 below), with preference being given to those areas already defended to that standard. In allocating or permitting sites for development, authorities should seek to avoid areas that will be needed, or have significant potential, for coastal managed realignment or washland creation as part of the overall flood defence strategy for coastal cells and river catchments.</p> <p><b>b. Undeveloped &amp; sparsely developed areas</b> These areas are generally not suitable for residential, commercial and industrial development unless a particular location is essential, eg for navigation and water-based recreation uses, agriculture and essential transport and utilities infrastructure, and an alternative lower-risk location is not available. General-purpose housing or other development comprising residential or institutional accommodation should not normally be permitted. Residential uses should be limited to job-related accommodation (eg caretakers and operational staff). Caravan and camping sites should generally not be located in these areas. Where, exceptionally, development is permitted, it should be provided with the appropriate minimum standard of flood defence and should not impede flood flows or result in a net loss of flood-plain storage.</p> <p><b>c. Functional flood plains</b> These areas may be suitable for some recreation, sport, amenity and conservation uses (provided adequate warning and evacuation procedures are in place). Built development should be wholly exceptional and limited to essential transport and utilities infrastructure that has to be there. Such infrastructure should be designed and constructed so as to remain operational even at times of flood, to result in no net loss of flood-plain storage, not to impede water flows and not to increase flood risk elsewhere. There should be a presumption against the provision of camping and caravan sites.</p>

Notes:

**(a)** All risks relate to the time at which a land allocation decision is made or an application submitted. The Environment Agency will publish maps of these flood zones. Flood zones should be identified from Agency flood data ignoring the presence of flood defences. Local planning authorities should, with the Agency, identify those areas currently protected by defences and the standard of protection provided by those defences.

**(b)** Development should not be permitted where existing sea or river defences, properly maintained, would not provide an acceptable standard of safety over the lifetime of the development, as such land would be extremely vulnerable should a flood defence embankment or sea wall be breached, in particular because of the speed of flooding in such circumstances (see paragraph 69 below).

**31.** In applying the sequential test, local planning authorities should consult and take the advice of the Environment Agency on the distribution of flood risk and the availability of flood defences in their areas. They should take account of the resulting level of actual risk in drawing up development plans and policies and considering proposals and applications for development. This test should also take into account the effects of flood risk on both local public transport availability and the surrounding road network serving any proposed development. Where extensive areas of land fall into the high-risk zones, further development may be needed to avoid social and economic stagnation or blight, or to allow existing development to be adequately protected. For example, in low-lying parts of eastern England, and in other areas there are large areas where alternative sites in lower-risk zones are not available. Authorities in such areas should pay particular attention to design and mitigation issues. Where, in the wider overall interest, permission is granted exceptionally for development within an undeveloped or sparsely developed flood plain, the threat of flooding should be managed to ensure that the development is and remains safe throughout its lifetime and does not increase flood risk elsewhere. Flood defences for most new housing development should be designed and constructed to protect against the flood with an annual probability of 1% for river flooding and 0.5% for coastal flooding for a period of 50 years, taking into account the allowances for climate change contained in the Project Appraisal Guidance for flood and coastal defence cited in Appendix A. Commercial and industrial development should aim to achieve the same minimum standard of defence. Where necessary, conditions should be attached to permissions and/or agreements used to secure these objectives.

**32.** The insurance industry has become increasingly concerned about environmental risks, including flooding, and the scale of claims to which they give rise. It is, therefore, continuing with reviewing its position in relation to flood risk, particularly following the floods of 2000. Before insurance is offered, some companies are using increasingly sophisticated techniques to identify the risk to specific properties. Developments at risk of flooding may increasingly face difficulties with the cost or availability of insurance and this, in turn, could cause problems for property buyers in obtaining mortgages. In extreme cases, properties might remain unsold, leading to blight on the whole development. Developers are advised, therefore, to seek the views of insurers at an early stage. For its own part, the insurance industry may wish to seek to reduce the risk exposure by making appropriate representations about proposals for the location of new development during the preparation of development plans. Authorities should consider consulting their own insurers to ensure that flood defence or other measures are adequate and are likely to satisfy the requirements of insurers.

**33.** Even in the highest-risk areas, some land uses such as amenity open space, habitat conservation measures or sports fields may be appropriate, provided that suitable arrangements can be made for

public safety and that these uses do not interfere with flood plain flows or compromise future shoreline or river management options. Similarly, the recreational and leisure use of water, including appropriate structures such as clubhouses, mooring basins and associated development as well as British Waterways operational depots and boat-related industries require a waterside location. As noted in Table 1, any ancillary residential accommodation should be limited to that which is operationally necessary and conditions should, where necessary, require that it is designed and managed with flood safety and evacuation considerations in mind. By their nature, mineral resources may occur in areas of flood risk because of their geological origin. Minerals extraction in such areas may provide potential benefits such as the provision of additional storage for flood water where this is feasible, would not increase the risk of flooding and is environmentally acceptable in all other respects. Particular attention will need to be given to the possible impacts of ancillary structures, including mineral stockpiles to ensure that they do not impede flood flows or reduce flood storage capacity. Further guidance on the effect of mineral workings on the water environment will be prepared as an Annex to the revised and expanded Mineral Planning Guidance Note 11 *Controlling the environmental effects of mineral workings*.

**34.** Civil emergency infrastructure such as hospitals, fire stations, police stations and emergency vehicle depots needs to be operational, including access, in all circumstances. Location in even low-risk areas subject to extreme events could lead to lack of availability should such an event occur. While some facilities, eg British Waterways operational depots, Environment Agency flood control installations or lifeboat stations, may inevitably need to be located in areas exposed to some risk, the need to preserve effective access and to protect these facilities and equipment from flooding must be taken into account in the siting and planning of new development. However, the Government recognises that much existing infrastructure is already located within areas at risk of flooding and that further development in such areas may also be needed to avoid adverse impacts on the speed of response to emergencies. In such cases, consideration should be given to whether existing flood protection and arrangements for access in times of flood need to be improved.

### **Previously developed land**

**35.** The Government places great emphasis on the need for urban regeneration and the redevelopment of previously developed land to minimise the need for development of green-field land. Because much past industrial development took place alongside rivers on suitable flat land, some previously developed land will be vulnerable to flooding. In making proposals for redevelopment of such land or the re-use of existing buildings and structures, local authorities should take account of the risks of flooding, the standards of existing flood defences and the ability to improve them. Any such redevelopment should avoid interference with flood plain flows or compromising future shoreline or river management options. Developers and local planning authorities should consider what types of new development would be appropriate to these circumstances. For example, a site may not be sufficiently well defended to make it suitable for housing over its full area, although it might still be possible to incorporate housing within a mixed-use scheme, utilising parts of a site at higher risk of flooding for open space or other recreational provision. Similarly, the upper levels of converted structures, eg in former port or warehouse areas, might be appropriate for housing with public areas and other uses at a lower level. A balanced flexible approach is required which addresses the risks of flooding whilst recognising the benefits of recycling previously developed land and the damage to urban regeneration caused by under-investment and urban blight. The acknowledged risks of flooding might be mitigated by confirmed good levels of protection, including protected access, prudent design of development and effective public warning mechanisms. Sites vulnerable to rapid inundation should defences be overtopped or breached are unlikely to be suitable for those of restricted mobility, whether in conventional, adapted or sheltered housing or in institutional accommodation.

**36.** Planning guidance on housing (PPG 3) already advises local planning authorities to take account of physical and environmental constraints on the development of land for housing, including flood risk. The principles in this guidance complement that advice. PPG 3 requires priority to be given to re-using previously developed land within urban areas, bringing empty homes back into use and converting existing buildings in preference to the development of green-field sites. Nothing in PPG 25 should be taken as departing from this guidance.

### **Canals and other artificial water bodies**

**37.** Canals, as inland waterways, operate differently to rivers and other watercourses as defined under the Land Drainage Act 1991. While some will fall within river or coastal flood plains, others will be outside flood-risk areas. Generally, canals have a limited number of feeders, which are often controlled so that they can be diverted away from the canal at times of flood. Sluices are controlled to discharge excess water from the canal during periods of high inflow to ensure that water levels do not exceed the freeboard and overtop to flood adjacent land. Canals also have some ability to store water before it is discharged, attenuating flood peaks and reducing the potential for flooding. In some cases, canals cross river catchment boundaries, and water could be accepted in one catchment and discharged in another.

**38.** The implications for development are twofold. Firstly, since the concept of a flood plain is not applicable, waterside development or redevelopment of previously developed land may not face the same flood-risk constraints as development alongside a river. Canals may thus retain their potential to act as catalysts for urban and rural regeneration. Secondly, where developments propose to drain into a canal, due consideration should be given to the level and impact this drainage would have on the canals ability to store water. The use of sustainable drainage systems is one way of overcoming concerns about the impact of development on the canals ability to handle flood water. However, authorities considering development in the vicinity of canals should not overlook their own capacity to cause localised flooding, eg where overflow channels fail to operate or where canal embankments fail or are breached. Dams and reservoirs pose a similar potential for possibly large-scale flooding. As for river flooding, a precautionary approach should be adopted at vulnerable locations, after consultation with the canal operator or dam/reservoir owner.

### **Integration of plans**

**39.** A range of plans (described in Appendix C) has been developed over the last decade to meet objectives for achieving sustainable development, maintaining biodiversity and working with the natural processes affecting flood-risk management on the scale of the catchment or coastal cell. Most of these are non-statutory. While they usually involve consultation it is not on the formal statutory basis of that involved in the planning system. However, these plans can have important land-use implications. It is important, therefore, that local planning authorities should be aware of, contribute to and take due account of these plans in so far as they affect land use. This should help to ensure consistency between planning decisions and relevant non-statutory plans, particularly shoreline management plans and Local Environment Agency Plans and any catchment flood management plans, which deal with flood-risk management on the wider scale. It will also be important to contribute to and take account of the river basin management plans that will be required to be published by 2009 under the EC Water Framework Directive.

### **Sustainable drainage systems**

**40.** Consideration of flood issues should not be confined to river and coastal flood plains. Development throughout a river catchment can have a significant impact on flooding simply by

increasing run-off. All built development tends to extend the area of impermeable ground, from which water runs off rather than percolating into the ground. This can increase both the total and the peak flow from built-up areas, resulting in increased flows downstream and thus increasing the risk of flooding. Replacing vegetated areas by roofs, roads and other paved areas is particularly significant in increasing run-off. Changes of use on previously developed land can also have significant downstream impacts where the existing drainage system may not have the capacity or be fit to carry the additional drainage from the redevelopment without enlargement or repair. Conversely, the replacement of industrial and commercial uses by housing can result in an increase in vegetated areas (in gardens etc) and thus reduce run-off. Some minerals extraction, field drainage, agricultural and forestry operations can also increase the quantity and rate of run-off. Of these, only minerals extraction is controlled under the planning system and mitigation measures are usually put in place through planning conditions to minimise and control the increase in run-off. Agricultural, field drainage and forestry operations are permitted development under the General Permitted Development Order 1995.

**41.** The restriction and reduction of surface water run-off from new developments can be encouraged by the provision of surface water storage areas, flow limiting devices in conjunction with surface or sub-surface storage or, where ground conditions permit, the use of infiltration areas or soakaways. Recently, there has been growing interest in the use of "soft" sustainable drainage systems (further details are in Appendix E) to mimic natural drainage. As well as reducing total and peak flows of run-off, these systems can contribute substantially to good design in improving the amenity and wildlife interest of developments, as well as encouraging natural groundwater recharge. As with any drainage system, however, sustainable drainage systems will only be effective to the standard to which they are designed. Most drainage systems can deal effectively with rainfall from a storm with an annual probability of about 3-4%.

**42.** Local planning authorities should, therefore, work closely with the Environment Agency, sewerage undertakers, navigation authorities and prospective developers to enable surface-water run-off to be controlled as near to the source as possible by the encouragement of sustainable drainage systems. The government has already proposed that Part H of the Building Regulations 1991 should be amended to encourage greater use of infiltration and other sustainable drainage systems. Following consultation, the Government expects to amend the Building Regulations in 2001. Certain statutory undertakers and organisations can develop and drain into watercourses and the works undertaken may represent permitted development. Highway authorities and water companies should, therefore, adopt good practice, as far as possible, including the use of sustainable drainage systems, and consult the Environment Agency and navigation authorities in relation to minimising the impacts of their discharges into watercourses.

## **Regional Planning And Development Plans**

### **River catchment planning**

43. The extent of both river and coastal flood plains in England is such that flood-risk issues are often of regional significance, particularly since what happens in one part of a river catchment will often have effects on other parts some distance away. Although administrative and geographical boundaries rarely coincide, the regional scale is the major opportunity to consider flooding issues at a level approaching that of the whole catchment or coastal cell. It is appropriate, therefore, to take flood risk and how it might alter as a result of climate change into account in the preparation of regional planning guidance (RPG) and development plans, including as an element in the appraisal of both RPG and development plans. While this may more naturally be accommodated within the collective approach to the preparation of RPG, the Government considers that it is also necessary for individual authorities to consider catchment-wide issues in preparing development plans and in determining applications. Actions by one authority can have significant implications for flood risk in the area of another. The need for planning on the wider river catchment or coastal cell basis will be emphasised with the implementation of the EC Water Framework Directive with its requirements for the identification of river basin districts and the preparation of river basin management plans.

### **Regional planning guidance**

44. The purpose, content and preparation of RPG is described in PPG 11. RPG should identify the principal areas where flooding issues are likely to be of regional significance, based on the Environment Agency's indicative flood plain maps. Within those areas, RPG should assess the implications and set out regional policies to discourage inappropriate development in flood-risk areas and manage remaining flood risk in a safe and sustainable manner. To the extent that it is relevant at the broader level of RPG, regional strategies should reflect the sequential approach set out in paragraph 30 and Table 1.

45. At the level of detail appropriate to RPG, regional strategies should ensure that run-off is managed locally in an economically and environmentally sustainable way, so as not to cause problems in other parts of a river catchment. Regional planning policies on development and flood risk should take account of the policies and strategies identified in Local Environment Agency Plans, in so far as they cover river-flooding issues, any catchment flood management plans and any relevant Shoreline Management Plans, which cover aspects of coastal flooding. This may include identifying the need to safeguard from development areas that are proposed for managed realignment of flood defences.

### **Development plans**

46. Within the context set by national and regional planning guidance, structure plans (and Part 1 of unitary development plans) provide the strategic locational guidance for development. Local plans (and Part 2 of UDPs) contain the detailed site-specific policies and may identify proposals for development. A strategic overview of the role and importance of development plans and key issues on plan content and procedures are set out in PPG 12. All such plans need to consider flood-risk issues at the relevant scale and relate them to the medium- to long-term objectives of other agencies and local communities, including the need for development and nature conservation. They should take account of and, where necessary, incorporate appropriate planning policies from the range of relevant non-statutory plans (Appendix C).

**47.** The Environment Agency is a statutory consultee in the preparation of structure plans and a recommended consultee for local plans and UDPs. It will contribute to the formulation of policies on flood defence issues. The main Agency input is through the surveys carried out under Section 105(2) of the Water Resources Act 1991. The Government intends that the Agency should exert a positive influence on development plans rather than reacting after the event. The Agency provided indicative flood plain maps to all local authorities in 1999 and these were updated in December 2000. Further revisions will be released at intervals. Those maps are based on the best information currently available and show the approximate extent of fluvial and tidal flood plain, not taking account of the designed protection provided by existing flood defences, for all watercourses in England.

**48.** Advice from the Environment Agency will help local planning authorities understand the wider effects of development throughout a river catchment. In particular, catchment flood assessment studies will provide a basis for catchment flood management plans to provide a large-scale framework for integrated management of risks associated with high flood flows in a sustainable manner. These will enable development plans and, in due course, river basin management plans to take account of the wider implications of flood risk. Similarly, on the coast, shoreline management plans will help to explain the interaction between different processes and identify currently preferred options for the management of particular lengths of shoreline. The Section 105 maps, plans and other information provided by the Agency should be taken into account when preparing development plans, notwithstanding the uncertainties involved in making predictions about the possible frequency and severity of flood risk.

*Structure plans and Part 1 of unitary development plans*

**49.** Structure plans and Part 1 of UDPs should set out the strategic approach to flood risk and the control of surface-water drainage. This should reflect discussion with the Environment Agency, English Nature and other bodies with a relevant interest. Issues to be considered include:

- the record of past flood events and any factors that may have affected the risk of flooding, including development or land-use change within the catchment or the carrying out of river or coastal management works;
- the need to develop a strategic understanding of the hydrology and drainage of river catchments in the plan area in consultation with the Environment Agency;
- the requirements of biodiversity action plans and the importance of statutory conservation sites in the river and flood plain (see PPG 9 *Nature conservation*);
- identification at the level of detail appropriate to structure plans of the land most likely to flood, including river and coastal flood plains, taking into account major events of low probability as well as better known high-frequency floods; and
- whether projected strategic locations for major new developments could exacerbate flood risk downstream, though not themselves directly at risk.

**50.** Taking these and other material considerations into account, structure plans should set out strategic policies to avoid the threat from flooding, where possible, or otherwise to manage it to ensure that future development is appropriately protected. Structure plans should identify those areas of coastal land and river basins where flooding is likely to be a risk both in the short and long term. They should set out requirements and restrictions regarding the type and form of development that will be acceptable and promote joint working where those areas fall within the boundaries of more than one authority. In some circumstances they may need to consider possible long-term changes in land use or managed retreat of flood defences to enable flood plains to flood naturally or

more extensively, thus providing the necessary storage and subsequent gradual release of flood water. In drawing up their policies, authorities preparing structure plans should apply the principles of the sequential test set out in Table 1. Where relevant, they should fully explain any reasons for variance from that test, should the authority concerned believe any departure is justified. It is important that all users of the structure plan, including developers and the insurance industry, clearly understand the basis of the policies in the plan. Structure plans should also identify the need for detailed attention to flood risk in local plans in specific areas.

#### *Local plans and Part 2 of unitary development plans*

**51.** Local plans should develop and apply the strategic guidance and policies in RPG and structure plans according to the local significance of flood risk. In doing so they should be aware of the likely impacts of changes on the future nature and frequency of flooding. For example, climate change can be expected to increase flood risk. Following discussions with the Environment Agency and other interested parties, local planning authorities should show the areas of flood risk on local plans where specific policies are to be applied to minimise and manage the risk. In doing so, they should apply the principles of the sequential test set out in paragraph 30 and Table 1. Any departures from the recommended sequential approach should be explained for the reasons given in paragraph 50 above. It might be appropriate to include the latest version of indicative flood plain maps, including the extreme flood line when it becomes available, as technical support to the local plan or in supplementary planning guidance to indicate where consideration of flood risk is likely to be necessary

**52.** In reviewing sites at risk of flooding when preparing their local plan, authorities should review their existing planned allocations of land for development against the risk-based criteria in the sequential test. To avoid duplication of work as far as housing land allocations are concerned, authorities may wish to combine this with the reviews of the sustainability of housing land allocations in accordance with paragraphs 30 and 31 of PPG 3.

**53.** Local circumstances may require the identification of areas, such as functional flood plains, as defined in paragraph 23, where new built development should be avoided and only development that is appropriate to the risk can proceed, subject to suitable design and conditions to secure the necessary management of that risk. Local plans should also identify sites where promotion of managed realignment of coastal defences or restoration of functions to flood plains could contribute to more sustainable flood management, as well as to amenity, landscape and biodiversity objectives.

**54.** Detailed policies in local plans should take account of whether an area of flood risk is already defended or not and of the standard of that defence. Policies should be prepared in the knowledge that defences can only reduce the risk of flooding. They cannot eliminate it entirely. If the residual risks are not fully assessed and acceptable, further development should not be permitted. This is particularly so in areas behind sea defences, where inundation by the sea can take place very rapidly and cover large areas of land to considerable depth. Coastal authorities should maintain regular contact with the Environment Agency about the extent of such areas.

**55.** Government and Environment Agency resources are directed at protecting existing developments, where this can be achieved at reasonable economic and environmental cost in relation to the numbers of people at risk and the value of protected assets. Resources are not available to provide defences in anticipation of possible future development. In low-lying undeveloped areas, flood management options may include a policy of managed retreat. In such areas, it should not be presumed that it would be economically justifiable to maintain any existing flood defence. It may be appropriate to restrict development in such areas pending decisions on

flood defence so that the options remain open. Plans should not provide for development in undeveloped high-risk areas that are not currently protected to an appropriate standard, unless that location is essential for the particular development or there are no alternative locations in lower risk areas. For such development to be acceptable, it must be suitably designed to cope with the risk of flooding or include effective proposals to protect the land. Any necessary flood-defence works must be fully funded, including provision for long-term maintenance, as part of the development.

**56.** Recognising that flood risk should be an integral part of all land-use decisions, local plans should include policies which promote the use in appropriate areas of more sustainable drainage systems to control the water as near its source as possible (Appendix E). Since development in one part of a catchment may increase run-off and hence flood risk elsewhere, the aim should be for new development not to increase run-off from the undeveloped situation and for redevelopment to reduce run-off. These issues should be discussed with the Environment Agency, the sewerage undertaker and the relevant waterway navigation authority during the preparation of local plans.

## **Development Control**

### **General considerations**

**57.** The susceptibility of land to flooding is a material consideration in determining planning applications. The land concerned may be that subject to the application or elsewhere if the development may have flood implications there. The potential consequences for occupiers, either of the development or elsewhere, in terms of personal safety and financial risk can be serious. Applicants for planning permission should, therefore, assess the risk posed by the development. They should consider the specific risk of flooding to the development being proposed over its currently expected lifetime and its possible effects on flood risks elsewhere in terms of its effects on flood flows and flood storage capacity and the run-off implications. Applications for renewal of planning permission should be reviewed in the light of the latest evidence on flood risk, taking into account any reviews of land allocations conducted in accordance with the guidance in paragraph 52. Such applications should, in any event, also be tested against the criteria in the sequential test set out in paragraph 30 and Table 1.

**58.** Applications by individual householders for minor extensions or alterations should not raise significant issues unless they are likely to have a direct and adverse effect on a watercourse or its flood defences, would impede access to flood defence and management facilities or where the cumulative impact of such developments could have a significant effect on flood storage capacity or flood flows. Such extensions or alterations should, however, be designed and constructed to conform to any flood protection already incorporated in the house being extended. Where extensions and alterations that are permitted development are likely to have a direct and adverse effect on a watercourse or its flood defences, or impede access, authorities should consider making an Article 4 Direction under the General Permitted Development Order 1995 to require planning permission so that full consideration can be given to these impacts. Each case is treated on its merits and further guidance on the policy relating to Article 4 Directions is given in DOE Circular 9/95 *General Development Order Consolidation 1995*.

**59.** Local planning authorities should ensure that within areas of flood risk identified by the Environment Agency, applicants are informed of this fact when, or preferably before, they formally submit a planning application. Where they have not already done so, authorities should also make site-specific information on their flood-risk policies part of their planning search procedures and advise those making searches to consult the Environment Agency for detailed information on flood risk.

**60.** In preparing their proposals, applicants should discuss with the local planning authority the requirements they will be expected to meet to satisfy the authority on flood risk and the run-off implications of the development proposed. They should consult the Environment Agency on the potential risks to their development, on the likely effects of their proposals on flood risk to others and on whether mitigation would be likely to be effective and acceptable. They should carry out an assessment of flood-risk and the run-off implications of their proposals that is appropriate to the scale and nature of the development and the risks involved and submit this with the application. Failure to do so may lead to delay in determining the application and could, in some cases, be a reason for refusal. Such assessments may require detailed hydrological investigations to determine the risks at particular sites and to inform the process of detailed design and the selection of mitigation measures. A flood-risk/run-off assessment, carried out by a suitably qualified competent person, is an essential element in the overall assessment of the economic viability of the

development as well as its acceptability in planning terms. Further guidance on the content of flood-risk assessments is contained in Appendix F.

## **Developer contributions**

**61.** Application of the sequential test in Table 1 may, in some circumstances, result in development being permitted that requires the provision of flood defence and mitigation works. Such provision, generally funded by the developer, is only acceptable provided it is consistent with the relevant flood-risk management policies and does not have a significant adverse impact on flood flows or storage. Local authorities and developers should have regard to the following considerations concerning the contributions developers should make to the flood defence and alleviation works required for a proposed development to proceed, because it is itself at risk of flooding and/or because it would increase the risk at other locations:

- as noted in paragraph 55, developers cannot normally call on public resources to provide defences for their proposed developments where they are not already programmed for the protection of existing development;
- however, the provision of previously programmed defences at public expense to protect existing development may also provide opportunities for new development, provided this does not itself add to flood risk at other locations, eg by adding to surface run-off;
- for some previously developed land, public investment in land remediation and infrastructure may include an element of flood defence and mitigation investment as a means of bringing such land into beneficial use;
- where the two preceding considerations do not apply but where other material considerations outweigh the risk of flooding and point to a proposed development being permitted, any necessary flood defences or flood alleviation works required because of the development form a part of that development. They should normally be fully funded by the developer. Authorities may wish to consider entering into an agreement under Section 106 of the Town and Country Planning Act 1990 to ensure that the developer carries out the necessary works and that future maintenance commitments are met. It will probably be appropriate to vest the resulting defences, which have been constructed to the operating authority's satisfaction, in the operating authority, with a dedicated commuted sum to cover maintenance for 30 years. After that time, it would be reasonable to regard the defences as a public asset that should then be maintained from the public purse. However, where such works would provide a wider benefit, the funding provided by the developer may be proportional to the benefits to him. In such cases, a reasonable allocation might be for the developer to fund the provision of the defences, which are then vested in and maintained by the operating authority. In appropriate cases local planning authorities might consider the imposition of a "Grampian" type condition requiring that the development not proceed until the necessary works have been carried out.. Similar arrangements may be needed in respect of the maintenance and renewal of culverts or of sustainable drainage systems not adopted as sewers. The establishment of a management company with a right to levy service charges, matched by enforceable obligations on the part of owners and occupiers might be one, though not the only, way of ensuring that future maintenance of such systems is guaranteed. Advice on the use of conditions in planning permissions and planning obligations is set out in DOE Circulars 11/95 and 1/97, respectively.
- the requirement for the developer to pay for construction and make arrangements for expected future maintenance costs of flood defence and mitigation works applies even where a proposed development does not require additional works but such works are considered necessary to prevent consequential additional flood risk to other areas and other properties;
- after application of the above and all other relevant considerations, the local planning authority, having taken advice from the Environment Agency and any other relevant operating authority,

should negotiate an appropriate contribution from the developer. If agreement cannot be reached on the provision of that contribution, the application should be refused in accordance with the precautionary principle.

### **Applications relevant to flood risk**

**62.** Applications likely to require particular consideration of flood risk issues include those for development:

- within a river flood plain or washland shown on the indicative flood plain map prepared by the Environment Agency;
- within a coastal flood plain, including that adjacent to the tidal length of a river, shown on the indicative flood plain map prepared by the Environment Agency;
- within or adjacent to any watercourse, particularly where there might be potential for flash flooding;
- adjacent to or including any flood bank or other flood control structure;
- situated in an area where the Agency have indicated that there may be drainage problems;
- likely to involve the culverting or diverting of any watercourse; or
- of such a size or nature relative to the receiving watercourse/drainage system that there could be a significant increase in surface water run-off from the area.

### **Consultation**

**63.** When they receive planning applications which they believe raises flooding issues, after having taken account of the considerations in paragraph 62 above, local planning authorities should undertake appropriate internal consultation (including the emergency services) in relation to their own flood defence responsibilities, as well as consulting the Environment Agency. The Agency is a statutory consultee for some developments (see Appendix D, paragraph D10 below) but the need to consult them in relation to flooding issues covers a much wider range of development. Local planning authorities should also, where relevant, agree with internal drainage boards the types of proposed development of interest to them and consult them on such developments within internal drainage districts and outside where they would have an impact upon them. Where run-off considerations are likely to be significant, authorities should consult the Environment Agency, the sewerage undertaker and, where relevant, any navigation authority concerned on the capacity of existing drainage systems, the feasibility and desirability of using sustainable drainage systems and the impacts of discharges into watercourses.

**64.** Government expects the Environment Agency and other bodies referred to in paragraph 63 to respond to consultations on the flooding aspects of planning applications within 21 days. Since consideration of the possible consequences of new development can be both time- and labour-intensive, local planning authorities should encourage applicants to provide the fullest possible information at the earliest possible stage. There are, therefore, obvious benefits in applicants discussing their proposals with the local planning authority and consulting the Agency and other bodies with an interest before an application is submitted. In responding to consultation, the Agency (and any other operating authorities) will consider the risk of flooding at the proposed site, the impact on flooding elsewhere or the impact of flood alleviation works on other property or nature conservation interests. It may then indicate that the proposal is acceptable, advise on conditions or modifications to make it acceptable, seek more information to enable a decision to be

taken or object that the application is not acceptable and cannot be made so by attaching conditions or seeking modifications.

65. Where they conclude that other material considerations outweigh the objections of the Environment Agency or other consultees on flooding issues, local planning authorities should inform them that they are minded to grant permission and the reasons for doing so and give them the opportunity to make further representations. While consultees may maintain their objections, there might be practicable improvements that could be incorporated which would minimise the perceived adverse impacts on their interests. It is important that where objections are maintained, this can be justified as reasonable in all the circumstances.

66. Consultees making and sustaining objections to development proposals on flood-risk grounds should bear in mind that they may be called upon to maintain their objections in any appeal by an applicant against the refusal of permission or the imposing of conditions based on their advice. In view of the increased weight that the Government wishes to be given to flood risk in the planning process, it is obviously important that objections on flood-risk grounds are well founded and will stand scrutiny on appeal.

67. Consultation arrangements may need to make special provision for:

- phased or other developments, where the cumulative effects of lost storage within flood plains or increased run-off can be significant but where it may be difficult to associate the necessary alleviation works with individual applications;
- development that would obstruct natural or engineered flood flows, leading to higher upstream water levels, flooding or increased erosion;
- impacts on statutory nature conservation sites within the flood plain, including the river itself, and areas that may be subject to significant change in surface run-off;
- building works on or near flood defence embankments or other control structures that might reduce their effectiveness or seriously impede their proper maintenance;
- development affecting an existing structure, constructed for another purpose, which may incidentally serve as a flood defence, the alteration or removal of which may place the previously protected area at increased risk;
- mineral workings in flood plain areas that could affect water storage and the control of flooding; and
- proposed residential development, particularly for people of impaired mobility, in areas identified through development plan consultation as being susceptible to flooding, whether or not it is protected by flood defences.

### **Environmental impact assessment**

68. For certain types of project, including flood relief works, local planning authorities will need to determine whether environmental impact assessment (EIA) is required under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. In addition, land drainage improvements that are permitted development under the General Permitted Development Order 1995 may require EIA under the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999. Where the development is likely to have significant effects on the environment, an EIA must be carried out. Developers should contact the local planning authority as early as possible to determine whether EIA is needed and, if so, what it should cover. The impact of development on flood risk is likely to be a significant element in the

EIA, particularly where it is likely to impact on designated conservation sites or compromise river and shoreline management options or biodiversity action plans. Further advice on EIA is contained in DETR Circular 02/99.

### **Development behind existing defences**

**69.** Further development on land protected by sea defences would be extremely vulnerable in the event of any overtopping or breaching of those defences because of the speed of flooding in such circumstances. A breach occurring as a result of a storm or a tidal surge, for example, might involve high risk of loss of life as well as extensive severe damage to and destruction of property. Planning authorities should take this risk fully into account when considering applications for development on such land, particularly in respect of single-storey developments with no means of escape to an upper floor. Subject to the sequential test in paragraph 30 and Table 1, such development should not be permitted where the existing flood defences, properly maintained and in combination with agreed warning and evacuation arrangements, would not provide an acceptable standard of safety. Similarly, for development behind river flood defences, consideration should be given to the need for the risks to be minimised by incorporation of appropriate flood protection measures in the design and construction of buildings. Details of such measures are contained in the report prepared by the Building Research Establishment Scottish Laboratory on *Design guidance on flood damage to buildings* (1996).

### **Caravan and camping sites**

**70.** Caravan, camping and other temporary occupancy sites give rise to special problems in relation to flooding. They have often been located on coastal or riverside sites with a high risk of flooding. The instability of caravans places their occupants at special risk and it may be difficult to operate an effective flood warning system. Such development should be refused in the areas at highest risk, where overtopping or breach of defences would lead to rapid inundation, as should proposed changes of use to residential mobile homes or permanent housing. Where permission is granted for caravan/camping sites or other temporary holiday accommodation, a planning condition should require the erection of suitable warning notices to inform people entering the site and the preparation of effective warning and evacuation plans. Advice on the way that such matters might be approached is given in Appendix G. It is strongly recommended that sites licensed under the Caravan Sites and Control of Development Act 1960, which do not require planning permission, should have similar warnings and plans. Caravanning and camping organisations should liaise with the local planning authority and the Environment Agency about any flooding risks which might apply and the arrangements for notifying users of the warning systems and evacuation procedures.

## **Further Information And Advice**

**71.** There are numerous sources of information on flooding in England. A bibliography of relevant publications, including those referred to in this guidance, is in Appendix B.

**72.** The assessment of the significance of flooding issues requires careful professional judgement. The developer is responsible for ensuring the safe development and secure future occupancy of his site and should ensure that appropriate expertise is available to carry out any necessary investigations and to design and execute any necessary flood alleviation works. While the local planning authority will need to consider flooding issues in the public interest, it is entitled to require the developer to provide at application stage suitable expert advice from an appropriately qualified competent person on such matters. To inform a developers assessment, the Environment Agency should make available any relevant flood-risk information subject to their normal charging policy. The Agency should also be aware of the reliance that developers and their experts may place on the information provided in terms of local flooding conditions and flood risk. A local planning authority is not required to carry out its own assessment of flood risk but may rely on the developers information, subject to any views expressed by consultees, particularly those of the Environment Agency, in determining the application and any necessary conditions. Those providing such expert advice should be aware of the reliance that may be placed on it.

## **Conclusion**

**73.** The Secretary of State expects local planning authorities and developers to take early action to implement the advice in this guidance but recognises that some of the information required for implementation will only become available with time. The Government also expects the Environment Agency to ensure that the relevant information is provided as soon as practicable and that responses to consultation by local planning authorities are submitted within the appropriate time-scales.

**74.** A flexible approach is needed to take due account of flood risk through the sequential approach in paragraph 30 and Table 1. This should ensure that further development normally avoids the areas of highest risk and that appropriate measures are taken to make development safe where other considerations in favour of the development proceeding may outweigh the flooding issues. The Government does not intend this guidance to inhibit the redevelopment of sites on previously developed land where this can be done within the requirements set out above and, in particular, the sequential test in paragraph 30 and Table 1. The policies and practices to be adopted by a local planning authority are for them to decide in the light of all the circumstances in their area, having had regard to this guidance. The Government will monitor the effectiveness of this guidance through high-level target 12 (see paragraph 17), will keep it generally under review and will, in any event, review it in the light of developing information about climate change and flood risk 3 years after publication.

## Appendix A - Causes Of Flooding And The Impacts Of Climate Change

### Causes of flooding

**A1.** Flooding occurs when the amount of water arriving on land (from rainfall, snow melt, surface flow, flow in watercourses or inundation by the sea) exceeds the capacity of the land to discharge that water (by infiltration, surface flow, piped drainage or surface watercourses). It can occur on any level or near-level areas of land but the main concern is with such areas adjacent to watercourses (fluvial flood plains) or low-lying ground next to the coast (coastal flood plains). The limits of flood plains cannot be defined precisely because floods with similar probability can arise from different combinations of event that will have different impacts. They are often delineated by the estimated peak water level of an appropriate flooding event on the watercourse or at the coast. On rivers, this has generally been taken to be the flood with a 1% annual probability of exceedance (the 1 in 100-year return-period flood) or the highest known water level. In coastal areas, because of the generally more dynamic nature of coastal flooding, the 0.5% annual probability (the 1 in 200-year return-period flood) or the highest known flood is generally used. It is recognised, however, that floods of greater magnitude than these will occur; such floods constitute extreme events. Locally flooding may occur due to groundwater overflowing, overland sheet flow or run-off exceeding the capacity of piped drainage during periods of heavy or prolonged rainfall. Such local flooding can only be addressed on a site-specific basis.

**A2.** The principal cause of river flooding is excessive rainfall or snow melt within a limited period, which overwhelms the drainage capacity of land, particularly when the ground is already saturated or when channels become blocked. Inundation by the sea is largely due to combinations of high tide, storm surge and wave activity but may also be associated with structural failure of defences. Some areas are subject to combinations of tidal and river impacts. The impacts can be aggravated by:

- the growth of built development in catchments and other changes in land use, which increase the rate and volume of run-off;
- sediment movement that has changed river cross-sections and affected flood levels;
- lack of maintenance of flood defence systems, watercourses, culverts (including the flood relief areas around them) and road gullies, particularly where this leads to channel blockage;
- canalisation, modification and diversion of rivers and watercourses, which increase the rate of flow and decrease the time taken for water to travel within a catchment; and
- building of structures (eg embankments) which restrict flows over historical flood plains and thereby create additional flood risks both upstream and downstream.

**A3.** Flooding is, therefore, a combination of human activity and natural physical conditions. In determining the risk posed by flooding, account needs to be taken of the likely depth, speed and extent of inundation and the potential for anticipatory action to be taken as a result of flood warnings. Rapid flows due to flash flooding<sup>11</sup> or inundation by the sea following failure of defences pose a greater risk to life than a steady rise in water level. The consequences also vary with land

---

<sup>11</sup> Flash floods are characterised by rapid rise and fall of floodwaters with peak flows occurring within hours of heavy rain. They are associated with small steep catchments affected by periodic heavy rainfall and can be significantly influenced by inadequate storm water drainage, the build-up of water behind bridges and culverts or the overtopping and/or breach of flood defences or reservoir dams.

use. For example, overtopping and possible failure of a flood defence defending a densely populated urban area is an extreme risk; the same event affecting agricultural land is unlikely to involve a serious threat to human life.

### Impact of climate change

**A4.** There is mounting evidence that the global climate is changing as a result of human activity. Sea level will rise globally as a result of thermal expansion of the oceans, melt-water from alpine ice and snow and from polar ice caps in Greenland and Antarctica. The current best estimate is for a 210mm rise between 2000 and 2050. However, this estimate is very uncertain and it could be as low as 100mm or as high as 550mm, depending on the future level of greenhouse gas emissions and the sensitivity of the climate system; the best-estimate sea-level rise is based on central estimates of each of these. To the climate-induced sea-level rise has to be added the movement of land, which is generally falling in the south-east and rising in the north and west. UK Climate Impacts Programme scenarios, which include both sea-level rise from climate change and land movement, estimate a rise of 410mm in East Anglia and 210mm in west Scotland by 2050.

**A5.** The rise in sea level will change the frequency of occurrence of high water levels. For example, the current 1-in-100-year high-water level on the east coast may be expected to be exceeded every 20 years on average by 2050, assuming no change in storminess. There may also be secondary impacts such as changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events. It should be recognised, however, that while sea-level rise and climate change could have a significant impact on levels of risk, current information suggests that the actual areas at risk are not expected to increase significantly.

**A6.** Following the 1990 reports of the Intergovernmental Panel on Climate Change, allowances for the regional rates of relative sea-level rise shown in Table A1 were adopted by MAFF (now DEFRA) for coastal defence schemes. These were based on an average predicted sea-level rise of 4.5mm per year over the next 40-50 years combined with the postulated rates of large-scale land movement. These allowances have been regularly reviewed. Since they were first developed, the best estimates of global and regional sea-level rise over the next 50 years have tended to reduce as more complex feedback effects have been taken into account in the modelling. However, in view of the uncertainties involved, the allowances have been retained at this level for coastal defence schemes and for the purposes of this guidance. All decisions on investment in defences are subject to economic, technical and environmental appraisal.

**Table A1: Allowances for regional rates of relative sea-level rise (2000-2050).**

Environment Agency region	Allowance
North-west and North-east (north of Flamborough Head)	4mm per year
South-west	5mm per year
Anglian, Thames, Southern and North-east (south of Flamborough Head)	6mm per year

**A7.** The latest climate change scenarios suggest that annual rainfall is expected to increase by 0-10% by the 2050s with the largest increases in the north-west. A shift in the seasonal pattern of rainfall is also expected, with winters and autumn becoming wetter over the whole of the UK, by as much as 20% under some scenarios. It is also suggested that the number of rain-days and the average intensity of rainfall are expected to increase slightly and that average seasonal wind speeds could increase over most of the country. There is much less certainty regarding this potential

increased storminess and the consequences for extreme wave activity on the coasts or for river run-off.

**A8.** Initial research has suggested that, for the Thames and Severn catchments, increases in peak flow of up to 20% for a given return period could be experienced within 50 years. These are preliminary findings and further work is required but they give added incentive to maintain current defences, where they are justified, and to adopt robust and sustainable solutions where defences are replaced. Such considerations also add importance to the need to evaluate the potential impact of extreme events even where it may not be economic to contemplate high levels of protection.

**A9.** Recent work has shown that there is some evidence of an apparent increase in more intense winter rainfall events in the UK since the 1960s. These are likely to contribute to increased flooding. This is in line with a general expectation of a more extreme hydrological cycle with climate change. Climate models also predict more extreme precipitation events in the UK.

**A10.** The Government has established the UK Climate Impacts Programme to help organisations, including local authorities and planning bodies, to assess their vulnerability to climate change and plan appropriate adaptation strategies. In 1998, the programme issued climate change scenarios for the UK. These are being revised to provide more information on extreme-weather events and greater detail at a regional scale. Publication is expected in early 2002.

## Appendix B - Some Relevant Publications On Development And Flood Risk

### Legislation

Town and Country Planning Act 1990  
Planning and Compensation Act 1991  
Town and Country Planning (General Development Procedure) Order 1995  
Town and Country Planning (General Permitted Development) Order 1995  
Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999  
The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999.  
Building Act 1984  
Building Regulations 1991  
Health and Safety at Work etc Act 1974  
Highways Act 1980  
Environmental Protection Act 1990  
Environment Act 1995  
Water Resources Act 1991  
Land Drainage Act 1991 as amended by the Land Drainage Act 1994  
Caravan Sites and Control of Development Act 1960  
Occupiers Liability Act 1957  
Occupiers Liability Act 1984  
Habitats Regulations 1994  
EU Habitats Directive  
EU Birds Directive  
EC Water Framework Directive (2000/60/EC)  
Ramsar Convention on Wetlands of International Importance.  
Environment Agency Byelaws (Regional)

### Planning Guidance

**DOE/MAFF/Welsh Office, 1992.** *Development and flood risk.* DOE Circular 30/92 (MAFF Circular FD1/92, Welsh Office Circular 68/92) London, HMSO, 11pp. [This Circular has been replaced in Wales by Technical Advice Note 15 below, and is replaced by this guidance in England]

**DOE, 1995.** *General Development Order consolidation 1995.* DOE Circular 9/95, London, HMSO,

**DOE, 1995.** *The use of conditions in planning permissions.* DOE Circular 11/95, London, HMSO, 48pp.

**DOE, 1997.** *Planning obligations.* DOE Circular 1/97, London, HMSO,

**DETR, 1999.** *Environmental impact assessment.* DETR Circular 02/99, London, TSO

**DOE/Welsh Office, 1999** *Planning requirement in respect of the use of non-mains sewerage incorporating septic tanks in new development.* DOE Circular 3/99 (Welsh Office Circular 10/99) London, TSO, 7pp.

**DETR, 2000.** *Regional planning.* Planning Policy Guidance Note 11, London, TSO,

**DETR, 1999.** *Development plans.* Planning Policy Guidance Note 12, London, TSO,

**DOE, 1992.** *Coastal Planning.* Planning Policy Guidance Note 20, London, HMSO, 22pp.

**DOE, 1994.** *Nature conservation.* Planning Policy Guidance Note 9, London, HMSO

**DETR, 2000.** *Housing.* Planning Policy Guidance Note 3, London, TSO

**Scottish Office, 1995.** *Planning and flooding.* National Planning Policy Guideline NPPG 7. Edinburgh, Scottish Office Environment Department, 31pp.

**Welsh Office, 1998.** *Development and flood risk.* Planning Guidance (Wales): Technical Advice Note (Wales) 15.. Cardiff, TSO, 7pp.

**Environment Agency, 1997.** *Policy and Practice for the protection of floodplains.* Bristol, Environment Agency, 21pp.

**Environment, Transport & Regional Affairs Committee, 2000.** *Development on, or affecting, the flood plain.* Second report of the Environment, Transport & Regional Affairs Committee, Session 2000-01, London, TSO.

## **Flood Defence Guidance**

**MAFF/Welsh Office, 1993.** *Strategy for flood and coastal defence in England and Wales.* London, PB1471 MAFF/Welsh Office, 39pp.

**MAFF, 1994.** *Water Level Management Plans: A procedural guide for operating authorities.* London, PB 1793 MAFF,

**MAFF, 1995.** *Shoreline Management Plans: A guide for coastal defence authorities.* London, PB2197 MAFF, [Revised guidance will be published early in 2001]

**MAFF/Welsh Office, 1996.** *Code of practice on environmental procedures for flood defence operating authorities.* London, PB2906 MAFF/Welsh Office, 37pp.

**MAFF, 1996.** *Flood and coastal defence.* London, PB2331 MAFF, 8pp. (This is currently being revised)

**MAFF/Environment Agency, 1998.** *Replies by the Government and the Environment Agency to the Sixth Report from the Agriculture Committee, Session 1997-8, "Flood and Coastal Defence" (HC707).* London, TSO,

**MAFF, 1999.** *High level targets for flood and coastal defence and elaboration of the Environment Agency's flood defence supervisory duty.* London, MAFF, 19pp.

**MAFF, 1999.** *Water Level Management Plans: Additional Guidance Notes for Operating Authorities.* London, MAFF,

**MAFF, 2001.** *Flood and coastal defence project appraisal guidance: Overview (including general guidance).* FCDPAG1, London, MAFF, 42pp.

**MAFF, 2001.** *Flood and coastal defence project appraisal guidance: Strategic planning and appraisal.* FCDPAG2, London, MAFF, 58pp.

**MAFF, 1999.** *Flood and coastal defence project appraisal guidance: Economic appraisal.* FCDPAG3, London, PB4650, MAFF, 102pp.

**MAFF, 2000.** *Flood and coastal defence project appraisal guidance: Approaches to risk.* FCDPAG4, London, MAFF, 76pp.

**MAFF, 2000.** *Flood and coastal defence project appraisal guidance: Environmental appraisal.* FCDPAG5, London, MAFF, 67pp.

**MAFF/DETR/English Nature/Environment Agency, 1999.** *Coastal Habitat Management Plans: A guide to content and Structure. Consultation draft.* London, MAFF/DETR/English Nature/Environment Agency.

**Environment Agency, 1999.** Environment Agency policy regarding culverts: Policy statement. Bristol, Environment Agency, 2pp.

**Environment Agency, 1999.** *Environment Agency policy regarding culverts: Explanation of policy.* Bristol, Environment Agency, 4pp.

**Environment Agency, 1999.** *Environment Agency policy regarding culverts: Technical guidance on culverting proposals.* Bristol, Environment Agency, 4pp.

**Agriculture Select Committee, 1998.** *Flood and coastal defence.* Sixth report from the Agriculture Select Committee, Session 1997-98. London, TSO,

**Environment Agency, 1999.** *Flood warning service strategy for England and Wales.* Bristol, Environment Agency, 14pp.

**Environment Agency, 1999.** *Floodline because floods dont just happen to other people: National Flood Awareness Week 18-24 October 1999.* Bristol, Environment Agency,  
**Environment Agency & MAFF, 2001.** *Catchment flood management plans: interim guidelines for consultation and pilot catchment studies.* Bristol, Environment Agency, 33pp.

## **General Information**

**Rendel Geotechnics, 1995.** *Erosion, deposition and flooding in Great Britain: A summary report.* London, Rendel Geotechnics, 81pp.

**Lee, E.M., Clark, A.R. & J.C. Doornkamp, 1995.** *The occurrence and significance of erosion, deposition and flooding in Great Britain.* London, HMSO, 177pp.

**Lee, E.M., 1995.** *The investigation and management of erosion, deposition and flooding in Great Britain.* London, HMSO, 208pp.

**Bye, P. & M. Horner, 1998.** *Easter 1998 floods: Report by the independent review team to the Board of the Environment Agency.* Bristol, Environment Agency, Vol 1:121pp, Vol 2:341pp.

**Environment Agency, 1998.** *Environment Agency response to the independent report on the Easter 1998 floods: Action plan.* Bristol, Environment Agency, 16pp.

**DETR & National Assembly For Wales, 2001.** *First consultation paper on the implementation of the EC Water Framework Directive (2000/60/EC).* London, DETR/NAW, 43pp.

**MAFF, 1999.** *Flood and coastal defence research and development: Report of the advisory committee.* London, PB4112 MAFF, 111pp.

**MAFF/Environment Agency, 1999.** *Proposal for the implementation of the recommendations of the advisory committee on flood and coastal defence research and development published 1999.* London, MAFF/Environment Agency, 18pp.

**DETR, Environment Agency & Institute For Environment And Health, 2000.** *Guidelines for environmental risk assessment and management.* London, TSO, 88pp.

**Environment Agency, 1998.** *The State of the Environment of England and Wales: Fresh Waters.* London, TSO, 214pp.

**Environment Agency, 1999.** *The State of the Environment of England and Wales: Coasts.* The Stationery Office, London, 201pp.

**Environment Agency, 2000 (in press).** *The State of the Environment of England and Wales: the Land,* London, TSO,

**Environment Agency, 2001.** *Lessons learned: autumn 2000 floods.* Bristol, Environment Agency, 56pp.

**Jeremy Benn Associates Ltd, 2000.** *The Environment Agency national Section 105 framework agreement NATCON 257: Extreme flood outline: Scoping study. Final report.* Skipton, Jeremy Benn Associates Ltd, 66pp.

**MAFF, Various dates.** *Flood and coastal defence research and development: Annual report* London, MAFF,

**MAFF, Various dates.** *Flood and coastal defence: Research news from Flood and Coastal Defence with Emergencies Division, Ministry of Agriculture, Fisheries and Food*

**Hydro Research & Development Ltd, 1993.** *Urban drainage the natural way.* Clevedon, Hydro Research & Development Ltd, 20pp.

**SEPA/Environment Agency, 1997.** *Protecting the quality of our environment: A guide to sustainable urban drainage.* Stirling & Bristol, Scottish Environmental Protection Agency/Environment Agency, 25pp.

**SEPA/Environment Agency/Environment & Heritage Service, 2000.** *Sustainable urban drainage systems: an introduction.* Stirling, Bristol & Belfast, Scottish Environmental Protection Agency/Environment Agency/Environment & Heritage Service, 20pp.

**SEPA, 2000.** *Watercourses in the community: a guide to sustainable watercourse management in*

*the urban environment*. Stirling, Scottish Environmental Protection Agency, 55pp.

**Environment Agency, 2000.** *River rehabilitation: Practical aspects from 16 case studies*. Bristol, Environment Agency.

**DOE, 1996.** *Review of the potential effects of climate change in the United Kingdom*. London, DOE,

**WS Atkins, Meteorological Office & ADAS, 1999.** *Rising to the challenge: Impacts of climate change in the South East in the 21<sup>st</sup> century*. Kingston upon Thames, Surrey CC,

**DETR, 2000.** *Climate change: The UK programme*. CM 4913, London, DETR, 209pp.

**DOE, 1995.** *Policy guidelines for the coast*. London, DOE, 65pp.

**Nicholas Pearson Associates, 1996.** *Coastal zone management towards best practice*. London, DOE, 74pp.

**CIRIA, 2000.** *Sustainable urban drainage systems: Design manual for England and Wales*. London, CIRIA,

**CIRIA, In press, 2001.** *Sustainable urban drainage systems: Best practice manual*. London, CIRIA,

**European Commission, 1997.** *Better management of coastal resources: A European programme for integrated coastal zone management*. Luxembourg, Office for Official Publications of the European Communities, 47pp.

**European Commission, 1999.** *Towards a European integrated coastal zone management (ICZM) strategy: General principles and policy options: A reflection paper*. Luxembourg, Office for Official Publications of the European Communities, 31pp.

**European Commission, 1999.** *Lessons from the European Commissions demonstration programme on integrated coastal zone management (ICZM)*. Luxembourg, Office for Official Publications of the European Communities, 93pp.

**DOE, 1999.** *A better quality of life: A strategy for sustainable development for the United Kingdom*. London, HMSO,

**DOE, 1996.** *The Environment Agency and Sustainable Development*. London, HMSO,

**DOE/MAFF, 1995?** *Rural England A Nation Committed to a Living Countryside*. London, HMSO,

**BRE Scottish Laboratory, 1996.** *Design guidance on flood damage to dwellings*. London, HMSO for Scottish Office Development Department, 30pp.

**Building Research Establishment, 1997.** *Repairing flood damage: immediate action*. BRE Good Repair Guide 11, Part 1, Garston, Building Research Establishment, 4pp

**Building Research Establishment, 1997.** *Repairing flood damage: ground floors and basements*. BRE Good Repair Guide 11, Part 2, Garston, Building Research Establishment, 4pp

**Building Research Establishment, 1997.** *Repairing flood damage: foundations and walls*. BRE Good Repair Guide 11, Part 3, Garston, Building Research Establishment, 4pp

**Building Research Establishment, 1997.** *Repairing flood damage: services, secondary elements, finishes, fittings*. BRE Good Repair Guide 11, Part 4, Garston, Building Research Establishment, 4pp

**Crichton, D., 1998.** *Flood appraisal groups, NPPG 7 and insurance*. In *Proc of a seminar on flood issues in Scotland, Perth, December 1998*. Perth, SEPA, 4pp.

**Association Of British Insurers, 2000.** *Inland flooding risk issues facing the insurance industry*. General Insurance Research Report No 10, London, prepared for the ABI by The Entec Consultancy, 74pp.

**BRE, 2001.** *The implications of climate change for the insurance industry: and update and outlook to 2020*. Watford, BRE, 69pp.

## **Appendix C - Some Relevant Statutory And Non-Statutory Plans**

**C1.** Since about 1990, there have been a number of initiatives in regard to non-statutory plans dealing, in particular with coastal issues. Many of these contain policies and proposals that have land-use planning implications. It is important that these are integrated where possible with the statutory development plan and that they are taken into account when deciding planning applications. Local planning authorities should be aware of these developments and be involved where necessary. The various bodies who are responsible for producing such plans may also be useful sources of advice and guidance.

### **Shoreline management plans**

**C2.** Shoreline management plans (SMPs) are prepared by coastal defence authorities (the Environment Agency and maritime local authorities) acting individually or as part of coastal groups. They result from a MAFF (now DEFRA) initiative under their strategy for flood and coastal defence and relevant studies leading to SMP development are grant-aided. SMPs set out a strategy for sustainable coastal defence within coastal sediment cells, taking account of natural coastal processes and human and other environmental influences and needs. A SMP should set objectives for the future management of the shoreline based on predictions of the likely future evolution of the coast and knowledge of coastal processes within the cell and should inform and be informed by the statutory planning process. The methodology involves assessment of a range of strategic coastal defence options and identification of a preferred approach for sections of coast (management units) within the plan area. The generic options for such sections of coast, all of which include monitoring to assess their effectiveness and how appropriate they continue to be, are:

- Do nothing;
- Hold the existing defence line by maintaining or changing the standard of protection;
- Advance the existing defence line; and
- Retreat the existing defence line (managed retreat or realignment).

**C3.** The choice of a preferred option is critical to future planning decisions relating to the coastal flood plain. Development plan policies, proposals maps and decisions therefore all need to take account of SMPs. Where the preferred option is either non-intervention or retreat, planning policies should strongly discourage further development in low-lying areas behind present shorelines. Additional development in such areas could unnecessarily commit flood defence authorities to expensive and unsustainable policies, which may in turn adversely affect biodiversity or other areas of the coast.

**C4.** SMPs are further developed through coastal strategies for their implementation within management units and where appropriate by scheme design and construction. The first generation of SMPs for all the English coast have been completed and are being reviewed under the MAFF research programme. This will lead to improved guidance for the production/review of future SMPs, including possibly their extension from the open coast, on which they have focussed to date, to estuarial situations.

### **Estuary management plans**

**C5.** Arising from an initiative by English Nature, Estuary Management Plans (EMPs) are prepared by a project team which aims to bring together all those with an interest in an estuary to reach a

consensus on the sustainable use of that estuary. The triggering factor in their development was the importance of nature conservation in estuaries and their initial development has been funded by English Nature, together with local authorities and other interested parties. All the major estuaries in England have been covered.

**C6.** Harbour management plans are similar in co-ordinating different interests within harbours and seeking to agree and implement management policies to promote sustainable use for conservation, recreation and economic activity.

### **Catchment flood management plans**

**C7.** MAFF (now DEFRA) and the Environment Agency are developing an initiative for catchment area studies that will lead to the production of catchment flood management plans. These will provide a vehicle for considering holistic approaches to flood management at a catchment scale. Full details will be developed during 2001 but the relationship to the planning system should be similar to that for shoreline management plans.

### **Coastal habitat management plans**

**C8.** Coastal Habitat Management Plans (CHaMPs) have been proposed by English Nature and the Environment Agency in consultation with MAFF (now DEFRA) and DETR. The concept is being trialled under an EU LIFE Nature project to 2003. They are intended to assist in the development of sustainable coastal defence strategies in those areas where coastal defence measures have implications for internationally important wildlife sites, ie

- Special areas of conservation (SACs) under the EU Habitats Directive;
- Special protection areas (SPAs) under the EU Birds Directive: and
- Wetlands protected under the Ramsar convention.

**C9.** Each CHaMP would cover an area comprising either a single coastal protected area or a complex of overlapping or contiguous sites, together with areas immediately adjacent to those currently designated where replacement habitats may be created and sustained. The plans would be prepared by English Nature and the Environment Agency and would be used by:

- operating authorities to plan flood and coastal defence works and associated habitat replacement works within the plan areas;
- MAFF (now DEFRA) to assist in decisions on grant aid for capital works; and
- English Nature to inform its reporting on site condition.

**C10.** While no CHaMPs have yet been prepared, the aim would be to integrate them into SMPs and their associated implementation strategies. It is proposed that a CHaMP would be a management plan under the terms of the EU Habitats Directive. Where the plan area overlaps with a European marine site, it would be written so that it can be integrated with the scheme of management provided for in the 1994 Habitats Regulations, thus enabling the requirement for a single management plan for each Natura 2000 site to be met.

### **Local Environment Agency Plans**

**C11.** The Environment Agency produces a range of technical plans for managing different aspects of the water environment. **Catchment abstraction management strategies** set out Agency

policies for the licensing of water abstraction. **Salmon action plans** and **Fisheries action plans** relate to the management of salmonid and other fisheries. The Agency has also published 130 general **Local Environment Agency Plans (LEAPS)** on a catchment basis to integrate the range of its functions and present issues to a more general audience. In respect of the water environment, this includes water quality, flood defence, fisheries, recreation, conservation and navigation. The plans consider the various interests of users and develop a long-term vision and medium-term strategies and actions through consultations with local communities and organisations, highlighting key issues and developing practical solutions. The main aim is to assess the problems and opportunities resulting from catchment pressures, activities and users and to propose action to optimise the overall future well-being of the environment. The Agency is currently reconsidering the role of general LEAPS, in recognition of the new role of Community strategies to promote local sustainable development.

### **Water Level Management Plans**

**C12.** These are prepared by operating authorities in accordance with the MAFF (now DEFRA) procedural guides. The *Code of Practice on Environmental Procedures for Flood Defence Operating Authorities* states that these plans provide a means by which the water level requirement for a range of activities in a particular area, including agriculture, flood defence and conservation, can be balanced and integrated. They should also provide opportunities for the adoption of a strategic approach to the management of flood defence and land drainage within a hydrological unit and should, therefore, be the central component of any local operational plan. Priority has been given to preparing plans on sites of international importance (SACs, SPAs and Ramsar sites) and SSSIs.

### **River basin management plans**

**C13.** Article 13 of the EC Water Framework Directive (2000/60/EC) places a duty on member states to ensure that a comprehensive river basin management plan is produced and updated every 6 years for each river basin district. The first set of plans must be published by December 2009, having consulted on a draft plan at least one year beforehand. The purpose of the plan is to set out the objectives for the water bodies within the river basin district and to explain in broad terms how they are to be achieved. The plans can include a register of any more detailed programmes and management strategies that have been prepared for each river basin district. The requirement to produce river basin district management plans will need to be introduced and the *First consultation paper on the implementation of the EC Water Framework Directive* was issued in March 2001. The non-statutory plans already referred to will provide a solid foundation for delivering some of the action required by the Directive.

### **Community strategies**

**C14.** Local authorities have a statutory duty to prepare Community strategies to promote the economic, environmental and social well-being of their area, taking into account guidance issued by the Secretary of State. Community strategies are intended to provide an over-arching framework, integrating the plans and programmes of local authorities and other local bodies working towards an agreed vision and establishing clarity of roles and responsibilities. Many community planning partnerships will recognise flood risk as a local public safety issue, to be addressed sustainably and on a whole-catchment basis, through the management of land drainage and land use. High-level sustainable development messages in Community strategies should support the development of appropriate flood-risk management policies in development plans.

## **Other relevant plans**

**C15.** Other plans that may be relevant to the consideration of development and flood risk include:

- Heritage Coast Management Plans are prepared by local authorities together with the Countryside Agency and the involvement of interested bodies. Their aim is to guide management to achieve the heritage coast objectives of conservation, recreation, rural economic development and environmental health. Only a limited number of the 45 areas of heritage coast in England include areas at risk of flooding.
- Biodiversity Action Plans are published by English Nature on behalf of the UK Biodiversity Group to implement the UK Biodiversity Action Plan, to which the Government is committed. They briefly outline the current status of particular habitats or species and the pressures on them, propose action and targets to maintain or increase biodiversity and identify research needs. A number of the habitats and species covered by such plans affect river and coastal flood plains.
- Integrated Coastal Zone Management Plans are prepared by a variety of organisations, often in the form of a coastal forum. They are aimed at encouraging the sustainable management of all aspects of the human use of the coast. A number of such plans have formed part of an EU demonstration project on integrated coastal zone management.
- Agenda 21 Plans are prepared by local authorities under Agenda 21 of the Declaration of the UN Summit on the Environment (Rio de Janeiro 1992) to promulgate local action in support of the global environment.

**C16.** A number of other plans may be relevant to consideration of development and flood risk, including the management plans for National Parks and Areas of Outstanding Natural Beauty and various non-statutory local authority plans such as those relating to nature conservation, tourism and recreation.

## Appendix D - Role Of The Environment Agency And Other Operating Authorities

### Policy framework

**D1.** The Environment Agency and other operating authorities have permissive flood defence powers that do not release riparian owners from any obligation to which they were subject by reason of "tenure, custom prescription or otherwise" before the commencement of the Water Resources Act 1991 or the Land Drainage Act 1991 (as amended 1994).

**D2.** Policy for flood and coastal defence is determined by DEFRA (formerly MAFF), including setting policy aims, objectives and targets for the operating authorities, providing guidance, funding a Research and Development programme and grant aiding eligible works. Policy for land-use planning is set by DTLR. DEFRA and DTLR work together to establish a coherent policy on development and flood risk.

**D3.** The management of flood risk is dependent on effective partnership working between the operating authorities and between them and local planning authorities and the emergency services. In this partnership, the primary role of operating authorities (and principally the Environment Agency) is to give advice on flood risk and that of local planning authorities is to prepare development plans and determine applications giving appropriate weight to flood risk.

### Operating authorities

**D4.** There are four types of operating authority, with differing powers and duties:

- **Environment Agency** -- sea defences and works on main rivers<sup>12</sup>;
- **Internal Drainage Boards (IDBs)** -- ordinary watercourses<sup>13</sup> in areas known as Internal Drainage Districts<sup>14</sup>;
- **Local Authorities** -- ordinary watercourses not in an Internal Drainage District; and
- **Maritime Local Authorities** -- protection against erosion or inundation by the sea.

**D5.** Operating Authorities are concerned with:

- the natural catchment area of watercourses and rivers;
- the channels occupied by rivers and watercourses during times of normal flow;
- flood plains and washlands which accommodate water during periods of flood; and
- coastal flood plains at risk from flooding from the sea or tidal lengths of rivers, whether or not protected by sea defences.

---

<sup>12</sup> Watercourses designated as such on main river maps.

<sup>13</sup> All those watercourses that are not designated as main river. Statutory areas of lowland Britain with special drainage needs.

<sup>14</sup> Statutory areas of lowland Britain with special drainage needs.

**D6.** The powers given to the operating authorities to carry out works are all permissive, which means they can choose either to carry out works or not at their discretion. No operating authority can be compelled to use their permissive powers.

### **The Environment Agency**

**D7.** The Agency has wide-ranging responsibilities including the management of water resources, control of pollution in inland, estuarial and coastal waters, and flood defence including water level management. The principal duty of the Agency is to "contribute towards the achievement of sustainable development" (Section 4, Environment Act 1995). In carrying out all its functions, the Agency is subject to general duties to protect and enhance the environment and promote recreation.

**D8.** The Agency has a duty to "exercise a general supervision over all matters relating to flood defence." Through its Regional and Local Flood Defence Committees, the Agency manages flood risk by:

- supervising all matters relating to flood defence in England and Wales;
- conducting surveys of flood risk areas;
- advising planning authorities on the implications of development proposals on flood risk issues and the environment;
- carrying out works, where appropriate, to reduce the risks of flooding from designated main rivers and the sea;
- issuing flood warnings and preparing written Dissemination Plans;
- clearing obstructions from rivers which may cause a flood hazard;
- using powers to consent to works that may affect flood risk;
- carrying out enforcement activity where appropriate; and
- educating the public on flood risk and the measures they should take

**D9.** The Agency has limited direct powers to control activities affecting main river channels and flood defences and impacting on the functions of floodplains through:

- The Environment Act 1995
- The Water Resources Act 1991
- The Land Drainage Act 1991 (as amended 1994)
- Environment Agency Byelaws
- Private Acts

**D10.** The Agency is therefore dependent upon an effective planning system to ensure the protection of the environment and to prevent future problems arising as a result of development in areas at risk of flooding. It is a statutory consultee for structure plans, for environmental assessment under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 and, under the Town and Country Planning (General Development Procedure) Order 1995 for development:

- Involving or including mining operations;

- Involving the carrying out of works or operations in the bed or on the banks of a river or stream;
- For the purpose of refining or storing mineral oils and their derivatives;
- Involving the use of land for the deposit of refuse or waste;
- Relating to the retention, treatment or disposal of sewage, trade-waste, slurry or sludge;
- Relating to the use of land as a cemetery;
- Within 250m of land which has been used for the deposit of refuse or waste; and
- For the purpose of fish farming.

### **Internal Drainage Boards**

**D11.** Internal Drainage Boards have powers under the Land Drainage Act 1991 to carry out measures to alleviate flooding in districts with special drainage needs, other than on main rivers. There are 235 internal drainage boards in England, in lowland parts of the country, often below sea level, eg East Anglia and the Fens.

### **Local Authorities**

**D12.** For watercourses not designated as main rivers, local authorities have powers, under the Land Drainage Act 1991, as amended by the Land Drainage Act 1994, to maintain or improve existing works or construct new works, except in internal drainage districts. Local Authorities also have certain powers of enforcement on ordinary watercourses. They can make byelaws that apply to ordinary watercourses to ensure the efficient working of the drainage system, and to the coast. Local authorities are also responsible for co-ordinating emergency plans of local bodies responding to major flood emergencies. As highway authorities, they are responsible for draining highways. This includes preventing water from flowing onto a highway, together with certain responsibilities for bridges and culverts under the Highways Act 1980.

### **Maritime local authorities**

**D13.** Maritime local authorities have permissive powers to carry out works to protect against coastal erosion or inundation by the sea.

## **Appendix E - Sustainable Drainage Systems**

**E1.** The disposal of surface water has long been a material consideration for local planning authorities in determining individual land-use planning proposals. Development reduces surface permeability by replacing vegetated ground with roofs and paved areas and through compaction of other areas by vehicular movements. This reduces the amount of water infiltrating into the ground and increases surface run-off. Any built-up area, therefore, needs to be drained to remove excess water. Traditionally this has been done using underground pipe systems designed for quantity, to convey water away as quickly as possible and thus prevent flooding locally. This increases the speed of run-off and can change the flooding regime of the catchment.

**E2.** The alteration of natural flow patterns in terms of increases in both the total quantity and peak flows of run-off through the extension of built development can lead to problems elsewhere within the river catchment, particularly flooding downstream. Increased flow rates can also cause erosion and damage stream and streamside habitats. Water quality issues are also important because pollutants from built up areas are washed into rivers or groundwater, harming fish and wildlife and being difficult to clean up. Because traditional drainage systems are designed to carry water away quickly without treatment, they cannot easily control poor runoff quality. They may also contribute to the problem where they feed into combined sewers of limited capacity and increase discharges to watercourses from combined sewer overflows. Amenity issues, such as water resources, community facilities, landscaping potential and the provision of wildlife habitats have largely been ignored in past planning and design of drainage systems. Continuing to drain built up areas without taking these wider issues into consideration is not a sustainable long-term option.

**E3.** Flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites through the use of sustainable drainage systems. This should be complementary to the control of development within the floodplain.

### **What are sustainable drainage systems?**

**E4.** Sustainable drainage systems use techniques to control surface water run-off as close to its origin as possible, before it enters a watercourse. This involves moving away from traditional piped drainage systems to engineering solutions that mimic natural drainage processes.

**E5.** A wide range of sustainable drainage options is available, from which promoters, designers, developers, planners, drainage specialists and civil engineers may choose in preference to piped drainage systems, including:

- preventive measures -- eg rain-water recycling, good-practice design and maintenance;
- filter strips and swales vegetated landscape features with smooth surfaces and a gentle downhill gradient to drain water evenly off impermeable surfaces, mimicking natural drainage patterns;
- filter drains and permeable and porous pavements permeable surfaces to allow rainwater and run-off to infiltrate into permeable material placed below ground to store water prior to discharge;
- infiltration devices -- below-ground or surface structures to drain water directly into the ground (soakaways, infiltration trenches, swales with infiltration and infiltration basins), which may be used at source or the run-off may be conveyed to the infiltration area in a pipe or swale; and
- basins and ponds structures designed to hold water when it rains; basins are free from water in dry weather, ponds contain water at all times and are designed to hold more when it rains; examples

include detention basins, balancing/attenuation ponds, flood storage reservoirs, lagoons, retention ponds and wetlands/reed beds.

**E6.** Local planning authorities and developers should seek advice from the Environment Agency, highways authorities and sewerage undertakers on the techniques available for sustainable drainage and their suitability for proposed development or redevelopment in specific locations.

### **Benefits of and constraints on sustainable drainage systems**

**E7.** Sustainable drainage systems can help reduce the environmental impact of development. Their use provides a significant contribution towards more sustainable development since they:

- manage environmental impacts at source, rather than downstream;
- manage water run-off rates, reducing the impact of urbanisation on flooding;
- protect or enhance water quality;
- are sympathetic to the environmental setting and the needs of the local community;
- provide opportunities to create habitats for wildlife in urban watercourses; and
- can encourage natural groundwater recharge (where appropriate).

**E8.** Although the benefits of sustainable drainage systems are secured principally at the river-catchment scale, their early consideration at all levels of the planning and development process can lead to opportunities for more imaginative and attractive developments. Surface water management using sustainable drainage systems can be implemented at all scales. It may start with prevention or good housekeeping measures and soakaways for individual premises and progress through the use of infiltration devices, tank storage or small basins for larger sites to basins and wetlands at the sub-regional scale. At any level, it can help to reduce the need for investment in flood management and protection works by mitigating the intrinsic additional flood risk that new development might otherwise generate. The use of sustainable drainage systems can in some circumstances allow development to proceed that would otherwise be refused because of the increased flood risk caused by run-off.

**E9.** While there are clear benefits to the use of sustainable drainage systems, there are also some constraints on the choice of system. The surface structures that may be needed can take more space than conventional systems. It is often possible, however, for them to be integrated into the surrounding land use, eg in public open space or road verges.

**E10.** Limitations to infiltration devices occur where

- the soil is not very permeable
- the water table is shallow
- the groundwater under the site may be put at risk; or
- infiltration of water into the ground, particularly if concentrated in a limited area, could adversely affect ground stability.

**E11.** For example, infiltration from particular types of development may be prohibited in groundwater protection zones or be subject to the need for investigation and appropriate additional treatment prior to discharge. Selection and design of infiltration systems needs to take account of the Environment Agency's *Policy and practice for the protection of groundwater*, together with

groundwater protection zone maps and groundwater vulnerability maps. The appraisal procedure recommended for non-mains sewerage in DETR Circular 3/99 could usefully be applied in planning for infiltration devices.

**E12.** Particular care is needed in designing sustainable drainage systems with appropriate capacity to handle run-off at their location. Contingency measures may be required to ensure that problems are not made worse when the intensity and/or duration of rainfall, and hence the quantity of run-off exceeds that for which the system was designed. This constraint applies equally to conventional drainage systems. In extreme events, sustainable drainage systems may, like other drainage systems be overwhelmed in that they will only deal with the rainfall event for which they are designed. They will assist, however, in reducing the initial impact of extreme events.

### **Implementation of sustainable drainage systems**

**E13.** Any perception that sustainable drainage systems are something new, and that the techniques are untried, is unfounded. There are numerous examples both in Britain and overseas of such systems being used successfully. These have required planners, developers, engineers, and architects to look at development in a more sustainable and imaginative way. While their use has not previously been the norm in the planning of development, the growing recognition of the impact of built development on run-off characteristics and the increasing emphasis on sustainable development will require that consideration be given to the use of drainage systems which control water as near its source as possible.

**E14.** Additional effort is often required at the conception and detailed stages of designing sustainable drainage systems. However, there is growing evidence that reduced implementation costs, as well as the general benefits of reduced overall flood risks and better control of pollution from urban run-off, more than compensate for this. Consideration of the following issues early in the planning and design stages is essential:

- integration of sustainable drainage systems into the overall site concept and layout;
- the need for investigation and subsequent remediation of contaminated land;
- agreements on adoption, maintenance and operation of the systems; and
- the need for monitoring long-term performance.

### **Promotion of sustainable drainage systems**

**E15.** The planning system can further the use of sustainable drainage systems by:

- incorporating favourable strategic policies within regional planning guidance and structure plans;
- adopting detailed policies for promoting sustainable drainage systems in local plans;
- persuading developers to adopt sustainable drainage systems wherever practicable, as part of all future development, if necessary through the use of appropriate planning conditions or by planning agreements; and
- developing joint strategies with the sewerage undertakers and the Environment Agency to further encourage the use of sustainable drainage systems.

## **Appendix F - Guidance On Requirements For Undertaking A Flood Risk Assessment**

**F1. This guidance relates only to the commissioning and undertaking of flood risk assessment studies at particular sites or over particular areas**

### **Flood Risk Assessments**

**F2.** Flood risk assessments may be of a relatively minor nature, evaluating a small development on a low risk site with minimal secondary effects, or may comprise major basin-wide studies for significant infrastructure developments. On occasions, preliminary or scoping studies may be undertaken prior to a fuller assessment. Developers should consult the Environment Agency and other relevant operating authorities to determine what information is already available on flood risk potentially affecting or affected by their site and its proposed development. They should also take full account of the local knowledge of flooding in the community.

**F3.** The detail and technical complexity of a flood risk report will reflect the scale and potential significance of the study but, in all cases, whenever a flood risk assessment is undertaken for any location, the resulting report should address, as a minimum, the following requirements:

1. A location plan at an appropriate scale that includes geographical features, street names and identifies all watercourses or other bodies of water in the vicinity. This should include drainage outfalls and, if necessary, cross-refer to their operational arrangements in the body of the report.
2. A plan of the site showing levels related to Ordnance Datum, both current and following development.
3. A more detailed indication, if appropriate, of flood alleviation measures already in place, of their state of maintenance and their performance.
4. An assessment of the source of potential flooding - rivers, tidal, coastal, groundwater, surface flow or any combination of these..
5. A plan of the site showing any existing information on extent and depth of flood events or on flood predictions. Information may be anecdotal, photographic, survey results or model estimates. The events should be identified with date/time, source of the data and supporting information provided on rainfall and/or return period, or probability of occurrence of the flood or storm surge event, or combination. Recorded data are particularly valuable and, if available, should be highlighted along with evidence of any observed trends in flood occurrence. Any changes that have taken place since the last event should be identified.
6. A plan and description of any structures which may influence local hydraulics. This will include bridges, pipes/ducts crossing the watercourse, culverts, screens, embankments or walls, overgrown or collapsing channels and their likelihood to choke with debris.
7. An assessment of the probabilities and any observed trends and the extent and depth of floods for the location and in the catchment context and, if appropriate, routes and speed of water flow. At this stage best estimates, based on the most up-to-date findings, should also be made of climate change impacts on probabilities. The assessment should ensure that the development meets an acceptable standard of flood defence for the design life of the development.
8. A cross-section of the site showing finished floor levels or road levels, or other relevant levels relative to the source of flooding, and to anticipated water levels and associated probabilities.

9. An assessment of the likely rate or speed with which flooding might occur, the order in which various parts of the location or site might flood, the likely duration of flood events and the economic, social and environmental consequences/impacts of flooding.
10. An assessment of the hydraulics of any drains or sewers, existing or proposed, on the site during flood events. The methodology for assessment must be clearly stated.
11. An estimate of the volume of water which would be displaced from the site for various flood levels following development of the site and of the run-off likely to be generated from the development proposed.
12. An assessment of the likely impact of any displaced water on neighbouring or other locations which might be affected subsequent to development. This should address the potential for change of the flooding regime both upstream and downstream of the site due to ground raising or flood embankments.
13. An assessment of the potential impact of any development on fluvial or coastal morphology and the likely longer-term stability and sustainability.
14. Because of the uncertainties in flood estimation and expected climate change impacts, hydrological analysis of flood flows and definition of defence standards should include the allowances for increased flows and sea-level rise in MAFF's project appraisal guidance for flood defence cited in Appendix A.
15. An assessment of the residual risks after the construction of any necessary defences. Where new or modified flood defence arrangements are provided, consideration should always be given to their behaviour in extreme events greater than those for which they are designed and information should be provided on the consideration given to minimising risks to life in such circumstances.

## **Appendix G - Warning Notices/Signs At Caravan And Camping Sites And Other Developments At Risk Of Flooding**

**G1.** All landowners are responsible for protecting their property against flooding. If their site constitutes a place of work, they may also incur duties under the Health and Safety at Work etc Act 1974. Where the public is invited or allowed to enter a site, owners and occupiers may also incur liabilities under the Occupiers Liabilities Acts. Any owner of property within an area of flood risk should, therefore, be aware of the degree of risk and its extent and take appropriate action in regard to warnings and emergency procedures.

### **Caravan and camping sites**

**G2.** Caravan and camping sites give rise to particular problems because of the special risks to occupants at times of flooding. Because of the attractions of a riverside or coastal location, such sites are often located in areas with a high risk of flooding where protection works may be impractical or uneconomic. Site owners within an area of flood risk, should seek advice based on the information held by the Environment Agency on the risks posed to those sites, namely on:

- the likelihood of flooding;
- the extent and likely depth of flooding;
- the flow rates which may be expected;
- the advance warning of flooding they could expect to receive: and
- routes for safe access and egress in the event of flood.

**G3.** Site owners should then consult the local authority, police and fire service, on the emergency procedures that should be put in place. On the basis of this advice they should prepare safe and effective plans for action to be taken in the event of a flood at the site and ensure that any person who resides in a caravan or tent on that site is informed of:

- the degree of risk; and
- the action to be taken in the event of a flood.

**G4.** Where a caravan or tent is brought on to a caravan or camping site for private short-term use, this information should be drawn to the attention of the person occupying it on arrival or registration. Where caravans or tents are situated at a caravan or camping site for long-term rental or occupation, the information should form part of the documentation relating to the occupation of the site or pitch. A fixed sign should also be displayed permanently at each entrance to the site giving this information. Such signs should be kept up-to-date if the information changes.

**G5.** Where planning permission is granted or a licence to operate is issued for caravan and camping sites, any part of which is in an area of flood risk, a condition should be attached requiring the provision of flood risk information to all persons occupying pitches on the site and the erection of suitable permanent warning notices. In the case of sites that are already permitted or licensed, or those for which no licence or planning permission is required, owners are strongly advised to follow the principles described above in respect of their consideration of flood risk issues.

## **Hotels, hostels and guest houses**

**G6.** Owners of hotels, hostels or guesthouses in areas at risk of flooding, should also seek advice on the basis of information held by the Environment Agency on the flood risk to their site. They should also establish the emergency procedures to be followed in the event of a flood and provide this information to each person temporarily resident at their premises. This should be done both on registration on arrival and by displaying notices on or beside the door of each unit of sleeping accommodation.

## **Other development in areas of flood risk**

**G7.** Employers and owners with premises in areas of flood risk have a duty under the Health and Safety at Work etc Act 1974 to ensure, as far as is reasonably practical, that their premises are maintained in such a way that employees and people using their premises can carry out their work without endangering their own health and safety or the health and safety of others. In some circumstances, this may require them to establish within the health and safety document suitable emergency procedures for any risks to their employees and other persons on their premises, including flooding. This is particularly important where sites are designed to attract the public, especially young children and old people (health centres, leisure centres, theme parks etc) or where large numbers of people may be expected to be present (eg shopping and recreational areas). In furtherance of this they should seek similar advice on the basis of information held by the Environment Agency on the risks of flooding to their premises and post appropriate notices on site.