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PLANNING

Planning Policy Statement 25:
Development and Flood Risk
Practice Guide



Planning Policy Statement 25:

Development and Flood Risk Practice Guide

December 2009
Department for Communities and Local Government

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Updating the PPS25 Practice Guide

Summary of main changes

This update of the practice guide replaces the version of the guide that was published on the Communities and Local Government website in June 2008. It reflects the intention announced at the time of publication to keep the guide fresh and relevant through periodic updates.

Our approach to this update is explained in paragraphs 1.11-14 below. Many of the amendments made are relatively minor and it would not be appropriate or helpful to list every change here. However, **your attention is drawn to the following more substantial changes from the June 2008 version of the guide:**

Chapter 2: Taking flood risk into account in the planning process

Additional advice on applying the sequential approach at the regional level over a longer time frame – see paragraph 2.14.

Reference to the role of waste and mineral planning authorities as ‘lead local flood authority’ paragraph 2.30.

Clarification on the provision of a site-specific flood risk assessment (FRA) with a planning application – see paragraphs 2.35-36, also paragraph 3.82.

Emphasis on the need to consult British Waterways, when appropriate – see paragraph 2.59.

New case studies illustrating planning appeals where a sequential approach has not been properly followed, and new and updated case studies illustrating strategic approaches to managing flood risk.

Chapter 3: The assessment of flood risk

Reference to Environment Agency mapping of areas susceptible to surface water flooding and advice on the use of this map in spatial planning, particularly in flood risk assessment – paragraphs 3.8 & 3.9 & 3.27.

Guidance on the chance of flooding occurring during the lifetime of a development – see paragraph 3.14 and associated footnote.

Clarification that flood risk appraisal/assessments do not have to be supervised by someone with chartered status – see paragraph 3.20.

Further advice on undertaking strategic flood risk assessments (SFRA) – see paragraphs 3.40-3.44, and 3.64.

Further advice on the issues relating to guidance provided within SFRAAs, including on the role of surface water management plans – see paragraphs 3.70-79.

Further guidance on the need for a proportionate approach to FRAs – see paragraph 3.86.

Updated guidance on climate change impacts – see paragraphs 3.96-3.98. Also paragraph 6.41 in relation to the design of flood risk management measures.

New and updated case studies on regional flood risk appraisal, SFRAAs and site-specific FRAs.

Chapter 4: The Sequential and Exception Tests

Updated guidance on applying the sequential approach to other sources of flooding, including use of Environment Agency mapping of areas susceptible to surface water flooding – see paragraphs 4.11-4.12.

Further advice on the application of the Sequential Test, including on the availability of alternative sites – paragraph 4.19 & 4.25, and in relation to regeneration areas – paragraph 4.38 and wind farms – paragraph 4.39.

Updated advice on sequential testing of site allocations, informed by a SFRA, when local development documents are reviewed or being finalised – paragraph 4.22.

Clarification on the approach to a proposed change of use of land to a caravan or camping (or similar) site – paragraphs 4.43-4.44.

Additional guidance on the ‘what is safe’ element of the exception test – paragraphs 4.54-4.68.

Clarification of the approach to developments containing different elements of vulnerability to flood risk – paragraph 4.73.

Expansion of advice on the application of the policy to critical infrastructure – paragraph 4.82.

Further clarification on defining functional floodplains – paragraph 4.94.

New case studies on applying the sequential approach/test, including the role of SFRA.

Chapter 5: Managing surface water

Further guidance on sustainable drainage systems (SUDS) – paragraphs 5.14, 5.17-5.24 and on the adoption and maintenance of SUDS – paragraphs 5.28-5.30.

Updated guidance on surface water management plans, integrated urban drainage and water cycle studies – paragraphs 5.37-5.46

Updated advice on the right to connect foul drainage to public sewers – paragraph 5.52.

Updated guidance on permitted development rights and permeable surfaces – paragraphs 5.55-5.57.

New and updated case studies illustrating surface water management and the use of SUDS.

Chapter 6: Risk management by design

Update on changes to UK Climate Change Projections in relation to flood risk management measures – paragraph 6.41.

Updated guidance on insurance issues – paragraph 6.49.

New case studies with examples of upstream flood storage, developer contributions to flood alleviation schemes and innovative design.

Chapter 7: Residual risk

Advice on the need to consult British Waterways, where appropriate – see paragraph 7.6.

Additional factors to be taken into account in assessing residual flood risk associated with overtopping or breaching of a flood defence – paragraph 7.13.

Further and updated guidance on emergency planning and inundation maps for flooding from reservoirs – paragraphs 7.18-7.20.

Updated case study on SFRA and residual flood risk.

Appendix A : PPS25 in context with other national planning policy

Updated in relation to other national planning policy.

Appendix B: Flood Risk Assessment (FRA) checklist

Formerly appendix C, providing a FRA pro-forma, now amended to make clear that this form should be used as a checklist (or aide-memoire).

1 Introduction

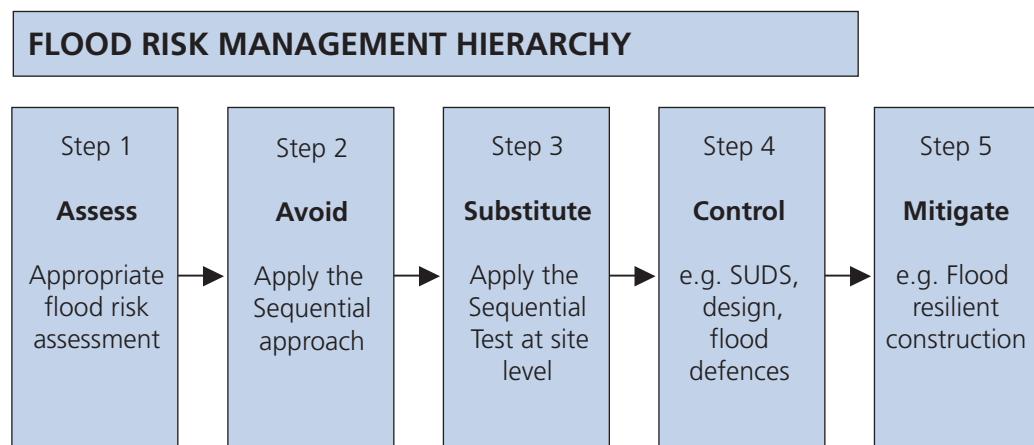
- 1.1 Planning Policy Statement 25 (PPS25) *Development and Flood Risk (Communities and Local Government 2006)* is about positive planning at all levels to deliver appropriate sustainable development in the right places, taking full account of flood risk. PPS25 sets out the policy approach. This practice guide explains further how to implement this approach.
- 1.2 PPS25 is part of the holistic approach to managing risk set out in the Government's strategy for flood and coastal erosion management, *Making Space for Water (Defra 2005)*. Planning has a key role to play in avoiding and reducing the risk from floods.
- 1.3 Flooding from rivers and coastal waters is a natural process that plays an important role in shaping the natural environment. But flooding can cause substantial damage to property and threaten human life, as the floods of summer 2007 showed. Such damage is a consequence of previous decisions about the location and nature of settlement and land use. It cannot be prevented entirely, but its effects can be reduced. We can manage new development in a way that ensures risks do not increase and can even be reduced.
- 1.4 The aim of our policies for managing flood risk through the planning system is to avoid such inappropriate development in flood risk areas. The key message of PPS25 is to avoid such inappropriate development and to locate development away from flood risk whenever possible. The approach it adopts to do this is to assess risk so it can be avoided and managed. This can be summarised in the following:

assess – avoid – substitute – control – mitigate

The hierarchy used in this practice guide further develops the *appraise, manage and reduce* flood risk approach in PPS25. This guide shows how this can be done in practice.
- 1.5 Flood risk is likely to increase because of climate change. Firm application of planning policy should mean risks can be managed allowing sustainable development to continue to benefit communities, the economy and the environment. The *Stern Review on the Economics of Climate Change (HM Treasury 2006)* pointed out that spatial planning is important in managing long-term flood risk, by encouraging private and public investment towards locations that are less vulnerable to climate risks including flooding.
- 1.6 Sir Michael Pitt's review of the summer 2007 floods (Cabinet Office 2008) supported PPS25 planning policy and urged that it should be rigorously applied by local planning authorities. His final report recommended that the operation and effectiveness of PPS25 should be kept under review and strengthened if and when necessary.

HOW WILL THIS GUIDE HELP YOU

- 1.7 The guide complements PPS25 by offering guidance on how to implement its policies in practice. It draws on existing good practice, through case studies and examples, to show how regional planning bodies and local planning authorities can deliver the national policies in PPS25 in the light of their own varying circumstances.
- 1.8 Each chapter is set within the context of the overall flood risk management hierarchy which is explained further in chapter 2:



- 1.9 At the beginning of each chapter this summary flow chart shows which part of the process the chapter relates to. It acts as a reminder that these steps are sequential. So, for example, you can only conclude that mitigation (step 5) is a possible solution to developing in areas at risk of flooding, if all the previous steps have been considered first. The hierarchy is colour coded as follows:

	Green	step(s) relevant to chapter
	Yellow	step(s) covered in previous chapters
	Blue	step(s) covered in following chapters

Chapter 2 – Taking flood risk into account in the planning process explains how Regional and Sub-Regional Spatial Strategies, Local Development Documents (LDDs) and Sustainability Appraisals should take flood risk into account in a strategic way. It also explains what PPS25 means for those responsible for deciding individual planning applications. An overview of the role of the various parties in the planning process is also provided.

Chapter 3 – The assessment of flood risk provides guidance on how to do Regional Flood Risk Appraisals, Strategic Flood Risk Assessments and site-specific Flood Risk Assessments.

Chapter 4 – The Sequential and Exception Tests explains how to apply the sequential approach generally and how to apply the Sequential Test at a local level. It also describes how to apply the Exception Test where this is relevant.

Chapter 5 – Managing surface water provides guidance on the spatial planning considerations of a range of measures for mitigating the adverse impacts of conventional drainage systems. An overview of the principles of sustainable drainage systems (SUDS) is provided together with signposts to relevant technical guidance on the design, implementation, maintenance and adoption of sustainable drainage measures. The role of Surface Water Management Plans in the planning system is also covered.

Chapter 6 – Risk management by design outlines a range of measures that can be implemented to reduce flood risk at development sites to an acceptable level.

Chapter 7 – Residual risk describes some of the key residual risk issues and outlines a range of possible management measures. The chapter discusses the limitations of measures designed to protect developments in flood risk areas.

WHO SHOULD USE THE GUIDE

- 1.10 The guide is aimed at regional and local planning officers, as well as development control officers. An important principle of PPS25 is that flood risk should be considered at all levels of the planning process. But it will also be relevant to anyone involved in the planning process such as:
- developers and their agents who need to understand how the planning process assesses flood risk and what is required to ensure that development is being located in appropriate places and designed to achieve the aims of PPS25
 - individuals with planning applications where flood risk is an issue, to help them minimise and where possible reduce flood risk overall
 - other stakeholders who are involved in development and flood risk; and
 - community groups who want to understand how the planning system deals with development in flood risk areas.

HOW THIS UPDATE OF THE GUIDE WAS PREPARED

- 1.11 This update (December 2009) of the practice guide replaces the version of the guide that was published by Communities and Local Government in June 2008. It reflects the intention to update the guide at periodic intervals to keep it fresh and relevant.
- 1.12 Communities and Local Government have recently undertaken an initial review of the implementation of PPS25. The findings were broadly positive and were followed up by a letter to local planning authorities in May 2009, drawing their attention to the review's findings. The letter emphasised the importance of reducing flood risk to and from new development through the application of PPS25, as recommended by Sir Michael Pitt in his final report published in 2008. Sir Michael's final report recommended that the operation and effectiveness of the policy in PPS25 should be kept under review and strengthened if and when necessary. The review and update of this practice guide (which supports the policy) is in keeping with Sir Michael's recommendation, and carries forward what the Government said about its intention to update the guide in its response to Sir Michael's review, published in December 2008.
- 1.13 This update of the practice guide reflects current and, as far as it is possible to do so, emerging Government policy. It also takes into account any relevant legislation enacted since the guide was published in June 2008. Any further legislative measures which have a bearing on the matters covered by this guide will be reflected in future updates.
- 1.14 As well as reflecting these developments, this update of the guide draws on:
 - feedback from practitioners, both in the light of implementing PPS25 policy in practice, and in identifying certain circumstances where further clarification of the wording in the guide would be of benefit; and
 - input from staff at the Environment Agency, Department for Environment, Food and Rural Affairs (Defra) and members of the Practice Guide Advisory Group.
- 1.15 Our thanks are due to all of those who have helped contribute to this update of the guide.

STATUS OF THE GUIDE

- 1.16 This guide is intended to support and facilitate the implementation of the Government's national planning policies on development and flood risk as set out in PPS25. As such, it should be taken into account by regional planning bodies and local planning authorities in the preparation of regional spatial strategies and LDDs and when deciding planning applications.

- 1.17 The use of examples taken from any development plan prior to its adoption is without prejudice to the Secretary of State's rights of objection or direction in respect of plan policies, or to call in plans for his own determination. The use of any example, whether from an adopted plan or otherwise, is also without prejudice to any decision the Secretary of State may wish to take in respect of any planning application coming before him as a consequence of a policy included in an example in this guide.
- 1.18 Where other published or electronically available material is cited, apart from Government documents, this is intended to provide pointers to good practice and does not necessarily confer full endorsement or adoption of the content by Communities and Local Government.
- 1.19 The case studies used are intended to suggest good practice in ways of working, rather than full endorsement of a particular proposal or decision.
- 1.20 Also included with this update of the guide are a number of recent decisions made on planning appeals to the Secretary of State, where the Planning Inspector has taken the view that the development proposal has not been in accordance with the policy approach in PPS25.

FURTHER INFORMATION AND REFERENCES

Making Space for Water, DEFRA, 2005.

Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.

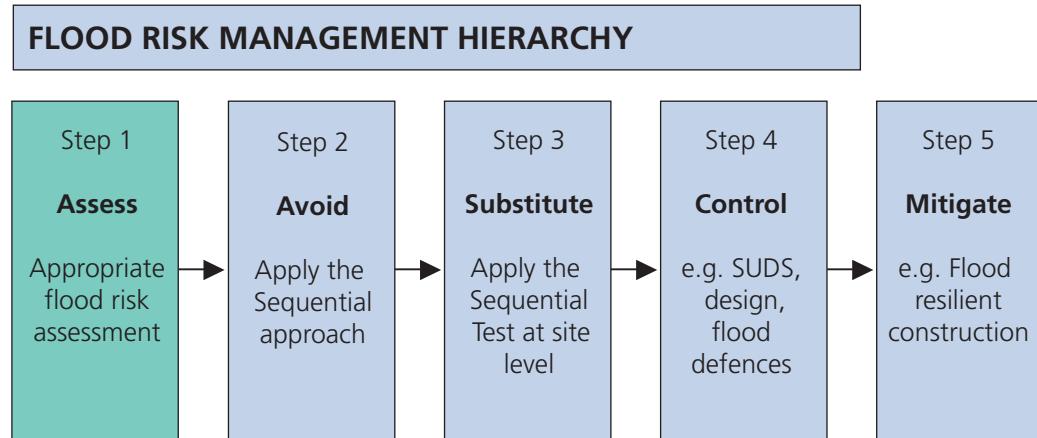
Stern Review on the Economics of Climate Change, Cabinet Office – HM Treasury, 2006.

The Pitt Review: *Lessons Learned from the 2007 Floods*, Cabinet Office, 2008.

The Government's Response to Sir Michael Pitt's Review of the Summer 2007 Floods, DEFRA, 2008; and *Progress Report*, Defra, 2009.

Initial review of the implementation of Planning Policy Statement 25: Development and Flood Risk, Communities and Local Government, 2009.

2 Taking flood risk into account in the planning process



INTRODUCTION

- 2.1 This chapter explains how flood risk should be taken into account at all levels of the planning system. By doing so inappropriate development can be avoided in flood risk areas which will help deliver sustainable development into the future.
- 2.2 Planners have a key role in managing flood risk through the hierarchy above. The planning system is the main way to avoid and reduce flood risk to and from new development. It also offers opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.
- 2.3 PPS25 is part of the plan led approach to spatial planning. The aim is to set broad policies and allocations for an area taking full account of flood risk. Once spatial plans are adopted there should be greater certainty that development can proceed in those allocated areas. Individual planning applications which conform to plan policies should be straightforward in granting planning permission, subject to other material considerations, as the principles for development will already have been appraised in the formulation of the plans.

MANAGING FLOOD RISK STRATEGICALLY

- 2.4 All forms of flooding (see figure 3.2) and their impact on the natural and built environment are material planning considerations. PPS25 requires flood risk to be taken into account at all stages of the planning process to avoid inappropriate development. This means using the hierarchy above at the same time as taking account of:
 - the nature of flood risk;
 - the spatial distribution of flood risk;
 - climate change impacts; and
 - the degree of vulnerability of different types of development.

- 2.5 The spatial planning approaches advocated in PPS25 (including the emphasis on close partnership working) can assist with the strategic management of flood risk, whilst realising the opportunities to improve the quality of the built and natural environment. Illustrative case studies of these approaches being put into practice can be found at the end of this chapter.
- 2.6 Figure 2.1 summarises how the spatial planning process should do this. The outcome should be a strategic approach to flood risk management at all levels following the flood risk management hierarchy so that a sequential approach is applied to the location of new development.

Figure 2.1 Overview of how the spatial planning process can manage flood risk strategically

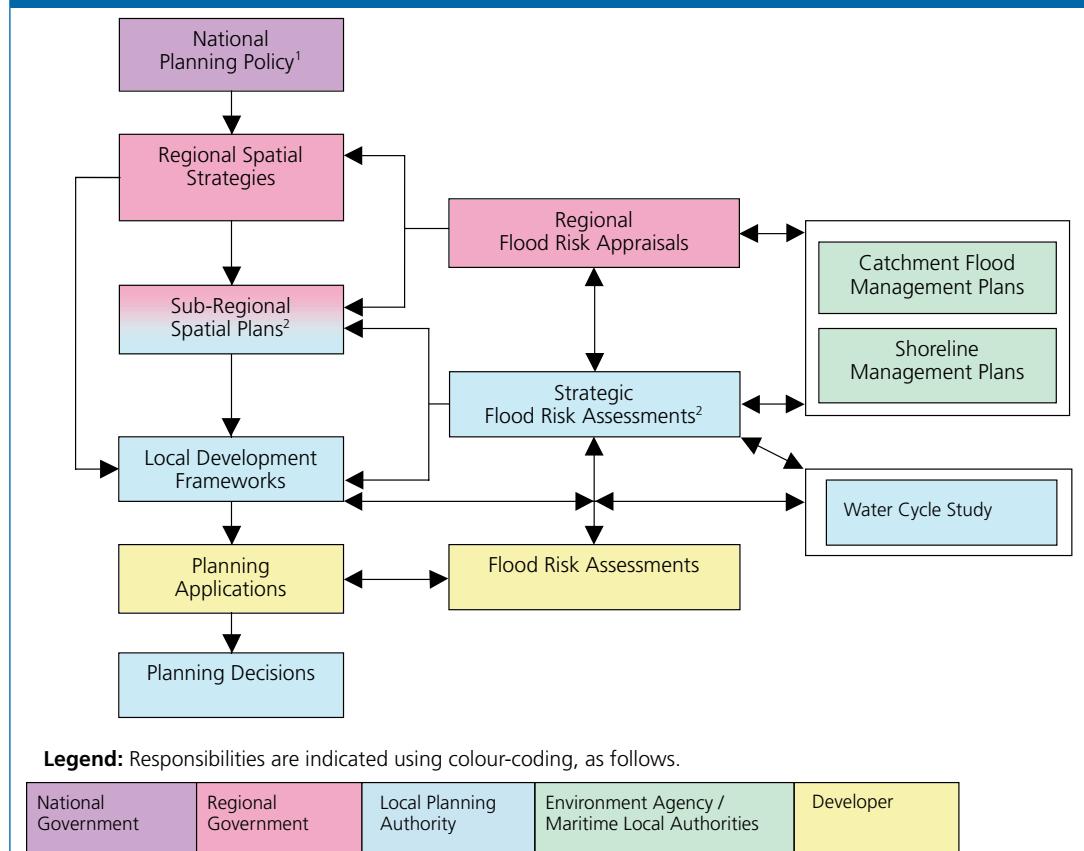
Flood Risk Management Stage	What it means	How the planning system deals with it	Who is responsible
Assess	Undertake studies to collect data at the appropriate scale and level of detail to understand what the flood risk is.	Regional Flood Risk Appraisals, Strategic Flood Risk Assessments, Flood Risk Assessments and application of the sequential approach.	Planning bodies and developers.
Avoidance/ Prevention	Allocate developments to areas of least flood risk and apportion development types vulnerable to the impact of flooding to areas of least risk.	Use the Sequential approach (including the Sequential Test and Exception Test where relevant) to locate development in appropriate locations.	Planning bodies and developers.
Substitution	Substitute less vulnerable development types for those incompatible with the degree of flood risk.	At the plan level, the Sustainability Appraisal should show how flood risk has been weighted against other sustainability criteria.	Planning bodies and developers.
Control	Implement flood risk management measures to reduce the impact of new development on flood frequency and use appropriate design.	Use River Basin Management Plans, Catchment Flood Management Plans, Shoreline Management Plans, Surface Water Management Plans, Flood Risk Management Strategies, appraisal, design and implementation of flood defences.	Planning bodies, Environment Agency and other flood and coastal defence operating authorities, developers and sewerage undertakers. Developers are responsible for design of new developments.

Figure 2.1 Overview of how the spatial planning process can manage flood risk strategically (continued)

Flood Risk Management Stage	What it means	How the planning system deals with it	Who is responsible
Mitigation	Implement measures to mitigate residual risks.	Flood risk assessments. Incorporating flood resistance and resilience measures. Emergency Planning Documents. Implementation of flood warning and evacuation procedures.	Planning bodies, emergency planners, developers, the Environment Agency, other flood and coastal defence operating authorities and sewerage undertakers.

- 2.7 Figure 2.2 shows who is responsible for producing the key documents required to manage flood risk through each stage of the spatial planning process. It also shows the link with other strategic documents prepared by flood and coastal defence operating authorities.

Figure 2.2 Key documents in the spatial planning process and their links with other key strategies for managing flood risk



Notes

1 Including Planning Policy Statement 25 '*Development and Flood Risk*' and the other flooding-related national planning policies listed in Appendix A of this Practice Guide.

2 Strategic Flood Risk Assessments may cover more than one local planning authority (LPA). The adoption of a catchment-based approach by a number of LPAs working in partnership could be highly beneficial and is strongly recommended as a means of looking strategically at flood risk issues across local authority boundaries.

3 This diagram has been developed from the original within *Flood Risk Assessment Guidance for New Development Phase 2 R&D technical report FD2320/TR2* (Defra and Environment Agency, 2005).

- 2.8 This strategic sequential approach (see chapter 4) is quite different from one which simply tries to match land uses to areas or zones with an ‘acceptable’ level of flood risk. Under PPS25 (annex D table D.1 defines flood zones) planners should steer development to Flood Zone 1, the zone of lowest flood risk, wherever possible. Where there are no reasonably available sites in Flood Zone 1, planners should consider reasonably available sites in Flood Zone 2, applying the Exception Test if necessary. Only where there are no reasonably available sites in Flood Zones 1 or 2, should sites in Flood Zone 3 be considered. The examples below are illustrations of planning applications that have been considered on appeal, where a sequential approach has not been properly followed and, as a consequence, has had a bearing on the appeal decision reached.

Examples of planning appeal decisions

Debenham, Stowmarket – a planning appeal dismissed on Sequential Test grounds

The planning application (to build a detached two-storey dwelling and detached cart lodge adjacent to the River Deben) was refused by Mid-Suffolk District Council.

There was disagreement between the parties over the level of flood risk. The latest Environment Agency Flood Map showed the site falling within Flood Zone 3 and recent modelling suggested that part of it fell within Zone 3b, the functional floodplain. On the basis of this assessment the Agency maintained an objection in principle to the scheme.

The Council's Strategic Flood Risk Assessment (SFRA) pointed to the site being within Zone 3 when climate change was taken into account as recommended in PPS25, and that a small section along the river frontage may be within the functional floodplain. The appellant pointed to site specific modelling and assessment demonstrating that the site almost entirely lay outside the 1:100 year flood event, and that even allowing for climate change, flooding would only encroach onto part of the site. This put the site into Zones 2 and 3 on the basis of the appellant's assessment.

Continued



The ford at Water Lane, Debenham, near the proposed development site when dry and in flood. Images courtesy of the Environment Agency and Mr P Carter

Debenham, Stowmarket – a planning appeal dismissed on Sequential Test grounds (continued)

The planning inspector judged there was a clear need for a precautionary approach and therefore considered the site should be regarded as being primarily within Flood Zone 3a, with a high probability of fluvial flooding.

In applying the Sequential Test the inspector noted there was no common ground about the area to which the Test should be applied. The inspector judged that it should be applied not just to Debenham, as argued by the appellant, but that it was reasonable to have regard to alternative sites with a lower probability of flooding within areas which are more or equally sustainable when compared with the appeal site, and which also contribute to the sustainability of the settlement which they are in. The Test should therefore be applied over a wider area as covered by the new local development framework Core Strategy, as argued by the Council.

The inspector judged that it was appropriate to consider other “reasonably available sites” for one market-provided dwelling, which was not intended to meet any specific affordable, local or other identified housing need, against the supply of sites which could meet broad housing market requirements over a wider area, particularly in locations of equal or greater sustainability. The appellant had not sought to do this exercise and there was no evidence to demonstrate that on this wider basis there were no other sites where the development could be located.

The inspector found the sequential testing carried out by the appellant as misapplied, that it had not been demonstrated that there were no other reasonably available sites in locations at a lower risk of flooding, and therefore the proposal failed to meet the Sequential Test.

The appeal was dismissed.

Maldon, Essex – a planning appeal dismissed on Sequential Test grounds

The planning application site was located in Flood Zone 3a, at risk of flooding from the Blackwater Estuary. The application was for a mixed development, including 13 new dwellings, commercial development and car parking to replace existing buildings previously used mainly for storage and maintenance of boats associated with the canal. This had been refused by Maldon District Council, partly because the site did not satisfy the PPS25 Sequential Test, there being both sites in the immediate vicinity at lower flood risk and capacity elsewhere in the district to ensure a 15-year supply of housing land.

The appeal inspector found that in the absence of any substantiated evidence to demonstrate there were no reasonably available sites in areas of lower flood risk, and having regard to the precautionary principle, she was unable to conclude that the proposal passed the Sequential Test. The Inspector also considered whether the proposal would pass the PPS25 Exception Test, but concluded that it did not satisfy the first 'sustainability' criteria of the test. She also found that taking the impact of climate change into account, the site was at risk of inundation in a 1 in 200 year breach of tidal defences, and that safe access and egress could not be achieved in such an event.

In conclusion, the inspector found on balance that the proposal would not represent an acceptable form of development, having regard to its location in Flood Zone 3a and the policy in PPS25. The appeal was refused.

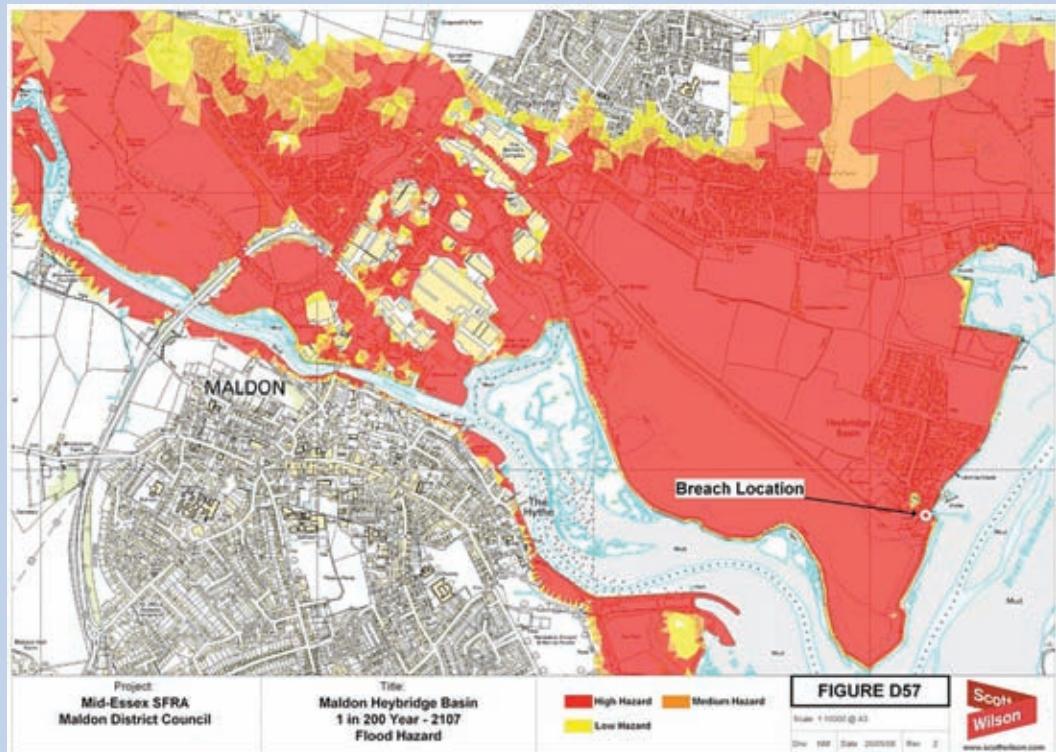


Image courtesy of Maldon District Council

Brentmead Place, Barnet, London – a planning appeal dismissed on the lack of a Sequential Test

The planning application site was located partly within Flood Zone 3a and partly within Zone 3b, the functional flood plain. The application (to replace derelict houses with new build residential student accommodation) was refused by the Council of the London Borough of Barnet.

The applicant failed to provide documents that met the minimum requirements for a Flood Risk Assessment. Evidence for the PPS25 Sequential and Exception Tests was provided subsequently. The Sequential Test was based on certain wards in the Borough of Barnet, based on the incorrect assumption that the development was associated with the Hendon campus of Middlesex University.

The appeal inspector considered the lack of association with any particular university. She took into account the definition of 'student' in both the signed and draft unilateral undertakings, and guidance in the PPS25 Practice Guide stating that the area to apply the Sequential Test will be defined by local circumstances relating to the catchment area of the development. She judged the minimum area of search should have been the whole of the Borough of Barnet.

It was considered that the appellant had failed to demonstrate that there were no reasonably available sites in Flood Zones 1 or 2. In addition the information submitted for the Exception Test did not demonstrate that the proposal would provide wider sustainability benefits that would outweigh the risk of flooding. The access route to the site would be flooded in a flood event, therefore safe access and egress to the site may not be possible. The increase in the development footprint would reduce the flood storage capacity of the site and may lead to an increase in flooding elsewhere. Accordingly, it was found that the development proposal did not pass the Exception Test, and the Sequential Test had not been appropriately applied.

In conclusion, the inspector found that the proposed development failed to comply with policy as set out in PPS25. Taking this into account with other concerns, she dismissed the appeal.

Decision-making and the role of sustainability appraisal

- 2.9 Those preparing Regional Spatial Strategies (RSSs) and Local Development Documents (LDDs) have to maintain a balance between considerations of flood risk and the various other sustainable development drivers, as well as regional targets for housing, economic growth and brownfield targets. One way in which flood risk can be considered within the wider context of sustainability is through the Sustainability Appraisal (SA) process. In order for flood risk to be properly evaluated at the SA stage, an appropriate Regional Flood Risk Appraisal and/or Strategic Flood Risk Assessment (see chapter 3) needs to be undertaken. The approach in figure 2.1 provides the evidence-base required to ensure that the decision-making process takes adequate account of flood risk issues.
- 2.10 The purpose of a SA is to promote sustainable development through the integration of social, environmental and economic considerations into RSSs and LDDs. SA for RSS

revisions, new or revised LDDs and supplementary planning documents, is a requirement of The Planning and Compulsory Purchase Act 2004 and must also incorporate the requirements of the Strategic Environmental Assessment Directive. Government guidance and a methodology that seeks to meet both the SA requirements and comply with the Directive is set out in *Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents: Guidance for Regional Planning Bodies and Local Planning Authorities*, (ODPM, 2005).

- 2.11 The first stage of the SA process is to set the context and objectives, establish the baseline and define a scope, which is set out in a Sustainability Appraisal Scoping Report. This report should identify the key sustainability issues or problems for the RSS or LDDs that it applies to. Avoiding and reducing the risk of flooding should be identified as a sustainability objective if it is a pertinent issue regionally or locally, and in some circumstances, it may be highlighted as a key sustainability issue.

THE KEY STAGES IN TAKING FLOOD RISK INTO ACCOUNT IN THE PLANNING PROCESS

REGIONAL SPATIAL STRATEGIES (RSSs)

- 2.12 A RSS should provide strategic policies for a region that are compatible with the requirements of PPS25. The policies for each RSS should recognise the flood risk issues unique to that region. Revisions to RSS should be consistent with Strategic Flood Risk Assessments (SFRAs), emerging Catchment Flood Management Plans, Shoreline Management Plans, Surface Water Management Plans and (when they are in place – the first phase of which will be in December 2009) River Basin Management Plans, which are being prepared in accordance with the Water Framework Directive.
- 2.13 PPS25 requires that regional planning bodies (RPBs) carry out Regional Flood Risk Appraisals (RFRA) to provide the evidence to support these policies. Guidance on how to produce a RFRA is given in chapter 3, and in figure 2.3 below.
- 2.14 In meeting its responsibilities under PPS25, the RPB should adopt a sequential approach in order to direct strategically significant growth areas towards locations with the lowest probability of flooding, taking account of the lifetime of the resulting development and the forecast impacts of climate change, wherever possible. In England just under 90 per cent of land is within Flood Zone 1, so at a regional scale there will be many opportunities to direct development in this zone. Chapter 4 provides further guidance on application of the sequential approach.
- 2.15 RPBs should demonstrate, in broad terms, with evidence, that they have applied the sequential approach to managing flood risk as part of the test of soundness of the RSS at the Examination in Public. The RPB should consider climate change (PPS25, Annex B) and the

impact that could have on whether existing and planned flood defences will be adequate in the future. The Environment Agency should be consulted to provide up-to-date information about their flood risk management strategies.

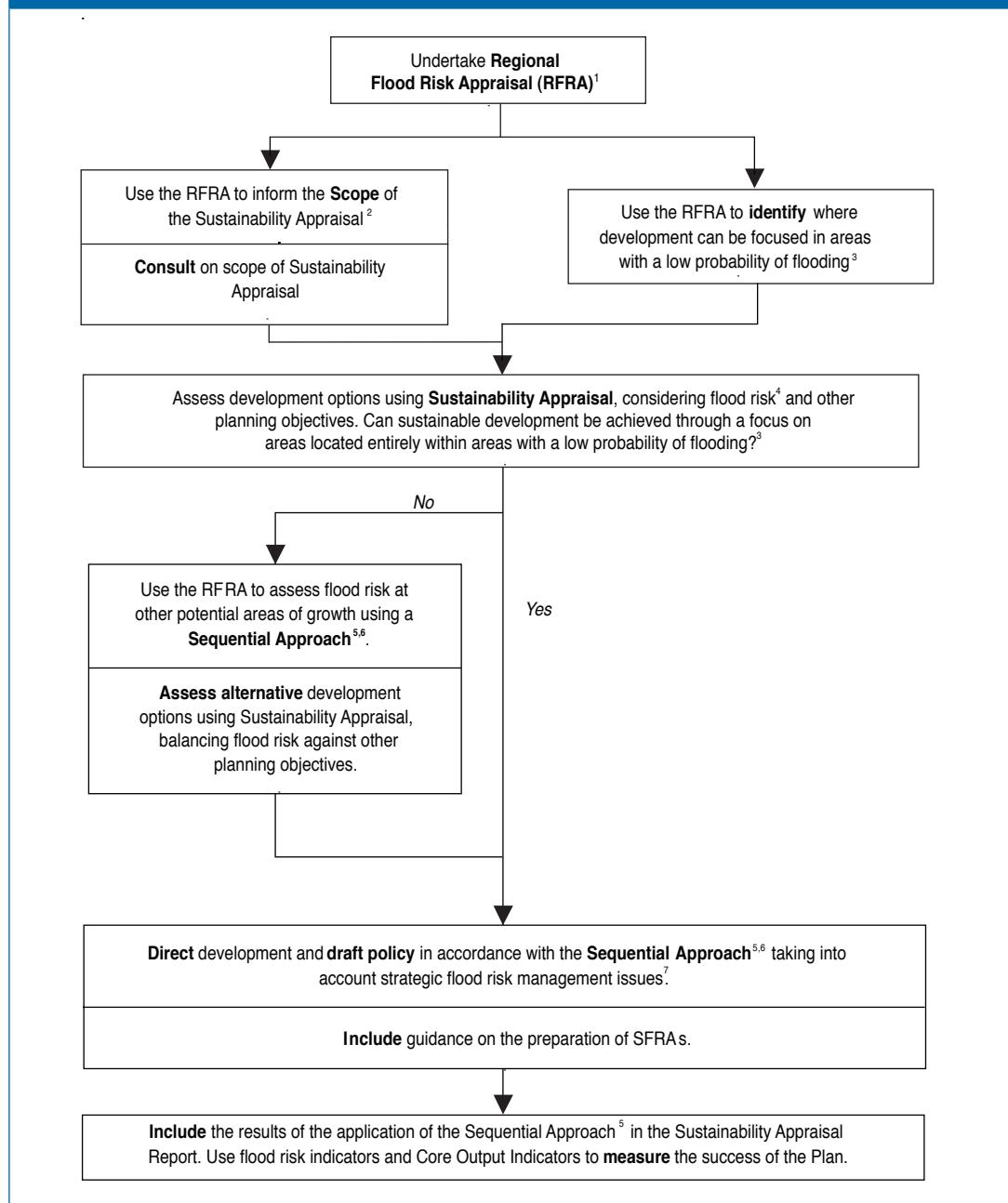
- 2.16 The RPB should indicate at the Examination in Public those instances where other sustainability criteria outweigh flood risk for reasons of regional or national importance and provide evidence of the decision making process. In these instances, the flood risk ‘avoidance’ and ‘substitution’ measures (see figure 2.1) are unlikely to be applied in full at the regional level and the onus to apply the Sequential Test falls with the local planning authority (LPA). An example of this would be the regeneration of an existing area which is a key priority to ensure its continued sustainability.
- 2.17 RPBs should consider the impacts of proposed development on the remainder of the catchment. RPBs should consider at a strategic scale whether there are opportunities to be gained to reduce flood risk to existing settlements through large-scale flood water storage schemes.
- 2.18 The RSS should include policies to limit the vulnerability of development in flood risk areas by establishing locational criteria to guide development allocation at the local authority level. Effective locational criteria will aid LPAs in applying the Sequential Test and help avoid the type of development that requires application of the Exception Test at the Local Development Document stage. This is an example of locational criteria:

‘Where it is necessary, following application of the Sequential Approach, to locate new development in Flood Zones 2 and 3, such development should be focused within areas where:

 - *the preferred policy option in the relevant Catchment Flood Management Plan or Shoreline Management Plan is to ‘hold the line¹ over the lifetime of the development*
 - *the standard of protection afforded by the existing defences is compatible with the land use type proposed*
 - *application of the sequential approach using completed SFRAs has been used to identify the areas within the zone that are at least risk, and*
 - *flood forecasting and warning systems, as well as flooding emergency response procedures, are well-developed’.*
- 2.19 Such criteria will help LPAs when they apply the Sequential Test. They will also help to keep to a minimum the number of cases where the Exception Test has to be applied.

¹ ‘hold the line’ refers to a policy of maintaining the existing flood defences and control structures in their present positions, and increasing the standard of protection against flooding in some areas.

Figure 2.3 Taking flood risk into account in Regional Spatial Strategies (RSSs)



Notes

1 Guidance on undertaking a RFRA can be found in chapter 3.

2 Guidance on developing the scope of SA can be found in ODPM (2005) *Sustainability Appraisal of Regional Spatial Strategies (RSS) and Local Development Documents (LDD)*. Guidance on suitable flood risk indicators can be found in *Flood Risk Assessment Guidance for New Development FD2320, D2.1*.

3 Flood Zone 1 for fluvial and tidal flooding and with a low risk of flooding from other sources.

4 Including an assessment of the potential effect of proposed development on surface water run-off.

5 Including the likelihood of the Exception Test being passed, where appropriate.

6 Including, in broad terms, consideration of the variability of flood risk within a Flood Zone from existing SFRAs.

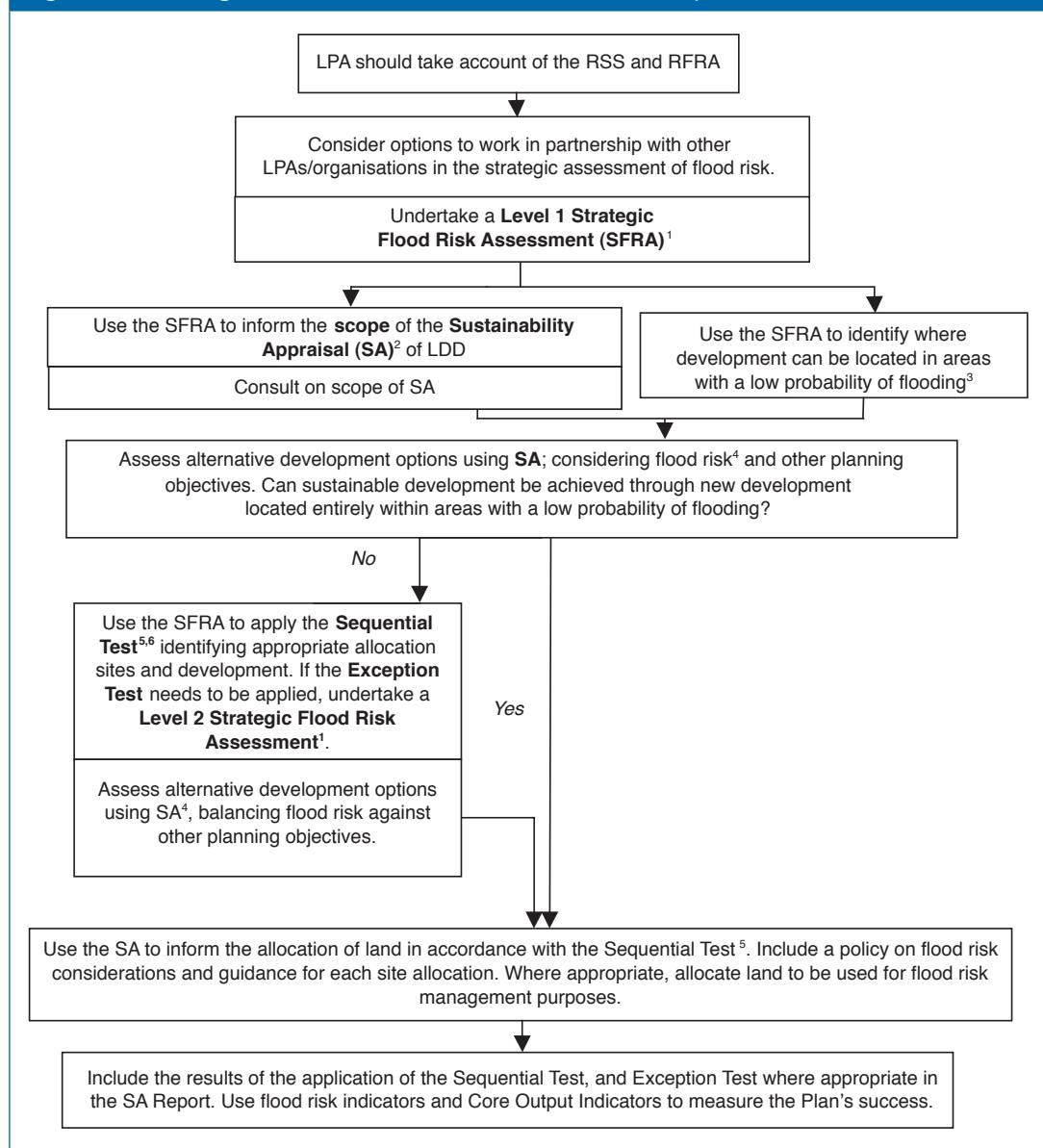
7 As identified through consultation with the Environment Agency and other operating authorities.

LOCAL DEVELOPMENT DOCUMENTS (LDDs)²

- 2.20 LDDs should deliver national and regional policy, while also taking account of specific local issues and concerns. The Core Strategy LDD should reflect the local planning authority's (LPA's) strategic planning policies and approach to flood risk. Site allocations should reflect the application of the Sequential Test, as well as guidance on how flood risk issues should be addressed at sites allocated within flood risk areas. Flood risk should be factored into LDDs in the detailed allocation of land use types across their area. Figure 2.4 illustrates this process.
- 2.21 PPS25 requires that LPAs prepare Strategic Flood Risk Assessments (SFRA) (see chapter 3) to an appropriate level of detail to allow the Sequential Test to be applied in the site allocation process. This is an essential part of the pre-production/evidence gathering stage of the plan preparation process. It is strongly recommended that LPAs consider whether it would be more effective to work jointly with other local authorities and stakeholders to prepare a sub-regional/county SFRA. The SFRA should take into consideration any regional guidance prepared by the RPB.
- 2.22 The SFRA will provide the baseline information for the Sustainability Appraisal (SA) of LDDs for the scoping and evaluation stages. It will also provide the evidence base for the application of the Sequential Test and the Exception Test in the land use allocation process. The LPA should demonstrate through evidence that it has considered a range of options in conjunction with the flood risk information from the SFRA and applied the Sequential Test, and where necessary the Exception Test, in the site allocation process. This can be undertaken directly or, ideally, as part of the SA. Where other sustainability criteria outweigh flood risk issues, the decision making process should be transparent with reasoned justifications for any decision to allocate land in areas at high risk in the SA report. The process should take account of any locational criteria included in guidance prepared by the RPB.
- 2.23 Site-specific allocations can be made in one or more LDDs. LDDs should identify the specific flood risk related issues which will need to be addressed for certain site allocations when a planning application is submitted for their development.
- 2.24 Area Action Plans provide the planning framework for key areas of change or conservation. They should identify the distribution of uses and their inter-relationships and include specific site allocations. Again, the allocation of sites in Area Action Plans must reflect application of the Sequential Test and where necessary the Exception Test, with transparent reasoned justifications provided for any decision to allocate land in areas at high risk. Area Action Plans should also highlight the specific flood risk related issues which will need to be addressed for certain site allocations when a planning application is submitted for their development, e.g. through criteria based policies on design and location of development.

² LDDs comprise Development Plan Documents and Supplementary Planning Documents. Development Plan Documents are part of the 'development plan', may allocate land for development, and are tested at independent examination. Supplementary Planning Documents may expand policies set out in a Development Plan Document or provide additional detail. They must not be used to allocate land because they are not subject to independent examination. Although only the term LDD is used in this document and in most cases it will be referring to a Development Plan Document, the distinction above must be borne in mind.

Figure 2.4 Taking flood risk into account in Local Development Documents (LDDs)



Notes

1 Guidance on undertaking a SFRA can be found in chapter 3.

2 Guidance on developing the scope of SA can be found in ODPM (2005) *Sustainability Appraisal of Regional Spatial Strategies (RSS) and Local Development Documents (LDD)*. Guidance on suitable flood risk indicators can be found in *Flood Risk Assessment Guidance for New Development FD2320, D2.1*.

3 Flood Zone 1 for fluvial and tidal flooding and with a low risk of flooding from other sources.

4 Including an assessment of the potential effect of proposed development on surface water run-off.

5 Including consideration of the variability of flood risk within a Zone.

6 Including in broad terms, consideration of the variability of flood risk within a flood zone from existing SFRAs.

Taking flood risk into account in waste and mineral planning

- 2.25 Waste and mineral planning authorities (including county councils) need to take account of flood risk when allocating land for development. Waste and mineral planning authorities (W/MPAs) should develop their policies and plans with due regard to Regional Spatial Strategies (RSSs), Regional Flood Risk Appraisals (RFRAs) and any available SFRAs. W/MPAs should liaise with relevant LPAs to ensure that all issues are covered when scoping out the necessary elements a SFRA should cover. The location of Mineral Safeguarding Areas and site allocations, in particular in relation to sand and gravel workings which are often located in functional floodplains, need to be identified. By taking this holistic approach it is possible to explore benefits such as restoring mineral working located in flood risk areas to increase flood water storage which can reduce flood risk, enhance biodiversity and the natural environment. Partnership working on joint SFRAs offers the best opportunity to identify and realise these opportunities.
- 2.26 There is no reason why the W/MPA could not coordinate a SFRA working with other LPAs if this is a preferred approach. For example, Gloucestershire County Council are coordinating a SFRA covering six borough councils to produce one SFRA covering the whole county.
- 2.27 Duplication of SFRAs should be avoided but where there is incomplete coverage of SFRAs of the area covered by a W/MPA, W/MPAs should use the best information available and may need to carry out more detailed work in specific areas of concern. Sources of readily available information include the Environment Agency Flood Map and historical information. The aim is for each county to have SFRAs which cover the whole area, either from one SFRA, or from aggregated ones carried out by LPAs.
- 2.28 W/MPAs should apply the sequential approach to allocation of sites for waste management and, where possible, mineral extraction and processing. Sand and gravel extraction is defined as 'water-compatible development' in PPS25 (table D. 2, PPS25). This acknowledges that sand and gravel deposits have to be worked where they are (often in flood risk areas). However, mineral working should not increase flood risk elsewhere and need to be designed, worked and restored accordingly. Mineral workings can be large and may afford opportunities for applying the sequential approach at the site level. It may be possible to locate ancillary facilities such as processing plant and offices in areas at lowest flood risk. Sequential working and restoration can be designed to reduce flood risk by providing flood storage and attenuation. This is likely to be most effective at a strategic (county) scale.
- 2.29 Waste operations such as landfill sites can pose a pollution threat. Risks will need to be fully taken into account in applying the sequential approach. Waste treatment facilities are classified as 'less vulnerable' except where handling landfill or hazardous waste when they are classified as 'more vulnerable' (see table D.2, PPS25).

- 2.30 W/MPAs will in many cases also have the ‘lead local flood authority’ role as set out in the letters of 17 December 2008 sent jointly by the Secretary of State for Environment, Food and Rural Affairs and the Minister for Local Government to Chief Executives, and subsequent Departmental letters of 29 April 2009. It is important that their roles as W/MPA and lead local flood authority are complementary here.

INDIVIDUAL PLANNING APPLICATIONS

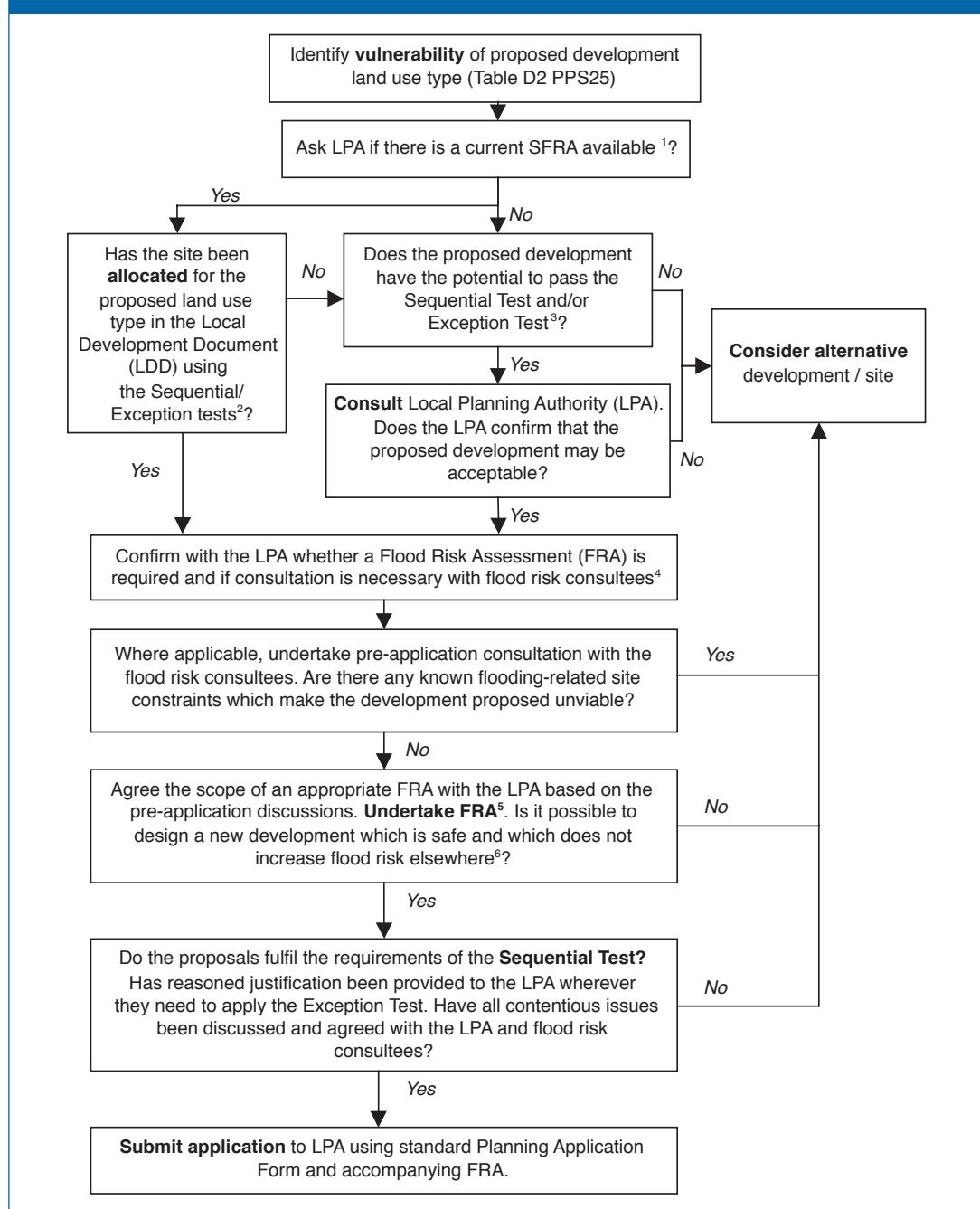
The role of the developer

- 2.31 Paragraphs 22-23 of PPS25 make it clear that it is the responsibility of the developer to consider the flood risk issues at a site. It is in their own interests to do this as early as possible. Flood risk is one of many constraints that need to be investigated before taking forward a development and it can have significant implications for the value of, and potential for, a development site. Whilst the Environment Agency Flood Map provides a useful indication of the likely flood risk issues at a site, and the SFRA should provide further, more detailed information, including on surface water and local flood risk, developers are advised to make independent checks prior to purchasing sites. Guidance on assessing flood risk at development sites is provided in chapter 3 of this guide.
- 2.32 If a proposed development is identified in a sequentially tested LDD that is supported by an SFRA, the site will already have been through the Sequential Test. As long as the development types making up the proposal are in accord with the LDD, a developer can rely on the outcome of that testing. However, there may still be opportunities for the sequential approach to be considered within the site (flood risk substitution).
- 2.33 However, where either:
- the site allocation has been sequentially tested as part of the LDD but the proposed development is not consistent in scale, development type and location with that allocation, or
 - the Sequential and Exception Tests have not been applied to the LDD and the site is within an area at risk of flooding;
- the developer will need to provide reasoned evidence in the Flood Risk Assessment (FRA) for the location of the proposed development. This justification must explain how the development would meet the requirements of the Sequential, and where necessary, the Exception Tests. It is the role of the local planning authority to carry out the actual test however (see chapter 4 below), based on this and its other sources of information.
- 2.34 In any event, the developer must apply the sequential approach to any flood risk within the site itself when determining the location of appropriate land uses. For example, where a site contains Flood Zone 1 and 2 land, the most vulnerable uses should be located in areas where

the detailed FRA shows the lowest flood risk. Guidance on use of the sequential approach within a development site is provided in chapter 4.

- 2.35 The scope of any site-specific FRA should be agreed with the LPA, if necessary in consultation with the Environment Agency and other relevant stakeholders. One of the major reasons why the Environment Agency objects to planning applications is that a FRA is either absent or inadequate. Ensuring that the FRA is appropriate will avoid delay and difficulty later. The FRA must show that the applicant has considered flood risk from all sources and demonstrated how flood risk will be managed for the lifetime of the development taking climate change into account.
- 2.36 Communities and Local Government's standard application form (One App) sets out when a FRA is required. It should be provided along with the application form when submitting the application to the LPA. It will also mean that design issues, such as the inclusion of sustainable drainage, can be considered at an early stage. What should be in an FRA is covered in more detail in chapter 3. A checklist which can serve as an aide memoire to developers on the matters their FRA should be taking into account is provided in appendix B.
- 2.37 Once a planning application, together with an appropriate FRA, is submitted by the developer, it will need to be validated in order for it to be considered and determined by the LPA. In considering the application the LPA will consult and seek advice from the Environment Agency and other relevant authorities.
- 2.38 The process from pre-purchase of land to submission of a completed planning application form with accompanying FRA is illustrated in figure 2.5.

Figure 2.5 Taking flood risk into account in preparation of individual planning applications



Notes

1 A SFRA can be defined as current if it has been prepared in accordance with PPS25.

2 If the site has been allocated in this way then subsequent steps in the process are likely to be significantly more straightforward.

3 If a site has not been allocated in the LDD because it was considered that the flood risk is unacceptable, it is unlikely that a proposed development at the site will be accepted by the LPA.

4 See paragraphs 2.49-2.60 of this Practice Guide for key consultees to the planning process with regard to flood risk.

5 Guidance on undertaking a FRA can be found in chapter 3.

6 Including surface water management.

The development control role of the local planning authority (LPA)

- 2.39 The LPA is the principal decision-maker on applications for new development. LPAs should respond actively to requests for pre-application discussions with any developer expressing an interest in submitting a planning application for a site that is in an area at risk of flooding, or which has potential to increase flood risk elsewhere. Specifically the LPA should:
- state where a development *proposal* would be unacceptable on flood risk grounds;
 - refer the developer to any policies within the LDD which have been sequentially tested and are of relevance to the site, including policies or guidance on acceptable land uses and the application of sustainable drainage measures;
 - refer the developer to the Strategic Flood Risk Assessment (SFRA) as this should form the basis of the applicant's site-specific flood risk assessment (FRA);
 - where the site has not been allocated in accordance with the requirements of the Sequential and Exception Tests, clarify the specific supporting information required to allow the LPA to apply the Sequential or Exception Test as part of the individual planning application process;
 - advise the developer on the need for a site-specific FRA (see paragraph 3.80 onwards) and consultation with Environment Agency and/or other flood risk consultees;
 - set out and agree the scope for the FRA using the Environment Agency Standing Advice (see paragraph 2.51 of this guide), or in direct consultation with the Environment Agency and any relevant flood risk consultees, as appropriate; and
 - encourage pre-application discussions with the identified flood risk consultees to ensure flood risk issues are resolved prior to submission of the planning application.
- 2.40 On receipt of the application, the LPA will consult the Environment Agency in accordance with Article 10 of the Town and Country Planning (General Development Procedure) Order 1995 (the GDPO). The GDPO was amended on 1 October 2006 to make the Environment Agency a statutory consultee for specified categories of development where flood risk is an issue. The LPA must consult the Environment Agency as follows:
- development other than minor development in Flood Zones 2 & 3;
 - development in Flood Zone 1 where there are critical drainage problems;
 - any development exceeding one hectare in extent;
 - development within 20m of the bank top of a Main River; and
 - any culverting operation or development which controls the flow of any river or stream.

- 2.41 The Environment Agency is required to respond to consultations on pre-planning enquiries within 21 days, unless otherwise formally agreed in writing. The Environment Agency will object if a FRA is required and has not been submitted with the planning application.
- 2.42 The Environment Agency advice and the evidence supplied by the developer will be used by the LPA as the basis for taking flood risk issues into account in their planning decision. In coming to its decision, the LPA should demonstrate how the requirements of the Sequential Test and, where necessary, the Exception Test have been met (see chapter 4). With the increased role of local authorities in local flood risk management, as concluded by the Pitt Review and accepted by the Government, the LPA should also consider the views of its other departments (e.g., for highways).
- 2.43 The Town and Country Planning (Consultation) (England) Direction 2009 subsumed within it the provisions of the previous (Flooding) (England) Direction, 2007, which was then cancelled. The Direction requires an LPA to notify the Secretary of State of any application for major development in a flood risk area, where it is minded to grant permission despite a sustained objection from the Environment Agency on flood risk grounds. This should only happen in a very small number of cases.
- 2.44 Normally the developer will become aware of objections from the Environment Agency through its statutory consultee role described in paragraphs 2.40-2.42. The LPA, the Environment Agency and the applicant should discuss and try to agree what changes could be made to the application that would enable the Environment Agency to withdraw its objection. Experience so far under the Direction suggests that this will usually be possible.
- 2.45 If, even after discussions, the Environment Agency concludes that it is unable to withdraw its objection, it will advise the LPA within the set timeframe. The LPA should then consider whether it is minded to grant permission or not. If it is, the Direction requires the LPA to notify the Secretary of State. This should be done through the appropriate regional Government Office. The Secretary of State will consider whether to call the application in for determination.
- 2.46 For the purposes of the Direction, development is defined as major if:
 - for residential development, the number of dwellings to be provided is 10 or more, or the site area is 0.5 hectares or more, or
 - for non-residential development, the new floorspace to be provided is 1,000 square metres or more, or the site area is 1 hectare or more.
- 2.47 A flood risk area is defined as:
 - land in an area within Flood Zones 2 or 3; or
 - land in an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency.

- 2.48 All LPAs should notify the Environment Agency of the decision on a planning application where they have objected (paragraph 29, PPS25).

KEY CONSULTEES TO THE PLANNING PROCESS

The partnership approach

- 2.49 PPS25 (paragraph 6) advocates a partnership approach. It is important to share expertise and information to be able to deliver effective and timely planning policy and decisions. Partnership working should occur at all levels in the planning process through engagement with key stakeholders, to ensure that flood risk is factored into the earliest stages of decisions and all key stakeholders are fully involved. Partnership working provides opportunities for:
- better cooperation;
 - a more coordinated approach;
 - locally agreed sustainable solutions; and
 - facilitating reduction in flood risk through development opportunities.

The role of the Environment Agency

- 2.50 The Environment Agency is a statutory consultee for RSSs, LDDs, Sustainability Appraisals and Strategic Environmental Assessments. They are also a statutory consultee for planning applications as detailed in the individual planning applications section (paragraphs 2.40-2.42 above). The Environment Agency's role at the pre-application stage will generally involve provision of relevant flood risk information and advice, as well as comments on the scope of site-specific Flood Risk Assessments (FRA).
- 2.51 The Environment Agency has Standing Advice available on its website which gives guidance to LPAs on:
- when the Environment Agency should be consulted;
 - making decisions on low risk planning applications where it is not necessary to consult the Environment Agency directly;
 - the types of application that the Environment Agency need to be consulted on; and
 - how to demonstrate that the Sequential Test has been applied transparently.

The Standing Advice also includes advice to developers and their agents on the types of application which will need to be accompanied by a FRA and guidance on householder and other minor extensions.

Other key flood risk consultees

- 2.52 The following organisations are key flood risk consultees who may also need to be consulted within the planning process. This is in addition to annex H of PPS25 which details the basic roles and responsibilities of key stakeholders.

Sewerage undertakers

- 2.53 Sewerage undertakers are generally responsible for surface water drainage from developments, where this is via adopted sewers. Sewerage undertakers are statutory consultees for RSSs and LDDs. LPAs should consult sewerage undertakers in developing their spatial plans, so that their Strategic Flood Risk Assessment (SFRA) takes account of any specific capacity problems and of the undertaker's Drainage Area Plans. Where Surface Water Management Plans are identified in the SFRA as a requirement LPAs and sewerage undertakers should work closely together. Developers should consult the Surface Water Management Plan if one has been produced, or their local sewerage undertaker on surface water disposal issues.

Local Authorities acting in Flood and Coastal Operating Authority/Maritime District Councils and emergency planning roles.

- 2.54 Where local authorities are the drainage authority under the Land Drainage Act 1991 (everywhere there is no Internal Drainage Board and on the coast), or are a Maritime District Council under the Coastal Protection Act 1949, LPAs should engage their engineering and emergency response staff when preparing the SFRA and in connection with specific planning applications that will impact on local drainage or flood risk, or which rely extensively on emergency evacuation or rescue plans. They also have emergency planning duties under the Civil Contingencies Act 2004.

Internal Drainage Boards

- 2.55 In locations where they exist, LPAs should confer with Internal Drainage Boards to identify the scope of any consultation required. This may include:
- preparation of a SFRA;
 - consultation on major developments in Flood Zone 1 that are within, or will drain into their Internal Drainage District;
 - all non-householder developments in Flood Zones 2 and 3; and
 - any applications that affect an Internal Drainage Board-controlled watercourse.

- 2.56 LPAs should then advise developers accordingly. Internal Drainage Boards have a high level of expertise in their local area and can be a very valuable source of information. Internal Drainage Boards will need to ensure that they meet targets of timescale and quality of response appropriate to the consultation.

The highway authorities

- 2.57 The LPA should ensure that the relevant highway authorities are consulted when preparing the SFRA and that the implications of individual applications for highway drainage are addressed by developers.

Reservoir undertakers (see chapter 7)

- 2.58 Under the Reservoirs Act 1975, reservoirs impounding over 25,000 cubic metres of water above natural ground level are categorised on a risk basis according to the consequences (in terms of potential for loss of life and/or damage to property) of a structural failure occurring. LPAs should discuss their proposed site allocations with reservoir undertakers to:
- avoid an intensification of development within areas at risk from reservoir failure; and
 - ensure that reservoir undertakers can assess the cost implications of any reservoir safety improvements required due to changes in land use downstream of their assets.

Navigation authorities

- 2.59 Navigation authorities (British Waterways and others³) should be consulted by the LPA and developers in relation to sites adjacent to, or which discharge into, canals, especially where these are impounded above natural ground level. It is important that British Waterways are consulted in such circumstances so that they can ensure that LPAs and developers have properly mapped potential breach inundation from canals correctly and can check for consistency.

Emergency services and multi-agency emergency planning

- 2.60 LPAs are advised to consult with their emergency planning officers as early as possible during the preparation of LDDs and liaise with them regarding any planning applications which have implications for emergency planning. Where issues affecting emergency services are identified it may be relevant to contact the Local Resilience Forum, or in some cases, it may be appropriate for the LPA to consult the emergency services themselves on specific emergency planning issues related to new developments.

³ Reference in this Practice guide to 'British Waterways' is to be taken to mean British Waterways *and/or* other navigation authorities, as appropriate.

MONITORING AND REVIEW OF PPS25

- 2.61 PPS25 paragraphs 35-37 sets out Communities and Local Government's monitoring and review strategy for development and flood risk policy. In addition to the indicators in the Environment Agency's annual 'Development and Flood Risk' report (previously known as the High Level Target 5 report) produced for Defra and Communities and Local Government as detailed in paragraph 36 of PPS25, Communities and Local Government are also monitoring:
- the Annual Monitoring Report, Core Indicator at regional and LDD level which seeks to measure flood protection and water quality. The indicator is identical at both regional and local level and seeks data on the '*Number of planning permissions, by local authority area, granted contrary to the advice of the Environment Agency on grounds of flood defence or water quality*';
 - the effectiveness of the former Flooding Direction and (from April 2009) the Consultation Direction which replaced it;
 - land use statistics to see the trends of development in flood risk areas; and
 - the effectiveness of SFRAs through Defra's research project (*Land use planning: Assessing the quality and influence of Strategic Flood Risk Assessments, 2009*).
- 2.62 An initial review of the implementation of PPS25 (see paragraph 1.12) has been carried out by Communities and Local Government, drawing amongst other things on the findings from the Environment Agency's 2007/08 Development and Flood Risk (HLT5) Report, and the initial findings earlier this year from Defra's research project on SFRAs. Communities and Local Government will continue to draw from these and other sources to monitor the implementation and effectiveness of the PPS25 policy approach.

ILLUSTRATIVE CASE STUDIES

- 2.63 The following case studies illustrate a few of the ways in which the spatial planning approaches advocated in PPS25, including the emphasis on close partnership working, can assist with the strategic management of flood risk, whilst realising the opportunities to improve the quality of the built and natural environment.

Regeneration Strategies

- 2.64 In some regions there is a significant legacy of past industrial activity along river corridors resulting in ribbons of brownfield sites and derelict industrial premises within floodplain areas. There is significant potential for strategies aimed at regeneration of such areas to result in an increase in flood risk to people and property unless the policies in PPS25 are carefully adhered to. However, where the sequential approach is followed and application of the Exception Test demonstrates that regeneration of such areas is a sustainable proposition, then opportunities can be taken to combine regeneration and environmental improvements

with a wider strategy to manage flood risk. This approach requires close collaboration between the key stakeholders such as the LPA, Regional Development Agency and Environment Agency.

- 2.65 Regeneration of brownfield land, whether as part of a development or where the site is not suited to development, offers opportunities to improve the management of flood water and reduce risk to communities. Through positive strategic planning, the use of brownfield land can achieve multiple benefits such as reducing flood risk, enhancing the public realm and encouraging biodiversity. (*Securing the future Supply of Brownfield Land, Communities and Local Government, 2008*)

Case study

Templeborough, Rotherham – an example of organisations working together to regenerate former industrial areas in a manner which considers flood risk, and also improves amenity and biodiversity

Templeborough is a regeneration project to the south and west of Rotherham town centre next to the River Don. The flooding issues have been tackled as part of a community-wide scheme focused on riverside regeneration. A local area initiative has been developed through a partnership including the local council, Regional Development Agency and the Environment Agency.

Flood risk to existing properties is to be reduced and derelict brownfield sites regenerated. The project has involved the use of a key potential regeneration development site to create a flood attenuation area alongside the river for the management of major flood events. This will also increase access to the river for the public who have historically been excluded from the river by heavy industry.

Rotherham town centre (image courtesy of Rotherham Metropolitan Borough Council).



Sustainable drainage systems

- 2.66 A sustainable approach to site drainage can make a significant contribution to reductions in flood risk in areas where there are flooding problems on existing watercourses downstream. The benefits of a sustainable approach to site drainage (water quality and place making) are covered in chapter 5. The successful implementation of these schemes benefits from the adoption of a cooperative approach as illustrated by the case study below.

Case study

Angmering – an example of cooperation of multiple developers, the use of sustainable drainage and clarity of maintenance responsibilities

The Bramley Green development is located in Angmering, West Sussex and consists of a mixed residential development of some 600 units. The development was built by a number of developers, who formed a consortium to deliver the infrastructure for the development as a whole. This included the provision of a new pond, a flood storage area and an under-drained infiltration area within a public open space. The picture shows the flood storage area with water in it.



The sewerage undertaker has adopted the surface water drains that discharge to the pond, while the pond, the flood storage area and an under-drained infiltration area are being maintained by the parish council.

Angmering development (image courtesy of Peter Brett Associates)

River and floodplain restoration schemes

- 2.67 Perhaps most in the spirit of the Government's *Making Space for Water* strategy are proposals that seek to combine new development with measures to restore heavily-modified watercourses and their floodplains to a more natural state. Such measures can include removing culverts, restoring meanders and re-connecting river channels with areas of floodplain obstructed by artificial features. All of these measures can result in reductions in flood risk, as well as significant improvements in amenity, biodiversity and water quality. Floodplains have developed naturally since the last ice age, adjusting to subsequent changes in climate, land use and management. Re-connecting a floodplain with its adjoining river channel restores its original function as an area of flood storage and sediment deposition. This shows the benefits of a spatial planning approach which enables other flood risk and water management strategies to be delivered.

Case study

Sutcliffe Park and Chinbrook Meadows, Lewisham

During development of Lewisham, Lee, Kidbrooke and Eltham in the 1930's, the River Quaggy was diverted underground using tunnels and culverts. This worked well except during heavy rainfall when Lewisham town centre would flood.

The solution to this was to reduce the amount of culverting and allow the river to run above ground. The aim was to re-establish it as a meandering, more 'natural' watercourse. This Quaggy Flood Alleviation Plan had three main benefits: better control over water flows, enhanced public open space and increased biodiversity.

A 'holding area' where floodwaters could be contained in times of high rainfall was developed in Sutcliffe Park in 2002. The new Sutcliffe Park was opened in 2004 to alleviate flooding in Lewisham Town Centre and creating a wetland site, rich in bio-diversity and of significant ecological and amenity benefit.

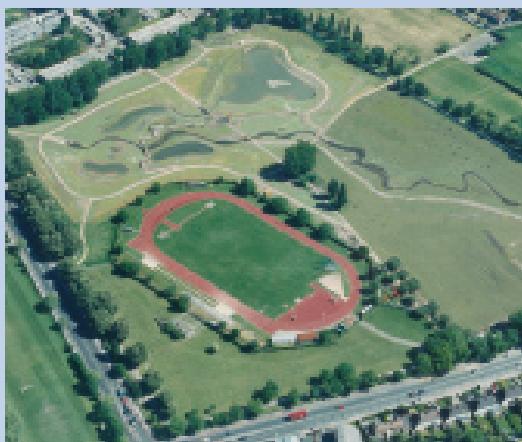
In addition, breaking the river Quaggy out of its concrete corridor in Chinbrook Meadows Park and allowing it to flow more naturally through the park reduced flood risk, as well as reintroducing river bank areas to encourage wildlife. The scheme, completed in 2002, includes the creation of boardwalks and bridges to enable visitors to interact better with the river.

The public footpath running through the meadows forms part of the South East London Green Chain Walk and the regional Capital Ring. The park has been awarded over several years the prestigious Green Flag award, which is designed to recognise and reward standards of excellence in parks and green spaces.

<http://www.qwag.org.uk/quaggy/restoration.php>

<http://www.greenwich.gov.uk/Greenwich/YourEnvironment/GreenSpace/ParksGardens/Eltham/SutcliffeParkFloodAlleviationPlan.htm>

<http://www.lewisham.gov.uk/LeisureAndCulture/ParksAndRecreation/LocalParks/ChinbrookMeadows.htm>



Aerial view of Sutcliffe Park with the restored Quaggy River running through it



Natural meandering watercourse, Chinbrook Meadows

Images courtesy of Lewisham Council

Case study

Former Waterworks Site (now Gheluvelt Park) Worcester

For over 200 years the public water supply for Worcester came from a waterworks on a four hectare site on the banks of the River Severn in the urban area. The site was within the recognised floodplain but a flood defence was in place with a high concrete wall.

When de-commissioning of the Waterworks took place the owners, Severn Trent Water, in partnership with the City Council and the Environment Agency agreed a scheme to restore the land to public park. Major improvements to flood management were achieved by removing the



flood wall, removing the 17 brick and concrete tanks, recontouring the site and restoring the active floodplain. The spoil was used to fill deeper tanks and develop housing on an adjoining site, not at flood risk. A local brook (Barbourne Brook) with main river status was also broken out of culvert and released to flow freely through the park and into the river. In the recent floods the park provided valuable flood storage to reduce the impact of the floods on Worcester (and the new housing on the periphery did not flood). The park was back in use, hosting a folk festival and craft fair shortly after the 2007 floods.

Image courtesy of Worcester City Council

Case study

Fairford Leys – an example of river restoration as part of a new development

The 217 hectare Fairford Leys site was developed to provide a golf course, sports field, public open space and approximately 70 hectares of mainly residential development on the edge of the River Thame floodplain. The site incorporates a large flood storage compensation area excavated and landscaped on the edge of the floodplain. The scheme led to a major river restoration project funded by the development.



A number of watercourses cross the residential development area, all of which have associated floodplain. Work was carried out to restore the heavily engineered rivers to a more natural state. This involved reforming the watercourses as multi-staged channels varying in width between 35 and 90 meters. The low flow channels were aligned with a restored sinuosity and provided with pools and riffles. The watercourse corridors were enhanced by planting of native vegetation including meadow grasslands, trees and marginal aquatic vegetation, and provided routes for pedestrians.

Fairford Leys, Aylesbury (image courtesy of the Environment Agency)

Case study

Brent Cross and Cricklewood Regeneration, London Borough of Barnet, North London – an example of strong partnership working, ensuring that flood risk was reduced across the board, not just concentrating on river flooding

The Masterplan Area of Brent Cross and Cricklewood is located within a highly urbanised part of North London which is predominantly brownfield and includes a mixture of uses from industrial and commercial through to residential. The North Circular main road cuts through the Masterplan Area, and running parallel with this road is the River Brent Main River which is contained within a 'U' shaped concrete channel. At present the River is an undervalued asset within the community as the concrete channel is unappealing and pathways alongside and over the river are seen as unsafe.



Masterplan Area

As part of an outline planning application for the regeneration of this area the existing Brent Cross Shopping Centre is to be redeveloped and integrated within a new town centre with a mix of uses. At an early stage the Environment Agency identified flood risk as one of the main constraints to redeveloping this site and has worked closely with the developer since then to ensure that the redevelopment maximises the opportunity to reduce flood risk. The development has sought to reduce flood risk in the following ways:

- The River Brent is to be realigned and restored throughout the Masterplan Area, setting new development back from the river, and using bioengineering techniques to restore the river channel and banks. In some places access to the river will be restricted to create a wetland style habitat, and in other places the river will be enhanced as a community asset providing access for shoppers and local residents. River restoration will make space for water and reduce flood risk. The Clitterhouse Ditch and an ordinary watercourse which drains into the Brent is also to be restored.

Continued

Brent Cross and Cricklewood Regeneration, London Borough of Barnet, North London – an example of strong partnership working, ensuring that flood risk was reduced across the board, not just concentrating on river flooding (continued)

- The existing and proposed developments have been fully modelled to ensure that the redevelopment proposals do not increase flood risk. Modelled flood extents have been used to help ensure that residential uses are located outside the floodplain. Modelled flood levels have helped to ensure that development will be safe and bridges are designed to be clear-span and above the modelled flood level. By making space for water through river restoration, the development has reduced the flood extent post-development.
- Across the Masterplan Area a reduction in surface water flood risk of approximately 75% has been achieved through use of a range of SUDS solutions, including areas of wetland.



Top: Flood Risk Before – baseline
Bottom: Flood Risk After – river diversion included
Images courtesy of Scott Wilson and the Brent Cross Cricklewood Development Partners

FURTHER INFORMATION AND REFERENCES

Circular 02/09 *The Town and Country Planning (Consultation) (England) Direction 2009*, Communities and Local Government, 2009; (replaces and cancels Circular 04/06 *The Town and Country Planning (Flooding) (England) Direction 2007*).

Enquiries to the Environment Agency should be through their National Call Centre on 08708 506506. Enquiries regarding flood risk will be forwarded to the Planning Liaison Team at the relevant local office.

Environment Agency website – www.environment-agency.gov.uk

Environment Agency Standing Advice can be found within the planning section of this website.

Flood Risk Assessment Guidance for New Development, FD2320 Phase 2, DEFRA and Environment Agency, 2005.

Land use planning – Assessing the Quality and influence of Strategic Flood Risk Assessments (SFRAs), R&D Technical Report FD2610/TR, Defra, 2009.

Making Space for Water: Developing a New Government Strategy for Flood & Coastal Erosion Risk Management, Environment Agency/DEFRA, 2006.

Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.

Planning Policy Statement 1, *Delivering Sustainable Development*, ODPM, 2005.

Planning Policy Statement 1, *Planning and Climate Change – Supplement to PPS1*, Communities and Local Government, 2007.

Planning Policy Statement 11, *Regional Spatial Strategies*, ODPM, 2004.

Regional Spatial Strategy Monitoring: A Good Practice Guide, ODPM, 2005.

Planning Policy Statement 12, *Local Spatial Planning*, Communities and Local Government, 2008; and technical amendments, 2009.

Planning for Biodiversity and Geological Conservation: A Guide to Good Practice, Communities and Local Government, 2006.

Policy regarding culverts: Policy statement, Environment Agency, 1999.

Policy regarding culverts: Explanation of policy, Environment Agency, 1999.

Policy regarding culverts: Technical guidance on culverting proposals, Environment Agency, 1999.

Securing the Future Supply of Brownfield Land. Government response to English Partnerships' Recommendations, Communities and Local Government, 2008.

Shoreline management plan guidance Volume 1: Aims and requirements, Defra, 2006

Standard Application Form and Validation of Planning Applications, Communities and Local Government, 2008, main webpage:

<http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyimplementation/standardapplicationform>

Strategic Environmental Directive (SEA Directive) European Directive, 2001/42/EC.

Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents, ODPM, 2005.

The Planning and Compulsory Purchase Act, 2004.

The Town and Country Planning (Local Development) (England) Regulations, 2004 – amended May 2008 and February 2009.

The Water Framework Directive, European Directive, 2000/60/EC.

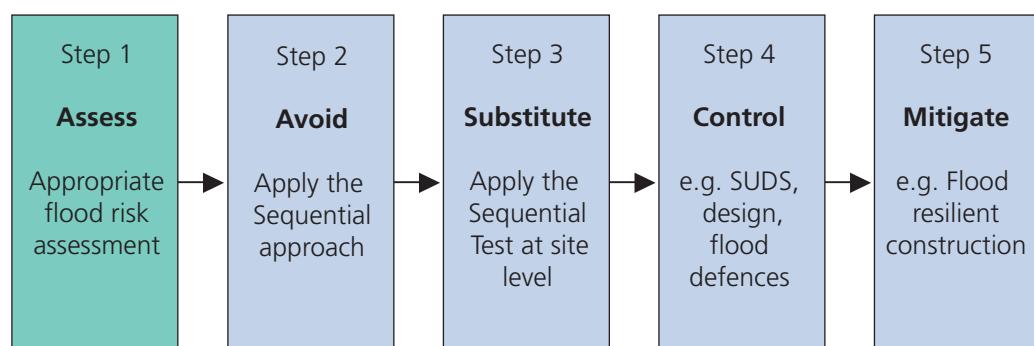
Town and Country Planning (General Development Procedure) Order 1995 (the GDPO) amended October 2006 and February 2008.

3 The assessment of flood risk

INTRODUCTION

- 3.1 The purpose of this chapter is to provide guidance on how flood risk assessments at all levels of the planning system should be carried out to inform the planning process. This is the first important step in the flood risk management hierarchy and will provide the information for understanding flood risk at the regional, local and site level. This will allow for full consideration of flood risk issues when preparing plan policies and making planning decisions. This guidance builds on PPS25, paragraphs 10-13 and annex E.
- 3.2 Flood risk needs to be assessed in order to inform decisions at all stages of the planning process. This is the first step in applying the sequential approach in the flood risk management hierarchy by providing information on which to base decisions.

FLOOD RISK MANAGEMENT HIERARCHY



- 3.3 A flood risk assessment should cover the probability, consequences and characteristics of flooding. Assessments should be based on all available information relevant to the scale (regional, local, and site) at which the assessment is being done.

AIMS OF FLOOD RISK ASSESSMENTS

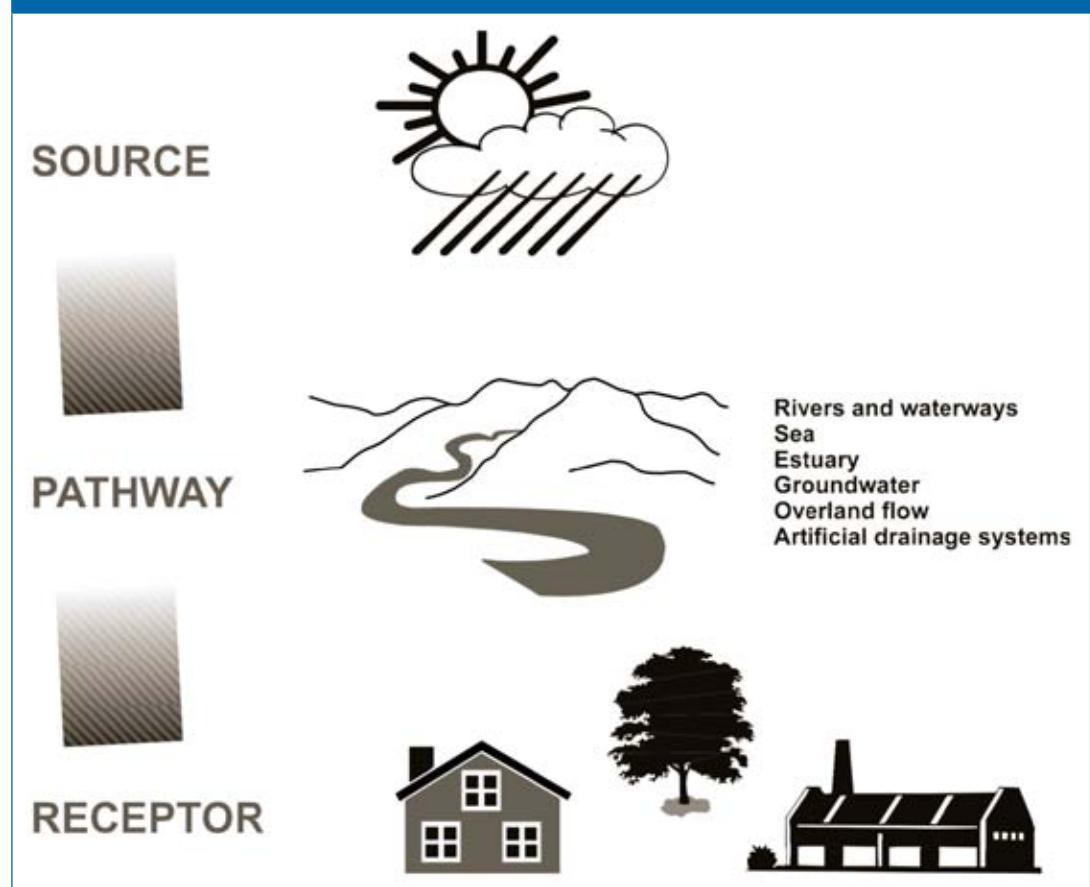
- 3.4 The main aims of flood risk assessment are to:
- appraise flood risk at the earliest stages of spatial planning;
 - inform decisions so that development is avoided in flood risk areas wherever possible;
 - ensure that all future land allocations are made on the basis of an appropriately detailed assessment which results in a full understanding of flood risk assessed at the regional or local level;

- ensure that policies, as well as the locational criteria for specific allocated development sites in Local Development Documents (LDDs) are appropriate to the actual local flood risks; and
- ensure that flood risks of all kinds are assessed and factored into the design of any new developments over their lifetimes, to minimise the risk of loss of life, injury and distress (social costs), as well as the economic and environmental costs of flooding.

THE SOURCE-PATHWAY-RECEPTOR APPROACH

- 3.5 Paragraph 9 of PPS25 suggests how the ‘source-pathway-receptor’ model should be applied to planning for development in areas of flood risk. This approach (see Figure 3.1) is already used in the planning system to address issues of land contamination and environmental pollution. Further information on the sources of flooding and the source-pathway-receptor approach can be found in the Construction Industry Research and Information Association’s Report C624 *Development and flood risk – guidance for the construction industry* (2004) and R & D report FD2320 *Flood Risk Assessment Guidance for New Development Phase 2* (Defra & Environment Agency, 2005).

Figure 3.1 An Example of the Source-Pathway-Receptor Approach for PPS25



Source: Construction Industry Research and Information Association (CIRIA) (2004) Development and flood risk – Guidance for the construction industry (C624)

Sources of flooding

- 3.6 Flooding can occur from a range of sources (see annex C PPS25). Rivers and the sea have historically been the principal causes of flood damage in England. However, the floods from surface water in the summer of 2007 caused significant damage. The Summer 2007 Flood Report produced by the Environment Agency reported that approximately two-thirds of the properties flooded were as a result of drains and sewers being overwhelmed by rainfall and run-off. Key sources of flooding are summarised in figure 3.2.

Figure 3.2 Key sources of flooding

Fluvial (Rivers)

- Inundation of floodplains from rivers and watercourses
- Inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels
- Overtopping of defences
- Breaching of defences
- Blockages of culverts
- Blockages of flood channels, or flood corridors.

Tidal

- Sea
- Estuary
- Overtopping of defences
- Breaching of defences
- Other flows (fluvial surface water) that could pond due to tide locking
- Wave action.

Surface water

- Sheet run-off from adjacent land (urban or rural)
- Surcharged sewers (Combined, foul or surface water sewers).

Groundwater

- Water table rising after prolonged rainfall to emerge above ground level remote from a watercourse.
- Most likely to occur in low-lying areas underlain by permeable rock (aquifers).
- Seepage direct into properties
- Groundwater recovery after pumping has ceased for mining or industry.

Infrastructure failure

- Reservoirs
- Canals
- Industrial processes
- Burst water mains
- Blocked sewers or failed pumping stations.

- 3.7 River and tidal flooding information is widely available and forms the basis of the Environment Agency's Flood Map.
- 3.8 The Environment Agency provided a first national map of areas susceptible to surface water flooding to Local Resilience Fora in August 2008 and to local planning authorities (LPAs) in July 2009. The map and guidance is available to LPAs at: www.geostore.com/environment-agency. The Environment Agency is currently examining how to improve this map, by addressing some of the simplifications which were made in developing the current areas susceptible to surface water flooding maps. It is hoped that improved mapping will be available by summer 2010. Surface water flooding is covered in more detail in chapter 5.
- 3.9 **For spatial planning purposes, the main use of the map will be as a starting point to highlight areas where the potential for flooding from surface water needs particular assessment and scrutiny within Strategic Flood Risk Assessments (SFRAs) and Regional Flood Risk Appraisals (RFRAs).** The output from these assessments should in turn inform development allocations within LDDs and outline the requirements for site-specific Flood Risk Assessments (FRAs) to be carried out by developers. LPAs should assess the suitability of the map in conjunction with other evidence (for example historical data, other models, and other organisations' data). The map should not be used as the sole evidence for any specific planning decision at any scale without further supporting studies or evidence.

Groundwater flooding

- 3.10 The final report for the Groundwater Flooding project under the *Making Space for Water* programme has been published. The recommendations from this report state that a national database collating records from all sources of groundwater flooding is both desirable and feasible.
- 3.11 The Environment Agency is progressing the recommendations from this report, in line with the recommendations from the Pitt Review (2007). It is currently progressing the options for mapping other sources of flooding, including that from groundwater flooding. Various short, medium and long-term options for surface water and groundwater mapping are being considered.
- 3.12 The Environment Agency is leading a project to collect historical records from LPAs, water and sewerage companies to populate a GIS database for use by all contributing bodies. The aim is for the project to produce maps of these historic records in Spring 2010.

ASSESSING FLOOD RISK

- 3.13 There are two components of assessing flood risk – the probability of flooding and the consequences of flooding.

The probability of flooding

- 3.14 The likelihood of a particular flood happening is best expressed as a chance or probability over a period of one year. For example, if there is a one in 100 chance of flooding in any given year, this can also be described as having a 1 per cent chance of flood each year. **However, if a flood occurs, it does not mean that another flood will not occur for 99 years.⁴**
- 3.15 Figure 3.3 summarises the flood zones as defined by PPS25, table D.1.

Figure 3.3 Annual probabilities of flooding associated with PPS25 Flood Zones

Flood Zone	Annual probability of flooding
1	< 1 in 1,000 (<0.1 %) from river or sea flooding
2	Between 1 in 1,000 (0.1%) and 1 in 100 (1%) for river flooding or between 1 in 1,000 (0.1%) and 1 in 200 (0.5%) for flooding from the sea
3a	> 1 in 100 (>1%) for river flooding and > 1 in 200 (>0.5%) for flooding from the sea
3b	Functional floodplain (see paragraphs 4.87-4.95 below).

Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences.

The consequences of flooding

- 3.16 Flooding in the worst instances can result in fatalities as well as damaging property and disrupting lives and businesses. It can have severe consequences for people, such as financial loss, emotional distress, and health problems. There are a number of key factors which affect the scale and severity of the consequences as follows:
- the source and type of flooding;
 - the depth and velocity of flood water;
 - the duration of flooding;
 - the rate of onset of flooding;
 - the rate of rise of flood water;
 - the presence or absence of debris in the flood water;
 - the degree to which people and/or assets are exposed to the flood water;

⁴ The chance of flooding occurring during the lifetime of a development can be calculated by the equation:

$$R = 1 - (1 - 1/T)^M$$

R = risk of exceedence/chance of flooding occurring

T = return period of flood in years

M = number of years (lifetime of development)

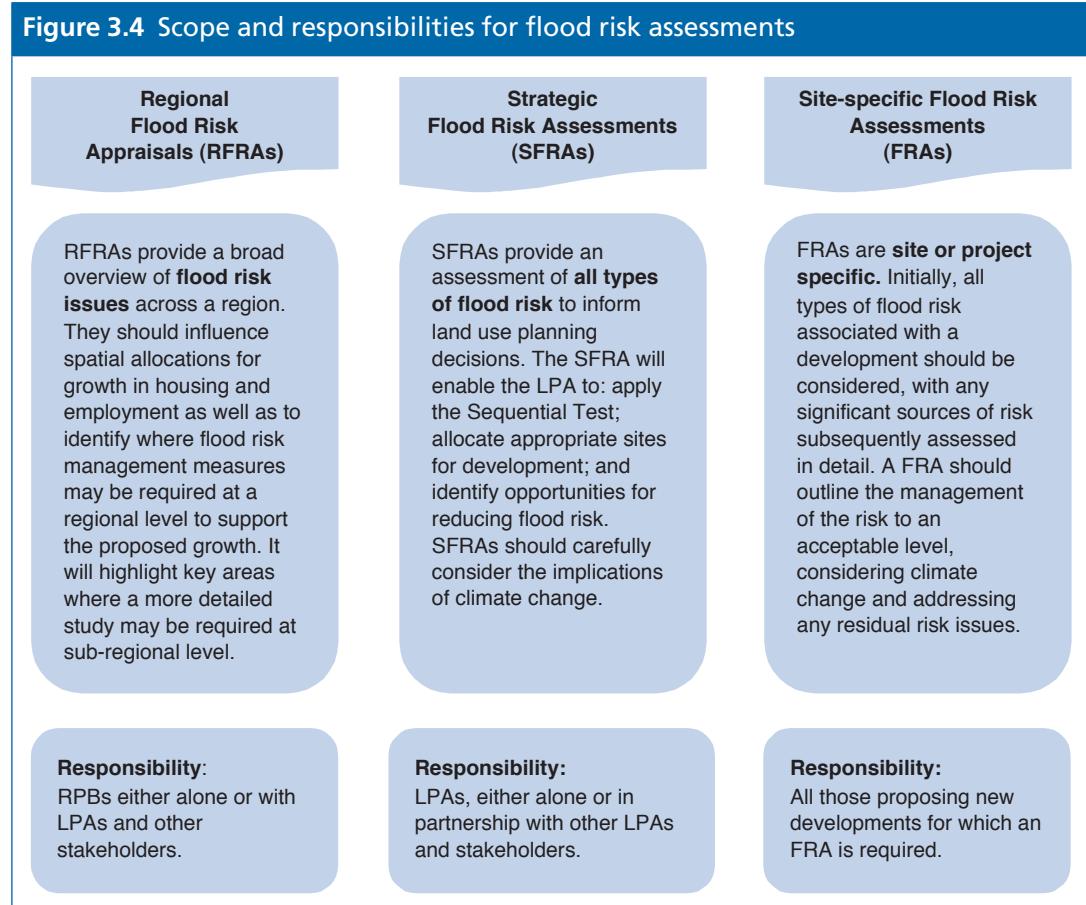
Using the above equation it is possible to calculate that a 1-in-200 year flood has a 39.5% chance of occurring within a development lifetime of 100 years.

- the level and amount of warning people receive;
 - behaviour of people during a flood event; and
 - the extent and vulnerability of the people and properties affected.
- 3.17 The Middlesex University's Flood Hazard Research Centre report, *The Benefits of Flood and Coastal Defence*, otherwise known as the *Multicoloured Manual*, provides guidance on quantifying the consequences of flooding at a strategic and detailed site-specific level. The main factors that contribute to risks to people during floods are explored in the DEFRA/EA (2004) *R&D Technical Report FD 2321/IR1 Flood Risks to People Phase 2 Interim Report 2*.
- 3.18 Defining what is safe in different flood situations is considered in chapter 4, paragraphs 4.53-4.58.

TYPES OF FLOOD RISK ASSESSMENT

- 3.19 Flood risk assessments will fall into one of three categories.

Figure 3.4 Scope and responsibilities for flood risk assessments



- 3.20 Flood Risk Appraisals/Assessments at the regional and local levels should be undertaken under the supervision of an experienced and competent flood risk management specialist. Regional Planning Bodies (RPBs) and LPAs have a key role as clients in ensuring that work is properly scoped and carried out to address the specified issues of local concern.

REGIONAL FLOOD RISK APPRAISAL (RFRA)

Responsibilities

- 3.21 The need for RPBs to prepare Regional Flood Risk Appraisals (RFRA) and consider flood risk when preparing Regional Spatial Strategies is highlighted in paragraphs 11 and 24 of PPS25. RPBs should approach this task with reference to paragraph E4 of PPS25.

Objectives

- 3.22 The primary objective of a RFRA is to provide an appraisal of strategically significant flood risk issues in a region in order to guide strategic planning decisions. The aim is to provide information to guide new development to the safest location possible. The RFRA should inform the policies for managing flood risk and the broad strategy for development within the regional spatial strategy. Where there are significant strategic flood risk issues, the RFRA should provide the necessary information to allow the RPB to develop clear policies in the regional spatial strategy on how these issues are to be addressed at local authority level. The regional spatial strategy should aim to avoid flood risk by directing development towards broad areas within Flood Zone 1 (the sequential approach). Where development is necessary in a flood risk area for other sustainability reasons such as regeneration, then the RFRA should indicate what flood risk issues need to be addressed in order for development to continue.

- 3.23 A staged approach should be adopted:

- review SFRAs;
- take a wider look, to assess implications of Catchment Flood Management Plans, Shoreline Management Plans, River Basin Management Plans etc; and
- use alongside other regional spatial strategy work streams to identify and evaluate growth options.

Scope

- 3.24 The key requirements of a RFRA are summarised in annex E of PPS25. The detailed scope of a RFRA will depend on the nature of the flood risk issues in each region. It is recommended that initially a scoping exercise is undertaken in order to:
- identify issues for the regional spatial strategy in relation to flood risk;
 - define the objectives of the RFRA in relation to flood risk;

- identify boundaries to the RFRA (including consideration of neighbouring regions);
 - identify stakeholders (wide consultation will be expected for the regional spatial strategy, those with a stake in flood risk need to be identified);
 - identify potential flood risk components (i.e. possible sources, pathways and receptors);
 - identify initial flood risk indicators to be used and likely acceptability criteria (see paragraph 3.31 below); and
 - decide baseline conditions for the assessment.
- 3.25 It is important to involve key stakeholders when drawing up the scope of the RFRA so that strategic issues are clear from the outset. It gives the RPB the opportunity to discuss with partners the flood risk issues facing the region. This exercise should aim to provide a clear scope and specification for the RFRA.
- 3.26 The RPB needs to ensure that the scope and level of information collated is appropriate to the scale of the flood risk issues and development pressures across and within the region. All the types of flooding listed in Figure 3.2 should be considered as part of a regional or sub-regional scale assessment.
- Sources of information*
- 3.27 Whenever possible, existing assessments of flood risk should be used. This can reduce costs and time implications associated with new assessments, but also provides continuity of approach and, hence, continuity of decision-making. The starting point to gain an overview of broad flood risk issues within a region should be the Environment Agency's Flood Map, bearing in mind that these maps only cover river and tidal flooding. Reference should be made to the Environment Agency's Catchment Flood Management Plans and Shoreline Management Plans and any existing SFRAs which have been produced by LPAs. In addition, the Environment Agency has provided a map to LPAs (July 2009) showing areas susceptible to surface water flooding. This map is not as sophisticated as the Agency's main Flood Map, but indicates areas of land susceptible to surface water flooding after extreme rainfall.
- 3.28 However, it should be borne in mind that climate change predictions continue to develop and that these may have significant impacts on previous flood risk assessments – the Flood Map does not include the predicted effects of climate change. Also, flood events that have occurred since the production of previous assessments will provide more up-to-date information on the reality of flood risk. These factors need to be taken into account when reviewing the adequacy of existing assessments.
- 3.29 Sewerage undertakers may be able to provide an overview of broad locations with significant sewer flooding problems, and a strategic view on where the capacity of drainage networks is most likely to be exceeded. Navigation Authorities, including British Waterways, may be able

to give advice on any potential issues associated with the canal network. Internal Drainage Boards will be a key source of information for areas within the drainage districts.

- 3.30 The RFRA should also consider, in broad terms, the potential impact of climate change on future flood risk for the region. This should include consideration of the timescales over which it would be appropriate to assess and design for climate change when undertaking SFAs within the region.
- 3.31 A possible way of measuring the significance of flooding issues across the region is through the use of flood risk indicators. These are measurable attributes of the existing flood risk or the impact of a development on flood risk (see FD2320 Defra/Environment Agency, 2005). Indicators would include:
- the area and proportion of the region that lies within Flood Zone 3;
 - the number of existing properties at risk from river, coastal, surface water and other sources of flooding for which information is available;
 - the number of properties currently benefiting from flood defences of a defined standard; and
 - the annual average value of the damages caused by flooding across the region.
- 3.32 By using existing sources of information to quantify indicators of this kind it should be possible to identify whether existing flood risk is a significant issue in different parts of the region and:
- where in the region the problem of flood risk is likely to be the greatest;
 - how much of the region is protected by flood defences;
 - where limitations on the amount of development might apply;
 - whether new development in the region is likely to add to that risk and; therefore
 - whether flood risk needs to be considered in more detail, for example at sub-regional level, or whether the RFRA can provide the necessary evidence base for the Sustainability Appraisal and preparation of the regional spatial strategy.

More detailed appraisal

- 3.33 If flood risk is a significant issue within the region and the more readily available information sources do not provide the necessary information to characterise the risk, a more detailed appraisal may be required. For example, if significant development is proposed in a particular area, then it is recommended to look at the implications of this at the sub-regional scale. This would provide an opportunity to find broad alternative locations for development, or would highlight the issues that would need consideration by the affected LPAs should the development go ahead. If development is necessary in areas with a

significant risk of flooding, more detailed information should be provided by a sub-regional scale SFRA, rather than carrying out individual SFRAAs for each LPA.

Role of RFRA in planning for housing

- 3.34 Planning Policy Statement 3 *Housing* (Communities and Local Government, 2006) sets out the approach to identifying a sufficient quantity of housing to improve affordability across the housing market. Both PPS1 and PPS3 recognise the importance of considering flood risk when identifying suitable land for housing, consistent with sustainable development objectives.
- 3.35 SFRAAs should feed into the evidence base supporting planning for housing policies. In particular, they should be considered when determining potential sources of land for housing. The *Strategic Housing Land Availability Assessment Practice Guidance* (Communities and Local Government, 2007) explains how regions and local planning authorities can identify *potential* land for housing. As part of considering the potential suitability of broad locations and sites for housing, the risk of flooding should be recorded as part of the assessment. It will be the subsequent plan-making stages that determine whether a site is suitable to be allocated for housing, having regard to the findings of the assessment and the application of the Sequential Test required in PPS25.

Outputs

- 3.36 A RFRA should summarise the key strategic issues relevant to flood risk and the spatial planning process across the region. As a minimum, a RFRA should include the following:
 - summary plans/figures (ideally with accompanying digital spatial datasets) showing the **broad spatial distribution of flood risk** for use in the appraisal of options considered within the regional spatial strategy, covering all sources of flooding;
 - suggested **policies** for sustainable flood risk management for incorporation into the regional spatial strategy; and
 - suitable **locational criteria** for flood risk management measures for use in areas of high flood risk that are likely to be considered for development, including **guidance** on the preparation of SFRAAs and the management of surface water run-off from new developments.
- 3.37 Examples of locational criteria of this kind are provided in paragraph 2.18.
- 3.38 The RFRA outputs should enable the RPB to:
 - inform the Sustainability Appraisal when considering development options for a region/sub-region;
 - consider opportunities to locate development away from flood risk areas;

- take full account of flood risk when considering development options;
- show transparency that the sequential approach has been applied at the regional scale, and
- enable flood risk policies to be developed to provide sound guidance on how LPAs should manage flood risk.

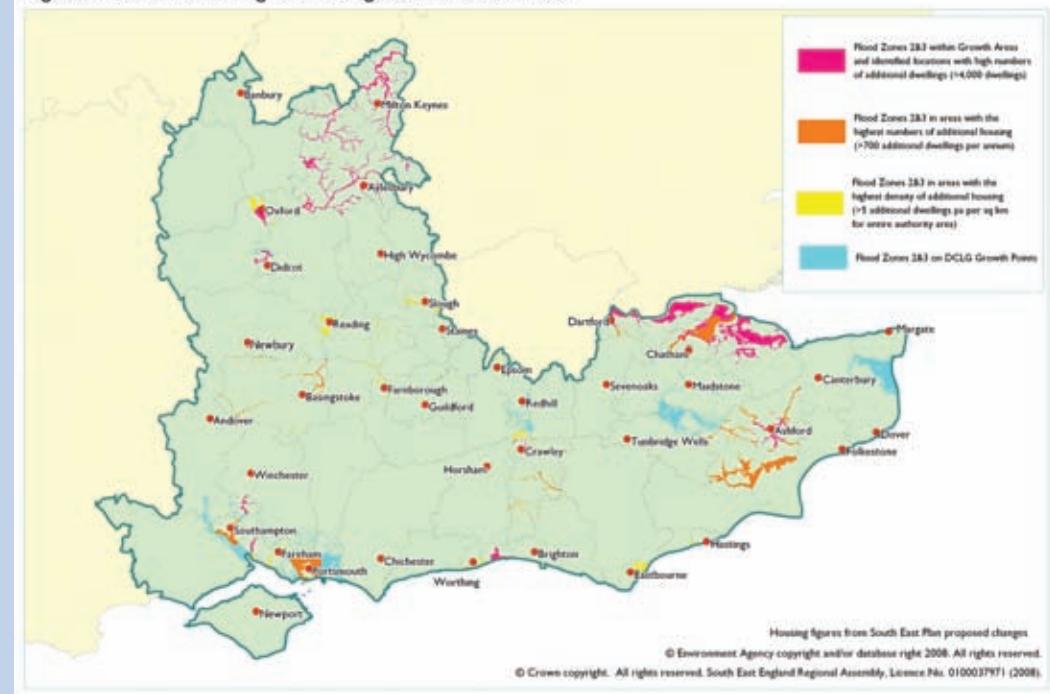
Case study

Regional Flood Risk Appraisal for the South East of England

The then South East England Regional Assembly (now the South East England Partnership Board) undertook a Regional Flood Risk Appraisal (RFRA) in autumn 2006, complementing the flood risk policy in the draft South East Plan. This was prior to the publication of PPS25 and the Practice Guide. At the time there was only limited information available on flood risk. The Assembly therefore commissioned an update of the RFRA.

The update of the RFRA published in late 2008 (see http://www.southeast-ra.gov.uk/sustainability_flooding.html) shows that areas in the South East of England where high growth and high flood risk coincide include South Hampshire, the Kent Thames Gateway, Ashford, Milton Keynes, Aylesbury, Oxford, Didcot, Reading, Crawley and Shoreham. For these identified areas flood risk indicators reflecting the full range of flood risk aspects/sources have been developed. However, the level of confidence concerning some indicators, such as flooding from surface or groundwater, is not high.

Figure 7: Coincidence of Highest Housing Growth and Flood Risk



Regional Flood Risk Appraisal for the South East of England (continued)



In areas such as South Hampshire and Kent Thames Gateway, the capacity to develop outside high flood risk areas considering all sources of flooding, and the scope of mitigation measures, has to be investigated broadly at local level before allocating future growth. The Government encourages a sequential approach, which steers development to areas without (or with mitigated) environmental constraints.

Images courtesy of the Environment Agency and the South East England Partnership Board

STRATEGIC FLOOD RISK ASSESSMENT (SFRA)

- 3.39 The Strategic Flood Risk Assessment is at the core of the PPS25 approach. It provides the essential information on flood risk, taking climate change into account, that allows the LPA to understand the risk across its area so that the Sequential Test can be properly applied.
- 3.40 SFRAAs should be a key part of the evidence base to help inform the allocation of development in a local plan area through the preparation of LDDs. It is unlikely that a LDD that was not supported by an adequate evidence base on flood risk would be found to be ‘sound’. Unsound plans must be withdrawn under regulation.

- 3.41 In carrying out its initial review of the implementation of PPS25 published in June 2009, Communities and Local Government recognised how getting good SFRAs in place across England is critical in meeting Sir Michael Pitt's recommendation for the implementation of the planning policy for managing flood risk. It is important to ensure SFRAs are robust, particularly in the light of the review findings that, in some cases, there had been differences in approach in covering matters such as surface water, groundwater and/or climate change. There is also the possibility that SFRAs could provide evidence to contribute towards meeting the requirements for providing Preliminary Flood Risk Assessments (PFRAs) under the EU Floods Directive.
- 3.42 The initial review of the implementation of PPS25, drawing on Defra's research study on the preparation of SFRAs, reported that over 85% of LPAs had completed a 'basic' level 1 SFRA (see paragraphs 3.43 onwards), with a further 13% in the process of being developed. Only 2% of LPAs had not produced a SFRA at all, largely due to awaiting finalising of boundary changes and/or reorganisation to unitary authorities.
- 3.43 Although nearly all LPAs have undertaken a level 1 SFRA, it is still felt it would be helpful and relevant to LPAs and other practitioners to provide guidance on the scope, approach and outputs expected for both level 1 and level 2 SFRAs, as set out in the earlier June 2008 version of this Practice Guide. LPAs should review their SFRAs if necessary to make sure they are "PPS25 compliant", and that they provide the necessary evidence to properly inform their development plan and development control decision making. The SFRA case studies following paragraph 3.64 below show where this has been done in practice.

Responsibilities

- 3.44 The need for LPAs to consider flood risk when preparing LDDs and to produce SFRAs is highlighted in paragraphs 12 and 25 of PPS25. PPS25 paragraphs E5-E7 gives some preliminary guidance and this is developed below. Local authority areas do not follow river catchment boundaries. As a catchment-based approach to flood management is desirable, LPAs should always consider the possibility of working in partnership with other LPAs to develop SFRAs at a catchment or sub-regional level. County level SFRAs may also be appropriate where minerals and waste issues can be considered at the same time.

Case study

Dacorum, St Albans, Three Rivers and Watford Strategic Flood Risk Assessment (SFRA) – an example of a sub-regional SFRA

Four councils in Hertfordshire grouped together to undertake a sub-regional Level 1 SFRA. The purpose of grouping together was to save time and resources by commissioning consultants to undertake this study over four boroughs. These boroughs also grouped together on this project as they wanted to ensure that future development would not have a flood risk impact on the neighbouring borough.

The end product of this piece of work is a robust SFRA that can be used in the local planning authorities' (LPA's) local development frameworks, including some useful maps on all sources of flooding.

The sub-regional SFRA enabled detailed analysis of flood risk to be carried out. The SFRA provides useful borough-specific flood risk assessment guidance which can be used by the LPA when advising developers on site-specific flood risk assessment. This guidance proposes a range of mitigation options and measures that can be put in place to reduce flood risk.

The LPAs also ensured that the key policy messages of the Thames Catchment Flood Management Plan were taken on board as recommendations in this document. This will help inform the compilation of borough-specific flood risk policies.

Case study

Strategic Flood Risk Assessment (SFRA) Task Group for the Thames Region – an example of the setting up a Task Group to manage multiple SFRA

In the Thames Region of the Environment Agency a SFRA task force was set up between August 2007 and March 2009 to project manage the delivery of eighty five local authority's SFRA across the region. This group provided a dedicated resource giving advice and guidance to all of these local authorities.

The role of this group was to take a proactive approach to delivering SFRA in Thames Region including influencing local authorities to undertake a SFRA, guiding them through the process, making recommendations for methodology and policy, and technically evaluating the outputs. That within two years three-quarters of all SFRA in this Region have now been completed to a high standard demonstrates the success of the group.

The approach adopted in this case study has been successful because it has fostered a partnership approach to delivering the goals of PPS25, and has given local authorities and their consultants one point of contact and a source of consistent advice, simplifying the process of SFRA production. This example could be used as a model elsewhere across the country.

Objectives

- 3.45 The key requirements of a SFRA are summarised in annex D paragraph D4 and annex E of PPS25. The SFRA should provide sufficient data and information on all types of flood risk to enable the LPA to apply the Sequential Test when determining land use allocations and, where necessary, the Exception Test. In addition, they will allow LPAs to:
 - fully understand flood risk from all sources within its area and also the risks to and from surrounding areas in the same catchment;
 - inform the Sustainability Appraisal so that flood risk is fully taken account of when considering options and in the preparation of LPA land use policies;
 - prepare appropriate policies for the management of flood risk within LDDs;
 - identify the level of detail required for site-specific flood risk assessments in particular locations; and
 - determine the acceptability of flood risk in relation to emergency planning capability.
- 3.46 It is important that the LPA takes ownership of the SFRA, and that it is developed in partnership with other key stakeholders, in particular, the Environment Agency, internal drainage boards and sewerage undertakers. Scoping a SFRA is essential to understand the strategic flood risk issues that need to be assessed. Consequently, the LPA should discuss the scope of the SFRA at an early stage with the Environment Agency and the other key

stakeholders. The Environment Agency, as a statutory consultee for the preparation of LDDs, needs to be satisfied that all flood risk issues are adequately covered and should be satisfied with the completed SFRA.

- 3.47 The LPA should project-manage the production of the SFRA, buying in any additional expertise and information needed from external consultants. The LPA needs to understand what the issues are for its area and the SFRA outputs it needs. The SFRA must be robust enough to use through the Sustainability Appraisal process.

General scope

- 3.48 A staged approach is recommended in PPS25 (annex E paragraph E6), designed to allow flexibility in the level of assessment required from one local authority area to another. In local authority areas where flooding is not a major issue and where development pressures are low, a less detailed approach will be required (referred to below as a Level 1 SFRA) relative to that necessary in areas where there is high development pressure and flooding is a significant issue.
- 3.49 Where a Level 1 SFRA shows that land outside flood risk areas cannot accommodate the necessary development and the Exception Test needs to be applied, the scope of the SFRA should be widened. This increased scope SFRA is referred to as a Level 2 SFRA in this Practice Guide. The recommended approach for Level 1 and Level 2 SFRAAs are outlined below.
- 3.50 The SFRA should be completed in time to inform the development of options for the allocation of land for development. For housing, this should be done through the Strategic Housing Land Availability Assessment. The timing of PPS25 and changes to the planning system have meant that some SFRAAs were carried out later than ideal.

Role of SFRA in planning for housing

- 3.51 Linked to the role of RFRAAs in planning for housing (paragraph 3.35), SFRAAs can help to assess the potential suitability of broad and site-specific locations for housing as required by the Strategic Housing Land Availability Assessments. As such, SFRAAs can inform the evidence base by helping to identify the level of flood risk.
- 3.52 However, the key role of the SFRA is to help determine whether potential sites identified in the evidence base are suitable to be allocated for housing as part of the subsequent plan-making stages. This will include applying the Sequential Test (and where appropriate the Exception Test) to potential sites to determine which are suitable to be allocated for housing. This means that flood risk mitigation measures should not be considered as part of how to overcome flood risk constraints as part of the Strategic Housing Land Availability Assessment.

Level 1 SFRA Scope and Approach

- 3.53 A Level 1 SFRA should be sufficiently detailed to allow application of the Sequential Test (annex D table D.1 of PPS25) and to identify whether development can be allocated outside high and medium flood risk areas, based on all sources of flooding, not just river and coastal, or whether application of the Exception Test is necessary. The information may also be used to assess how any environmental objectives relating to flooding, as defined in the Sustainability Appraisal, may be affected by additional development. A Level 1 SFRA may principally be a desk-based study making use of existing information.
- 3.54 Information sources for Level 1 SFRA may include:
- Environment Agency Flood Map (covering river and tidal flooding);
 - Environment Agency ‘Areas susceptible to surface water flooding’ map;
 - RFRA (including all sources referred to in the guidance provided on their preparation);
 - National Flood and Coastal Defence Database and National Flood Risk Assessment available from the Environment Agency;
 - expert advice from the Environment Agency who may be able to provide reports containing the results of detailed modelling and flood mapping studies, including critical drainage areas and historic flood events;
 - information from other flood risk consultees, including internal drainage boards, sewerage undertakers, highways authorities, local authorities (in their role as statutory drainage (operating) authority), navigation authorities, reservoir operators and informed local sources;
 - geological and soil maps (so the potential for the implementation of source control and infiltration sustainable drainage techniques, groundwater and overland flood risk can be assessed); and
 - historical records of flood events from local newspapers, local residents and community groups.

Level 1 SFRA Outputs

- 3.55 The key outputs from a Level 1 SFRA are:
- plans showing the LPA area, Main Rivers, ordinary watercourses and flood zones, including the functional floodplain if appropriate (as defined in annex D table D.1 of PPS25), across the local authority area, as well as all previously allocated development sites (or sites to be considered in the future);

- an assessment of the implications of climate change for flood risk at allocated development sites over an appropriate time period, if this has not been factored into the plans above⁵;
 - areas at risk from other sources of flooding such as surface water and groundwater flooding (N.B. the Environment Agency Flood Map only shows rivers and tidal flood risk);
 - flood risk management measures, including location and standard of infrastructure and the coverage of flood warning systems;
 - locations where additional development may significantly increase flood risk elsewhere through the impact on existing sources of flooding, or by the generation of increased surface water run-off (a Surface Water Management Plan may be needed);
 - guidance on the preparation of flood risk assessments for allocated development sites; and
 - guidance on the likely applicability of sustainable drainage systems techniques for managing surface water run-off at key development sites.
- 3.56 This information should be sufficient to allow application of the Sequential Test and inform the Sustainability Appraisal and subsequent plan policies.
- 3.57 Where the Level 1 SFRA demonstrates that land in Flood Zone 1 (taking climate change into account) cannot accommodate the necessary development then the Exception Test needs to be applied. A more detailed Level 2 SFRA will need to be carried out, including further data collection and/or analysis, as detailed in the following section.

⁵ Guidance on appropriate timescales over which to assess climate change impacts may be provided within the RFRA. For a Level 1 assessment, it is suggested that the minimum requirement would be a qualitative appraisal, by a flood risk management professional, of whether site allocations could potentially be affected by climate change impacts, as defined within Annex B of PPS25.

Level 2 SFRA Scope

- 3.58 The Level 2 SFRA corresponds to the ‘increased scope’ SFRA referred to in paragraph E6 of PPS25. The principal purpose of a Level 2 SFRA is to facilitate application of the Sequential and Exception Tests. More detailed information is required where there is deemed to be development pressure in areas that are at medium or high flood risk and there are no other suitable alternative areas for development after applying the Sequential Test. This more detailed study should consider the detailed nature of the flood hazard, taking account of the presence of flood risk management measures such as flood defences. This will allow a sequential approach to site allocation to be adopted within a flood zone (paragraphs 17 and D4 of PPS25). It will also allow the policies and practices required to ensure that development in such areas satisfies the requirements of the Exception Test, to be identified for insertion into the LDD.
- 3.59 The scope should consider the detailed nature of the flood hazard within a flood zone including:
- flood probability;
 - flood depth;
 - flood velocity; and
 - rate of onset of flooding.
- 3.60 These factors can be significantly affected by the presence of flood defences or any other infrastructure which acts as a flood defence (see chapter 7 and below). Flooding behind such infrastructure can occur either as a result of:
- constructional or operational failure of the defence, either in whole or in part (breach); or
 - water levels rising to exceed the level of the defence (overtopping); or
 - overloading of the surface water drainage system, either due to its own limited capacity, or being unable to discharge due to high water levels outside the defended area.
- 3.61 These mechanisms can lead to rapid inundation of areas by flood water and the consequences can be potentially catastrophic (chapter 7).

Information on flood defences

- 3.62 As part of a Level 2 SFRA information on the location, standard and condition of existing flood defences should be obtained from those who operate and maintain these assets. Future policy for these flood defence systems and assets, as set down in Catchment Flood Management Plans and Shoreline Management Plans should be reviewed.

Assessment of flood defence breaching and overtopping

- 3.63 Section S3.2 of *FD2320 Flood Risk Assessment Guidance for New Development Phase 2*, Defra/Environment Agency R & D Project 2004, provides guidance on the assessment of the risk to people behind flood defences. This document suggests three approaches to the assessment of flood risk of increasing complexity (Simple-Intermediate-Complex). FD2320 (Section D3.4) suggests that the Simple or Intermediate methods may be appropriate for SFRA, although the approach taken will depend upon the flood risk, pathways and receptor vulnerability in the area behind the flood defences. The analysis needs to be sufficiently detailed to allow the application of the sequential approach within the flood zone. Assessment of flood defence breaching should generally be undertaken on the basis of a design event of the appropriate design standard (1 per cent for river flooding, 0.5 per cent for flooding from the sea), including an allowance for climate change.
- 3.64 Assessment of overtopping of flood defences should generally be undertaken on the basis of events exceeding their design standard up to a 0.1 per cent flood event, including an allowance for climate change. In coastal areas, factors such as wave height and direction will also need to be included in the assessment.

Case study

Calder Valley Level 1 SFRA and Central Wakefield Area Action Plan (CWAAP) Level 2 SFRA – examples of good practice

The Calder Valley Level 1 SFRA for Calderdale and Kirklees Metropolitan Borough Councils and the City of Wakefield Metropolitan District Council, formed a key component of each Council's Strategic Environmental Assessment and the Sustainability Appraisal, and it influenced the development of the Core Strategy. This joint study recognised the need for consideration of inter-district flood risk hazards and linkages, particularly in respect of the risks from surface water flooding.

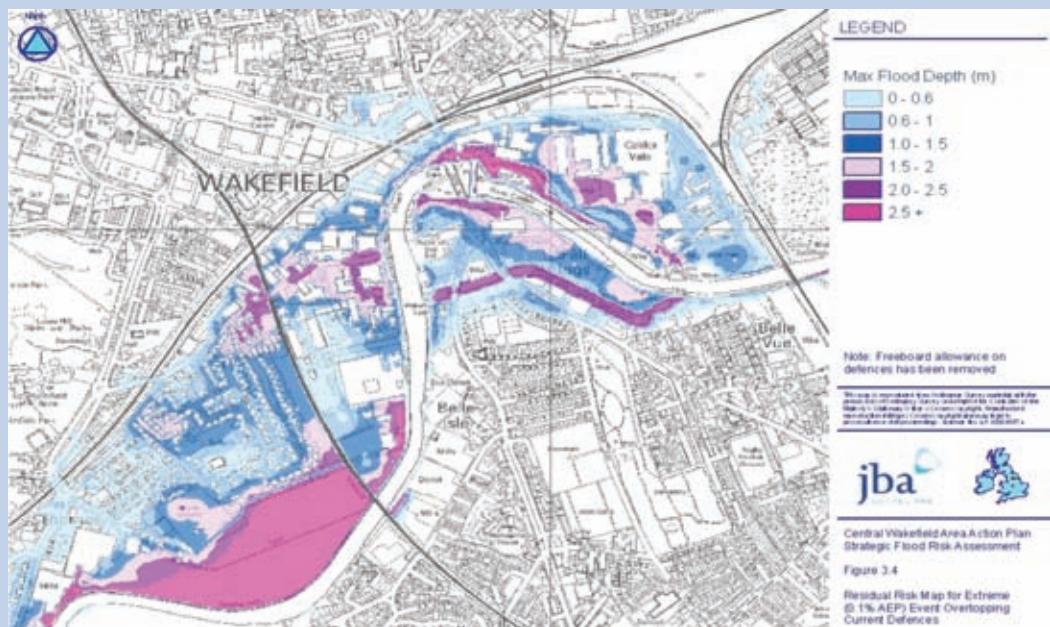
The SFRA undertook detailed surface water screening modelling in six key areas. Drawing upon a suite of SFRA flood risk maps showing fluvial flood extents and depths for different levels of protection, areas naturally vulnerable to surface water flooding and areas subject to climate change sensitivity, a rich picture of the spatial scale and nature of actual and residual flood risks was provided.

The Level 1 SFRA enabled the Councils to implement the Sequential Test and provided an early screening on the likely outcome of the Exception Test, allowing them to seek alternative lower risk sites and determine the need to undertake a Level 2 SFRA. In addition, the Level 1 SFRA identifies Critical Drainage Areas and then suggests locations where Surface Water Management Plans are required.

Continued

Calder Valley Level 1 SFRA and Central Wakefield Area Action Plan (CWAAP) Level 2 SFRA – examples of good practice (continued)

Central Wakefield is proposed as the economic heart of the district and based on information provided in the Level 1 SFRA, the Level 2 SFRA was completed, providing a better understanding of the flood risk mechanisms in central Wakefield. The Level 2 SFRA provided the evidence base for carrying out the Exception Test on five Special Policy Areas across the city, and to support the Central Wakefield Area Action Plan. Integrated flood risk management and development solutions were needed and detailed modelling of the River Calder and central Wakefield was developed to help assess both actual and residual flood risks. A suite of key indicators was adopted and a flood risk balance sheet used to test the policy areas, and to propose land use policies that reflected the scale of residual risks.



*Residual risk map for extreme event overtopping current defences
Image courtesy of JBA Consulting*

The Examination in Public for the Wakefield Core Strategy and the Central Wakefield Area Action Plan accepted that this approach to land use policy was appropriate, and should override individual landowner expectations for higher vulnerability development. Benefiting from the updated 'PPS25 compliant' SFRA work, and in line with the Inspector's findings, Wakefield Council amended its Core Strategy and Development Policies and is using the Level 1 SFRA to prepare the Site Specific Proposals development plan document.

Case study

Isle of Wight (IoW) SFRA – example of good practice

This island wide SFRA provides a robust and credible evidence base to apply the flood risk Sequential & Exception Tests in PPS25. It informs development proposals and allocations through the local development framework process, including individual site specific flood risk assessments (particularly in assessing and avoiding flood risk). Site specific allocations have been turned down using SFRA information to sequentially test their appropriateness.



Newport Harbour [Supplementary Planning Guidance] will be revised through the Site Allocation Development Plan Document and Newport Waterfront [Supplementary Planning Guidance], and the SFRA will be used to assess suitable uses for potential development sites. Image courtesy of Isle of Wight Council

Continued

Isle of Wight (IoW) SFRA – example of good practice (continued)

In response to the need for growth, the Council identified 14 potential broad development areas comprising over 1400 potential development sites and the SFRA has considered the flood risk to each one of these locations. Two digital GIS datasets with “traffic light” development site flood risk classifications and flood zone maps have been produced and these comprise:

- Attribution Database: Sites are attributed with the highest risk flood zone that poses a risk to them, and each site is assessed on the basis of whether it will be impacted by climate change and tidal and fluvial flooding events. Information on the requirements of a flood risk assessment, historic flooding, proximity to a Main River and any defences are also presented. The dataset also categorises the infiltration potential and surface water run off potential for each site.
- Site Specific Database: This dataset contains greater detail for those sites identified as being in Flood Zones 2, 3a or 3b and provides the variation of flood risk across each site; historic flooding; climate change implications; and a drainage assessment, thereby identifying parts of each site where certain uses are restricted.

A three-tiered assessment of flood risk has been undertaken: Level 1 identified all potential sites suitable for development; Level 2 identified all potential sites impacted by a flood risk zone; and Level 3 identified the flood risk present at each site. A focus has been given to fluvial and tidal flood risks due to their prominence, and surface water and groundwater have been assessed proportionate to the risks involved.

The SFRA has played a significant role in influencing the submission Core Strategy so that the most appropriate types of development are at the most suitable locations to contribute towards sustainable growth within the Island. Four Core Policies on General Criteria for Housing Development; Sustainable Development; Flood Risk; and Water Resources, require flood risk management actions to be carried out. This includes minimising flood risk, meeting the Sequential and Exception Tests and all development to include sustainable drainage systems.

For specific locations around the Island, which include regeneration areas and vulnerable communities, Supplementary Planning Documents (SPD) will be developed which will address the specific flood risk related issues that need to be taken into account by development proposals within areas covered by the SPD. The SPD will outline what measures need to be demonstrated so that new developments would not be at risk of flooding as a result of climate change, or would not worsen flood risk elsewhere. It would also ensure that the identified risks are appropriately managed in specific settlements.

Case study

Hull City Council SFRA – an example of where surface water flooding was identified as a particular issue resulting in the production of a city-wide Surface Water Management Plan

In June 2007 over 8000 properties within Hull City were flooded from surface water. This was the first time the city had experienced flooding of this magnitude. None of the properties were flooded from the Humber Estuary or from the rivers, yet 95% of Hull is classified as at a high risk from fluvial and tidal flooding.

Having already carried out a level 1 SFRA, a level 2 SFRA was completed in November 2007. The steering group tasked with producing the SFRA consisted of Hull City Council, East Riding of Yorkshire Council (neighbouring authority), the Environment Agency and Yorkshire Water. The methodology and outputs of the SFRA were agreed by the steering group. The SFRA considered the detailed nature of the flood hazard, taking account of the presence of flood risk management measures such as flood defences. Simplified surface water modelling to identify flood risk areas associated with pluvial flooding was undertaken. A key output was the map below which designates the city into 6 different degrees of flood risk from all sources of flooding.

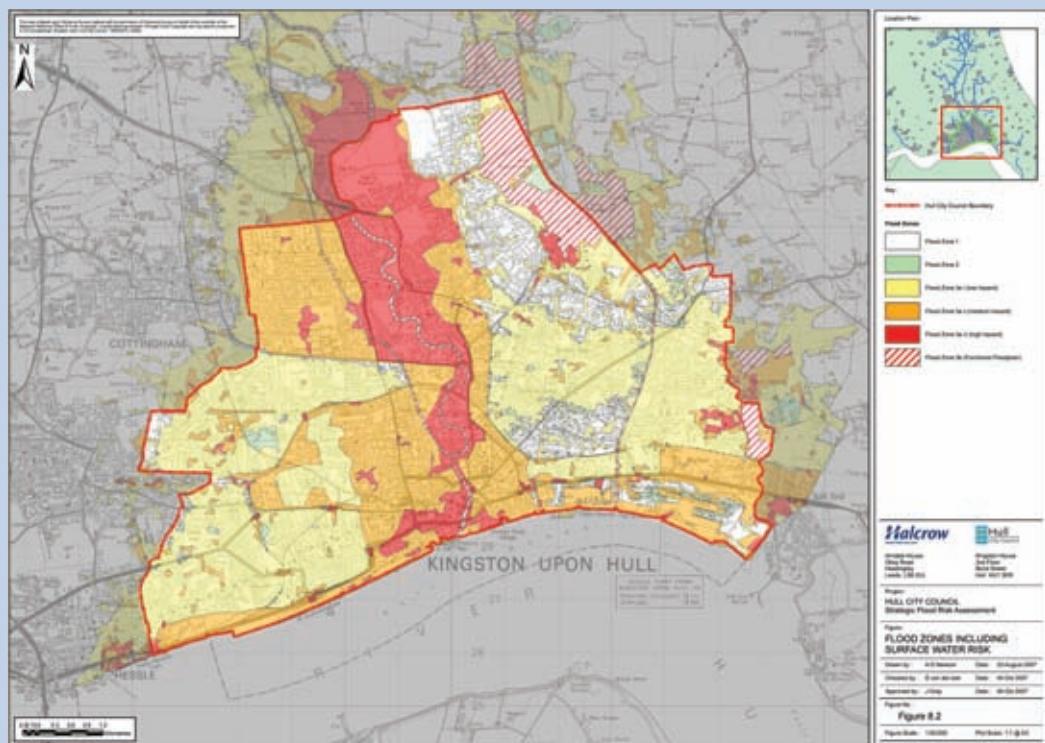


Image courtesy of Hull City Council

Continued

Hull City Council SFRA – an example of where surface water flooding was identified as a particular issue resulting in the production of a city-wide Surface Water Management Plan (continued)

Some Local Standing Advice was produced to accompany the map.

<http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/FLOOD%20RISK%20ASSESSMENT/FRSAPROPOSALS.PDF>

This outlines the level of detail required within flood risk assessments and when to consult the Environment Agency. The Local Standing Advice enables the Council to make fully informed planning decisions and apply the Sequential and Exception Tests. In addition, the advice provides detailed flood design solutions to mitigate the flood risk (e.g. raised floor levels, height of flood proofing and the level of a place of safety).

Building on the SFRA, Hull City Council was successful in attaining DEFRA support for the production of a city-wide Surface Water Management Plan (SWMP). The SWMP will:

- provide a detailed understanding of surface water risk and the same members of the SFRA steering group are leading this work.
- inform options to reduce the risk of surface water flooding and possible locations for aqua greens (multi-use areas used for recreation or amenity use when dry and to store water in extreme flood events).
- influence long term capital investment decisions of the local authorities, Environment Agency and water company.

The SWMP is due to be completed before the end of 2009 and will be crucial in influencing how other SWMP's are produced in the future.

Crucial elements to manage flood risk effectively include:

- Strong partnerships able to take difficult decisions
- Consideration of all sources of flooding
- Clearly defined output (map and recommendations)
- Simple tools which planers and developers can apply (e.g. local standing advice)
- Senior officer and political support to apply the recommendations
- Needs to be publicly available and widely understood
- A long term strategy.

Case study

Sheffield City SFRA – an innovative approach to flood risk mapping in urban areas

As part of the Core Strategy process, Sheffield City Council undertook a Strategic Flood Risk Assessment. The SFRA included work to map functional floodplain (Flood Zone 3b) to aid the implementation of PPS25. However, given the predominantly urban nature of the LPA area, and the prevailing convention to remove built-up areas from functional floodplain, a special designation was given to those areas of functional floodplain lying in the urban area – Flood Zone 3a(i).

This meant that there was an acknowledgement of the high flood risk in these areas, without applying the strict policy restrictions associated with functional floodplain (Flood Zone 3b). Sheffield City Council's resultant Core Strategy ensures that the footprint of built development in these areas would not be increased and would, where possible, be reduced. In addition the policy prevents the locating or subdividing of properties that would be used for more vulnerable uses. This innovative approach is now being promoted for SFRAAs throughout the Region.

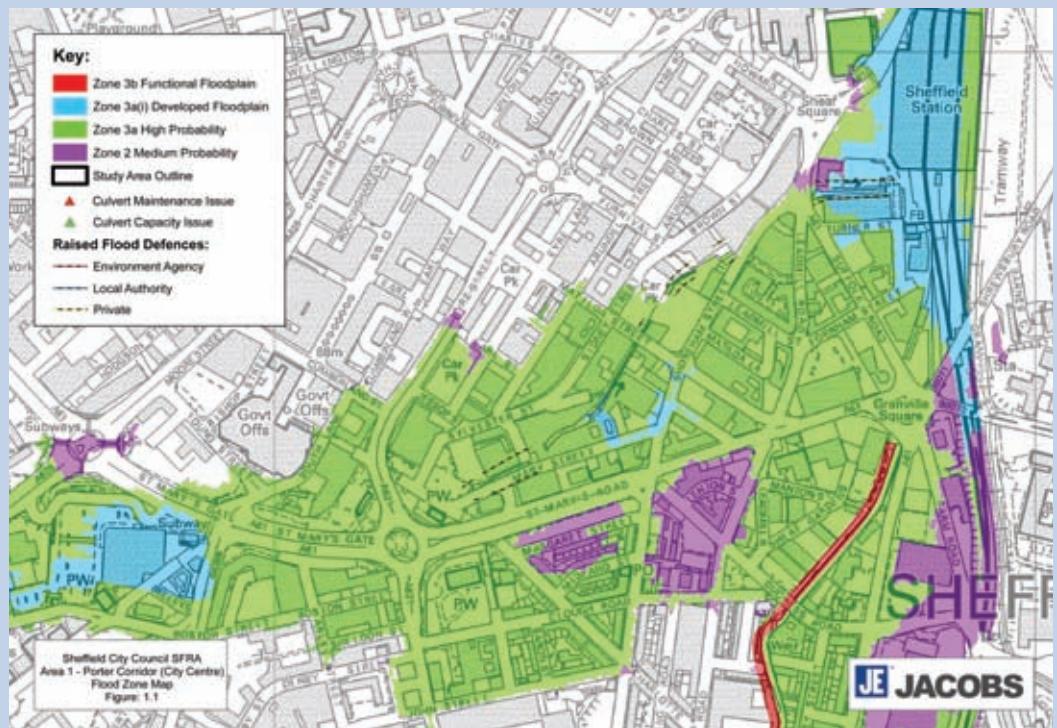


Image courtesy of Jacobs and the Environment Agency

Level 2 SFRA Outputs

- 3.65 A Level 2 SFRA should build on the source information that would be comprised within a Level 1 SFRA and contain:
- an appraisal of the current condition of flood defence infrastructure and of likely future flood management policy with regard to its maintenance and upgrade;
 - an appraisal of the probability and consequences of overtopping or failure of flood risk management infrastructure, including an appropriate allowance for climate change;
 - definition and mapping of the functional floodplain in locations where this is required;
 - maps showing the distribution of flood risk across all flood zones from all sources of flooding taking climate change into account;
 - guidance on appropriate policies for sites which could satisfy parts a) and b) of the Exception Test, and on the requirements that would be necessary for a flood risk assessment supporting a planning application for a particular application to pass part c) of the Exception Test;
 - guidance on the preparation of flood risk assessments for sites of varying risk across the flood zones, including information about the use of sustainable drainage techniques;
 - identification of the location of critical drainage areas and identification of the need for Surface Water Management Plans; and
 - meaningful recommendations to inform policy, development control and technical issues.
- 3.66 In general, the SFRA should aim to provide clear guidance on appropriate risk management measures for adoption on potential sites within Flood Zones 2 and 3, which are protected from flooding by existing defences, to minimise the extent to which individual developers need to undertake separate studies of the same problem e.g. breach and overtopping studies. In some instances improvements to existing flood defences may be required to manage residual flood risks (see annex G of PPS25). Where such flood defence works are considered, the SFRA should include an appraisal of the extent of any works required to provide or raise the flood defence to an appropriate standard.
- 3.67 The SFRA should provide information on the variation of risk within flood zones which are protected by flood defence infrastructure, draw appropriate conclusions and make recommendations for each potential development site.

Sub-regional SFRA

- 3.68 Where sub-regional assessments are undertaken, these will provide more detailed information on the broad spatial distribution of flood risk within extensive areas of Flood Zone 2 and 3, where development is to be considered, but where it will be necessary to apply the Exception Test. An example of a sub-regional SFRA is provided on page 51. Such studies can be led by RPBs or by groups of LPAs, as described above. A sub-regional SFRA provides the opportunity to locate necessary development safely on a wider strategic basis, avoiding the constraints of local administrative boundaries.

Issues related to guidance provided within SFRA

Defended areas

- 3.69 Policy and practice for managing these particular risks in these areas as part of the spatial planning process should be included in the SFRA. This will need to be made in full knowledge of the future plans for management or maintenance of the flood defences and drainage infrastructure, together with knowledge of how climate change will affect the protection offered over the lifetime of the development.
- 3.70 When new development is an option behind raised flood defences the impact on residual flood risk to the development itself and to other properties should be considered. New development behind flood defences can, depending on the circumstances, increase or reduce the residual flood risk, should these defences breach or overtop, by interrupting conveyance routes (flow paths) and/or by displacing flood water. If conveyance routes that allow flood water to pass back into a river or the sea following failure of a flood defence are blocked this will potentially increase flood risk to existing properties. If there is a finite volume of water able to pass into a defended area following a failure of the defences, then a new development, by displacing some of the flood water, will increase the risk to existing properties. Raised land on which new development is located may prevent flood water from reaching other areas which would have otherwise flooded.
- 3.71 It is recommended that, should any land allocation be proposed in a defended flood area, consideration be given to the potential cumulative impact of loss of storage at the allocation sites on flood risk elsewhere within the flood cell. Such assessment should be appropriate to the scale and nature of the proposed development and flood risk. If the potential impact is unacceptable, mitigation should be provided or allocations rejected. Since the impact of proposed new development in defended areas on the flood risk to existing development could be negative or positive, depending on the circumstances, it is essential that hydraulic modelling is thorough and robust.

Example 1: Limited land allocation

The total area of land allocation within a flood cell that is defended against fluvial flooding to a standard of 1 per cent (including an allowance for climate change and freeboard) is 0.2 ha. The flood cell within which the proposed allocation site is located has a total area of 50 ha. If a breach in the flood defences occurred, the depth of flooding at the allocation site would be 0.3 m. Simple calculation indicates that the impact of loss of floodplain storage on this site on water levels in the flood cell could be expected to be in the order of:

$$0.3 \times (0.2/50) = 0.0012 \text{ m higher}$$

As the increase is negligible, compensatory floodplain storage would not be necessary, although it should be demonstrated in site-specific flood risk assessments that the amount of residual floodplain volume lost due to the development had been minimised by careful development design.

Undefended areas excluding the functional floodplain

- 3.72 Where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, it should comply with policy in PPS25 paragraph 5, i.e. remain safe without increasing flood risk, and ideally reducing the risk. Because of this, the implications of development for flood risk, including issues such as safe access, need to be carefully considered and appropriate guidance provided to developers within the SFRA.
- 3.73 Application of the flood risk management hierarchy should be used before solutions such as ground raising or the construction of new defences are considered. Defence may be provided in a number of ways, and the SFRA should look at options, such as flood storage, in these circumstances, as well as embanked defences at the site in question.
- 3.74 In undefended coastal areas, raising the ground is less likely to impact on maximum water levels from tidal sea flooding and provision of compensatory storage may not always be necessary, whereas in undefended estuarine areas, raising the ground could impact on maximum tidal levels and provision of compensatory storage may be necessary. There are few circumstances where provision of compensatory flood storage or conveyance will not be required for undefended fluvial floodplain areas. This is because, whilst single developments may have a minimal impact, the cumulative impact of many such developments can be significant. Compensation should aim to be provided for on a “level for level” basis to mimic floodplain characteristics prior to the proposed development.

Compensatory Flood Storage/Conveyance

- 3.75 Where development may be proposed in flood risk areas there may be a need to establish whether there is land available for compensatory flood storage in order to ensure that overall flood risk does not increase. A Level 2 SFRA should look at the feasibility of the compensatory flood storage being provided in the near vicinity of new development. Similarly with conveyance routes, these need to be considered as part of the SFRA. The LPA needs to bear in mind that if compensatory flood storage cannot be found, or conveyance

routes cause significant impacts, then proposed allocations may in the future not be able to pass part c) of the Exception Test.

- 3.76 Further consideration of compensatory storage is given in chapter 6.

Example 2: Substantial allocation

A number of allocation sites are proposed within an area that is defended against fluvial flooding to a standard of 1 per cent (including an allowance for climate change and freeboard). The total area of the allocation sites is 20 ha. The flood cell within which the proposed development is located has a total area of 50 ha. If a breach in the flood defences occurred, the average depth of flooding at the allocation sites would be 0.3 m, based on the volume of water passing through the breach over the duration of the flood. Simple calculation indicates that the impact of loss of floodplain storage on this site on water levels in the flood cell could be expected to be in the order of:

$$0.3 \times (20/50) = 0.12 \text{ m higher}$$

Such an increase would be unacceptable and therefore the development should be designed to avoid such a significant loss of storage. A more detailed analysis would be required to assess the impact of the proposed allocation sites on residual flood risk, and measures identified to avoid an unacceptable impact.

Run-off rates and volumes from new development

- 3.77 SFRAAs should provide baseline information on where flooding from surface water and run-off is a problem now and possibly in the future due to climate change. SFRA outputs should be used to identify areas with critical drainage issues where measures will be required to ensure that these risks are managed safely, either through development or investment from operating authorities, in particular sewerage undertakers. This should be done by consultation between the LPA, the local authorities' own drainage function, Environment Agency, internal drainage boards and sewerage undertakers. The identification of areas of critical drainage issues should result in Surface Water Management Plans being commissioned which will seek ways to manage surface water flooding in the future.
- 3.78 Local authority led Surface Water Management Plans should become a co-ordinating mechanism at regional, sub-regional and local levels. Surface Water Management Plans should allow LPAs to:
- Undertake a comprehensive assessment of surface water flooding as part of their strategic flood risk assessment and predict where it could happen;
 - Make informed land use planning decisions on the basis of such an assessment;
 - Clarify responsibilities and co-ordinate investment in drainage systems to manage the risk more effectively, and with greater use of sustainable drainage systems;
 - Improve emergency plans for surface water flooding; this approach is pro-active and risk-based, and therefore delivers resources where they are needed most.

- 3.79 SFRAAs should be used as an initial stage to producing guidance to developers on how surface water should be managed and on the potential for using sustainable drainage measures. This topic is covered in chapter 5 of this practice guide. The starting point for this guidance should be the policies stated in annex F, paragraph F10 of PPS25. These policies state that both the rates and volumes of run-off from new developments should be '*no greater than the rates prior to the proposed development, unless specific off-site arrangements are made which result in the same net effect*'. This may have significant implications for new developments, which developers will need to factor into the earliest stages of their site assessments.

SITE-SPECIFIC FLOOD RISK ASSESSMENT (FRA)

Responsibilities

- 3.80 Landowners have the primary responsibility for assessing the flood risk to and from their property. Site-specific Flood Risk Assessments (FRAs) are generally prepared by prospective developers for specific development sites. The general principles and key requirements of a FRA are summarised in annex E of PPS25. The responsibilities of the developer, LPAs and other key stakeholders in the development control process relevant to new development sites are discussed in chapter 2 of this practice guide. FRAs may be stand-alone documents submitted by the developer to accompany a planning application, or, where an Environmental Statement is required for a development, the developer should ensure that the FRA is incorporated into this.

Objectives

- 3.81 The objectives of an FRA is to establish the following:
- whether a proposed development is likely to be affected by current or future flooding from any source;
 - whether it will increase flood risk elsewhere;
 - whether the measures proposed to deal with these effects and risks are appropriate;
 - if necessary provide the evidence to the LPA so that the Sequential Test can be applied; and
 - whether the development will be safe and pass part c) of the Exception Test if this is appropriate (paragraph D9c of PPS25)

When is a site-specific Flood Risk Assessment required

- 3.82 Paragraph E9 annex E of PPS25 defines when a flood risk assessment should be produced as part of a planning application. It is important to recognise that the Environment Agency is likely to object to a planning application if a FRA is required but not produced, or is deemed to be inadequate. The Standard Application Form (One App) clearly sets out when a FRA is needed. It should be provided along with the application form when submitting the application to the LPA. A checklist which can serve as an aide memoir to developers on the matters which their FRA should be taking into account is set out in appendix B.

- 3.83 The Environment Agency website www.environment-agency.gov.uk enables developers to examine whether their proposed site is within Flood Zone 2 or 3 using the Flood Map. This website also provides developers with standing advice which covers broad FRA requirements.

Scope

- 3.84 PPS25, annex E paragraph E3 sets out the minimum requirements for FRAs.
- 3.85 Where SFRAAs have been completed, these form the starting point for the site-specific FRA. The scope of a FRA can be very variable depending on factors such as the type and characteristics of flood risk and whether the development is in accordance with a sequentially tested LDD policy.
- 3.86 FRAs should always be proportionate to the degree of flood risk and should make optimum use of information already available. It is also important that as well as being proportionate to the degree of risk, an FRA should be appropriate to the scale, nature and location of the development. For example, where the development is an extension to an established existing house for which planning permission is required and the house is in an area of high flood risk, it is quite proper that a FRA is prepared to assess that risk. However, a pragmatic approach should also be taken, having regard to the scale and nature of the development, on the level and detail of the information required to enable the LPA, with advice as necessary from the Environment Agency, to be able to reach an informed decision on the planning application. In such a case it would be expected that the LPA would need a lower level of coverage and detail in the FRA than for a new detached property in a similar location.
- 3.87 Where a SFRA has been produced this should provide more detailed information on flood risk as it will cover all sources of flooding. Where no SFRA has been prepared, interim procedures should be agreed with the LPA in consultation with the Environment Agency and any other key consultees.
- 3.88 The scope of FRAs should be agreed with the LPA in consultation with the Environment Agency and any other relevant bodies, as set out in chapter 2 of this practice guide and annex H of PPS25. Pre-application meetings are highly recommended for large developments to ensure that all flood risk issues, including surface water management options, are adequately scoped. The key components of a FRA are summarised in Figure 3.5.

Levels of FRA

- 3.89 *Development and flood risk – guidance for the construction industry C624* (Construction Industry Research and Information Association (CIRIA), 2004) defines three levels of FRA which can be undertaken⁶. This process is useful to determine the level of detail required in the FRA to ensure that it is fit for purpose. The three levels are summarised in Figure 3.5 and covered in more detail in the following sections.

⁶ A FRA toolkit is available to download from the CIRIA website (<http://www.ciria.org/downloads.htm>). This includes a flowchart that guides the user through the tiered FRA process. Further details about the methodologies and approaches to FRA may be found in CIRIA publication C624 and FD2320 (Section D3.5).

Figure 3.5 Levels of FRA

FRA Level	Description
Level 1	Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information, including the SFRA, where there is one in place, Environment Agency Flood Map and their Standing Advice. The screening study will ascertain whether a FRA Level 2 or 3 is required.
Level 2	Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or that the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include the following: <ul style="list-style-type: none"> • an appraisal of the availability and adequacy of existing information; • a qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
Level 3	Detailed study to be undertaken if the Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: <ul style="list-style-type: none"> • quantitative appraisal of the potential flood risk to the development; • quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • quantitative demonstration of the effectiveness of any proposed mitigation measures.

Figure 3.6 Typical sources of information

FRA Level	Typical Sources of Information
1 Screening study	<ul style="list-style-type: none"> • Strategic Flood Risk Assessment • Environment Agency Flood Map • Environment Agency Standing Advice • PPS25 table D.1 • Surface Water Management Plan and Water Cycle Study
2 Scoping Study	<p>All the above plus</p> <ul style="list-style-type: none"> • Regional or local policy statements or guidance (e.g. Regional Spatial Strategies, Local Development Documents) • Regional Flood Risk Appraisals • Catchment Flood Management Plans/Shoreline Management Plans/River Basin Management Plans • Surface Water Management Plans • Consultation with the LPA/Environment Agency/sewerage undertakers and other flood risk consultees to gain information and to identify, in broad terms, what issues, related to flood risk, need to be considered including other sources of flooding • Historic maps • Local libraries and newspaper reports • Interviews with local people and community groups • Walkover survey to assess: <ul style="list-style-type: none"> – Potential sources of flooding – Likely routes for flood waters – The site's key features, including flood defences, and their condition • Site survey to determine: <ul style="list-style-type: none"> – General ground levels across the site – Levels of any formal or informal flood defences relevant to the site • Other documents listed in Appendix C of this Guide.
3 Detailed study	<p>As above, plus</p> <ul style="list-style-type: none"> • Detailed topographical survey • Detailed hydrographic survey • Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development • Monitoring to assist with model calibration/verification • Continued consultation with the LPA, Environment Agency and other flood risk consultees.

Outputs of a FRA

- 3.90 As highlighted above, the content of a FRA should always be appropriate to the scale and nature of the development. The outputs of a FRA will be site-specific and dependant on the site characteristics. A typical Level 2 or Level 3 FRA could cover the following:

Development description and location

- the type of development proposed and where it will be located
- the vulnerability classification (table D.2, annex D, PPS25)
- whether the proposed development is consistent with the Local Development Documents
- evidence that the Sequential Test and Exception Test (if necessary) has been applied in the selection of this site for the development type proposed, or reference to this if presented in other planning documents.

Definition of the flood hazard

- all sources of flooding that could affect the site
- identify sources, describe how flooding would occur, with reference to any historic records wherever these are available
- the existing surface water drainage arrangements for the site.

Probability

- the flood zone the site is within
- information from the SFRA covering the site
- the probability of the site flooding taking account of the contents of the SFRA and of any further site-specific assessment
- the existing rates and volumes of run-off generated by the site, including information on flow and rate of onset.

Climate change

- the effects of climate change on flood risk for the lifetime of the development – use annex B of PPS25.

Detailed development proposals

- details of the development layout, referring to the relevant drawings (cross referring to the main application)

- where appropriate, demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (applying the Sequential Test at site level).

Flood risk management measures

- how will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime.

Off site impacts

- demonstrate how the measures to protect the development from flooding will ensure that there will be no increased flood risk elsewhere
- measures to prevent run-off from the completed development causing an increased impact elsewhere
- the incorporation of sustainable drainage systems in the overall design of the development or justification of why they are not suitable.

Residual risks

- an assessment of the flood-related risks that remain after measures to protect the site from flooding have been implemented
- who will manage the risks and enforce compliance over the lifetime of the development.

A FRA checklist is provided in appendix B.

Case study

Newhaven Regeneration and North Street, Lewes projects - examples of partnership working between developer and the Environment Agency in producing robust FRAs

The Environment Agency is working in partnership with Lewes District Council, Newhaven Town Council and various other bodies on the Newhaven Regeneration Project and the North Street Vision Project in Lewes.

These projects are considering the regeneration potential of two large areas of previously developed land within Lewes District.

The Newhaven Regeneration Project is mainly looking at the regeneration of the east bank of the River Ouse, which currently mostly has port related uses. The project is looking at the potential to regenerate the site with mixed use development and the relocation of port related uses. As part of the regeneration of this area new tidal river defences will be required to protect the flood cell to the 1 in 200 year tidal event for the year 2115. Numerous meetings involving a number of key stakeholders have been held.

The North Street Vision is looking at the regeneration potential of the west bank of the River Ouse, north of the Phoenix Causeway in Lewes. The site currently contains commercial uses and the project is looking at the potential to replace this with mixed use development. As part of the regeneration of this site new fluvial defences are proposed to protect the whole of this particular flood cell up to the 1 in 100 year event, including allowances for climate change. There have been numerous meetings involving a number of key stakeholders and public consultation and workshops have taken place to gain a wider view of the proposals.

The majority of both sites are situated within the indicative floodplain and a significant area of the North Street site was flooded in 2000. Both projects are currently awaiting the outcomes of the Lewes District Council's Strategic Flood Risk Assessment to inform the planning process.

Allowing for uncertainty

- 3.91 Where flood risk is an important issue and evidence is required to show that the planning application passes the Exception Test, FRAs may require complex analyses and the use of specialist techniques and software, particularly in the design of measures to protect vulnerable properties from flooding. Hydrologists and hydraulic modellers seldom have all the data they require in order to accurately determine the flows and flood levels associated with events with annual probabilities as low as one per cent. It is important that developers discuss with LPAs and the Environment Agency to ensure that where such studies are proposed, they are appropriate and the approach takes adequate account of the need to:
- calibrate and verify numerical models using all relevant information reasonably available;
 - allow for uncertainties in the input parameters; and
 - consider the sensitivity of modelling results to uncertainty in the input parameters and adopt a precautionary approach, particularly where uncertainty could have serious consequences.

Use of modelling software

- 3.92 The modelling software chosen for detailed Level 3 FRAs should be capable of producing the relevant outputs identified in the scope for the FRA. It will generally be appropriate to choose commercial hydraulic/river modelling software that is in widespread use for work in relation to river and coastal flooding. Surface water flooding and design of drainage elements may require different software. In certain circumstances, for example, where the applicability of a model to a specific situation has not been previously demonstrated, it will be necessary for those conducting the FRA to have independent benchmarking tests carried out to demonstrate model performance using standard data.
- 3.93 In reporting on any hydraulic modelling carried out as part of the FRA, a technical description of the model should be provided. This should include the name and version of the software used. Where non-standard software has been used, evidence should be provided to demonstrate the applicability of the model(s) to the situation in question.
- 3.94 A non-technical summary of modelling outputs should be produced for non-specialists to be able to understand the conclusions and implications for flood risk on and off the site.

CLIMATE CHANGE

- 3.95 The Environment Agency Flood Map and Flood Zones do not currently take account of climate change impacts; PPS1 Planning and Climate Change – Supplement to Planning Policy Statement 1 and PPS25 requires that the spatial planning process should. When completing RFRA and SFRAs, planning bodies will need to agree how to factor climate change into these studies and over what timeframe. Policy in this area may best be defined at

a regional level based on the nature of the development pressures and flooding problems across the region. It should be borne in mind that the costs and benefits of all publicly-funded flood alleviation schemes are considered over a 100 year time horizon, to help ensure that the preferred options take account of long-term sustainability issues.

- 3.96 New UK Climate Projections (UKCP09), updating those that were published in 2002 by the UK Climate Change Impacts Programme (UKCIP02), were published in June 2009. They are available via the climate change 'adaptation' pages of Defra's website. The Chief Planner of Communities and Local Government wrote at that time to Chief Planning Officers of LPAs and regional planning bodies advising on the publication of UKCP09 and to set out the implications for the planning process (see <http://www.communities.gov.uk/publications/planningandbuilding/climateprojections>).
- 3.97 Pending further work being carried out by Defra and the Environment Agency on the differences between the UKCP09 and UKCIP02 projections, the Chief Planner's letter advised that whilst there is a range of projections in UKCP09 of future climate for any given variable, based on different emissions scenarios and probability levels, around the 50% probability point on the central emissions scenario the data are broadly similar to the UKCIP02 projections. As a result, there is a general expectation that the assumptions on changes in climate that LPAs have been working from remain reasonable.
- 3.98 Annex B of PPS25 provides details on the allowances to be made for climate change effects when assessing flood risk. The guidance in annex B is based on a supplementary note provided by Defra to those appraising publicly-funded flood alleviation projects. In line with the advice given in the Chief Planner's letter, the figures presented in Annex B of PPS25 should continue to be used until any revised guidance is issued.
- 3.99 Any flood modelling and mapping exercises undertaken by LPAs as part of SFRAs will need to determine flood probability areas in the future, taking account of climate change and flood risk management infrastructure over an appropriate time period. Such information may be used to inform future revisions to Flood Zone maps showing flood risk in the SFRA. Guidance on this may be provided at a regional level. The focus should be on considering the sustainability of land use allocations, based on what climate change effects may mean for allocated sites in the long-term.
- 3.100 For individual developments, an appropriate allowance should be included over the lifetime of each development in question. Developers should therefore carefully consider and advise those undertaking the FRA, on what the design life of the development is. The assessor can consider the implications of climate change for this period using the *precautionary allowances* and *indicative sensitivity ranges* in PPS25 annex B.
- 3.101 In areas at tidal risk the vertical extent of Flood Zone 2 (medium probability) will often be small in comparison with the predicted increase in sea level over the next 100 years. Thus modelling should carefully consider the future increased probability of flooding in Zone 2 and the adjoining area of Zone 1.

LIFETIME OF DEVELOPMENT

- 3.102 For practical reasons it is difficult to define the lifetime of development as each development will have different characteristics. For guidance, residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. An example of this would be if the development was controlled by a time limited planning condition.
- 3.103 For development other than residential, its lifetime will depend on the characteristics of that development. Planners should use their experience within their locality to assess how long they anticipate the development being present for. Developers should justify why they have adopted a given lifetime for the development when they are formulating their FRA. The impacts of climate change need to be taken account of in a realistic way and discussions between developers, the LPA and Environment Agency should result in an agreement of what allowances are acceptable.

A hypothetical example of how the flood risk assessment process should work at all levels of the planning system

The following hypothetical example illustrates how appropriate assessments of flood risk at all stages of the planning process can result in positive outcomes.

Site A is within a suburb of a town adjacent to a tidal estuary. The suburb in question is within Flood Zone 3a, but is two kilometres inland of the estuary. The town as a whole is protected to a 1 in 200 annual probability (0.5 per cent) standard against tidal flooding by existing flood risk management measures operated and maintained by the Environment Agency using their permissive powers. The site is brownfield land and drains to a watercourse, which in turn flows into the estuary beneath the tidal defences. Ground levels across the site range between 3 and 4.5m Above Ordnance Datum (AOD).

The Regional Planning Body, in setting regional housing targets for growth, and in their broad application of the sequential approach, identified broad locations for housing within Flood Zone 3a. The Regional Spatial Strategy provides clear guidance on how the flood risks associated with such development are to be assessed and managed. In particular the Regional Flood Risk Appraisal (RFRA) considered the content of the relevant Catchment Flood Management Plan and Shoreline Management Plan and identified areas protected to a high standard by existing flood risk management measures where future policy will be to 'hold the line'. The RFRA contains supplementary guidance to LPAs on how to assess the residual flood risk within these areas of Flood Zone 3a through the SFRA.

Following a Level 1 SFRA, the LPA, as part of determining which sites to allocate for development, applied the Sequential Test and found that there were an insufficient number of reasonably available sites at lower flood risk for them to achieve their housing targets without some housing being required in Flood Zone 3a. Thus, they commissioned a Level 2 SFRA to allow the residual risk in defended areas of Flood Zone 3a to be defined more accurately using techniques and guidance referred to in this Practice Guide, together with the supplementary guidance in the RFRA.

The Level 2 SFRA considered the probability of a breach occurring in the tidal defences. The consequences of such a breach were modelled using the recommended techniques, taking climate change into account. The flood zone was divided-up into areas of higher, medium and lower relative risk based on the depths, velocities and speed of onset of flooding following failure of the defences. The SFRA considered the associated issue of how sensitive flood levels are in these circumstances to ground-raising operations, so that appropriate policies on compensatory storage could be included in the local development document (LDD). The SFRA also considered the management of surface water in such areas and made practical recommendations on how to achieve the necessary sustainable approach to drainage.

The sequential approach was used by the LPA, on the basis of the above information, to allocate more vulnerable land use types being considered within this zone to areas at least risk. A reasoned justification was then provided as to why developments, for which the Exception Test had to be proved, satisfied the requirements of parts a) and b) of this test. This formed part of the evidence-base for the LDD. Site A is one such site.

The LDD provided locational criteria for Site A, backed-up by more detailed guidance in the SFRA as follows:

'Any development proposed at this site must satisfy the Exception Test, part c in PPS25. The site is at risk of tidal flooding in the event of a breach in the existing flood defences, which currently provide protection against a 1 in 200 annual probability flood. Environment Agency policy is to 'hold the line' of these defences, continue with maintenance operations and consider schemes to maintain the standard of protection that they afford in the face of sea level rise. However, the Environment Agency is not obliged to maintain defences and can provide no guarantee that the defences will not fail. A Strategic Flood Risk Assessment (SFRA) undertaken by this authority has identified that, should the defences fail, the depth of flooding at this site is unlikely to exceed 5m AOD. Floor levels should be raised above this level and all infrastructure and services below this level should be resilient to the impacts of flooding. The SFRA indicated that raising properties in this way will have a negligible impact on flood risk elsewhere and there is therefore no requirement to provide compensatory flood storage. The Flood Risk Assessment for this site should include a clear statement of how flood risk issues at this site will be managed taking account of climate change, and the above guidance. All other sources of flooding should be considered'.

The site currently drains to a watercourse which is tide-locked at high tide. Discharges of surface water from the site should be restricted to existing levels as a minimum requirement. The site is underlain by a shallow sand/gravel aquifer and the use of infiltration techniques for surface water disposal is likely to be feasible. Other Sustainable Drainage Systems should be provided to attenuate run-off further and improve water quality and amenity.

The developer commissioned a FRA based on the information provided in the SFRA and LDD. Following a pre-application discussion with the LPA and Environment Agency, the FRA subsequently submitted by the developer with the planning application included details of how the flood risk issues will be managed at the site, including flood warning and access and egress arrangements, which have been discussed with the LPA emergency planning officer. The site incorporated water-compatible land uses at ground level, including a parking area with porous and pervious paving and an area of green, open amenity parkland incorporating an infiltration basin. All infrastructure is flood resilient to a level of 5m AOD. Residential property has been located on the highest parts of the site and the proposed ground floor level is at 5.5m AOD. This level was recommended by the developer's professional advisers following a detailed consideration of the SFRA, of the various other sources of flood risk and consultation with the Environment Agency. Surface water ponding was noted in various parts of the site, which have been allowed for within the design of the surface water management system, and built development avoided these locations. Surface water is managed by a combination of swales and storage features, with sufficient volume to store water over a tidal cycle without causing flooding within the site, to permit a free discharge at lower stages of the tide.

The application was approved as the developer was able to show through the FRA that the development was in compliance with LDD policy and provided the evidence to pass the Exception Test.

FURTHER INFORMATION AND REFERENCES

Environment Agency web-site: www.environment-agency.gov.uk

Development and Flood Risk – Guidance for the Construction Industry, CIRIA Publication C624, 2004.

Directive on the assessment and management of flood risks (the Floods Directive), European Commission, 2007/60/EC.

Flood and Coastal Defence Appraisal Guidance, (FCDPAG3) Economic Appraisal, 2000.

Flood Risk Assessment Guidance for New Development Phase 2, R&D Report FD 2320, DEFRA/Environment Agency, 2005.

Flood Risks to People, Phase 2 Interim Report. Agency R&D Technical Report FD 2321 DEFRA/Environment Agency, 2006.

Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.

Planning Policy Statement 1, *Delivering Sustainable Development*, ODPM, 2005.

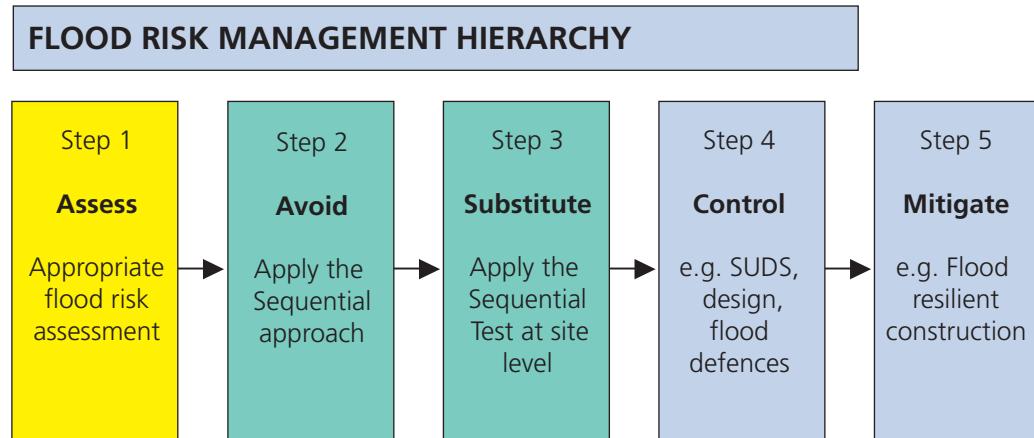
Planning Policy Statement 3, *Housing*, Communities and Local Government, 2006.

Review of the 2007 Summer Floods, Environment Agency, 2007.

The Benefits of Flood and Coastal Defence, – “The Multi-Coloured Manual” Middlesex University Flood Hazard Research Centre, 2006.

The Strategic Housing Land Availability Assessment Practice Guide, Communities and Local Government, 2007.

4 The Sequential and Exception Tests



INTRODUCTION

- 4.1 This chapter explains how to apply the sequential approach, Sequential Test and Exception Test. This chapter provides additional guidance to clarify how the Sequential and Exception Tests should be used when considering redevelopment and regeneration issues on a strategic basis and for individual properties, windfall sites and change of use. Additional guidance is given on what needs to be considered when assessing whether a site is safe and seeks to clarify some aspects of the flood risk vulnerability classification.
- 4.2 Application of the sequential approach to spatial planning reinforces the most effective risk management measure of all – that of avoidance. Application of the approach from as early as possible in the plan-making process, and particularly application of the Sequential Test at the Local Development Document level, will help ensure that development, including regional housing targets, can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds. Application of the Exception Test will ensure that new developments which are needed in medium or high flood risk areas will only occur where flood risk is clearly outweighed by other sustainability factors and the development will be safe for its lifetime, taking climate change into account.
- 4.3 Once assessment of flood risk has been determined on a strategic basis, it is for the Regional Planning Body (RPB) or local planning authority (LPA) to undertake the sequential approach to determine the best options for future development that avoids flood risk. This needs to be done in a transparent and clearly documented way using the information gathered in Regional Flood Risk Appraisals (RFRA) and Strategic Flood Risk Assessments (SFRA). Approximately 90% of England's land area is within Flood Zone 1 (the area of lowest risk) so, at the regional level, it should be possible to direct the majority of development to areas of low flood risk. Where development is identified as necessary to maintain the sustainability of communities in areas already developed within Flood Zones 2

and 3 (such as parts of Hull and London), the sequential approach can be applied with the aim of locating development in those parts of the area at the lowest risk. At the local level LPAs can use the more detailed Sequential and Exception Tests to allocate sites that will be at lowest risk from flooding and provide the evidence that there are reasonably available sites for the development proposed.

THE SEQUENTIAL APPROACH

- 4.4 Paragraphs 14-15 of PPS25 sets out the requirement to apply the sequential approach. This approach is a simple decision-making tool designed to ensure that areas at little or no risk of flooding are developed in preference to areas at higher risk. RPBs/LPAs should make the most appropriate use of land to minimise flood risk, substituting land uses so that the most vulnerable development is located in the lowest risk areas. They should also make the most of opportunities to reduce flood risk, e.g. creating flood storage and flood pathways when looking at large-scale developments.
- 4.5 The aim should be to keep all development out of medium and high flood risk areas (Flood Zones 2 and 3 and other areas affected by other sources of flooding) where possible. All opportunities to locate new water-incompatible developments in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.
- 4.6 Planning Policy Statement 3 *Housing* (Communities and Local Government, 2006) sets out a plan-led approach to housing based upon plans identifying broad locations at the regional level. In such circumstances, RPBs will need to apply the sequential approach for flood risk (see paragraphs 3.34-3.35 above).

Applying the sequential approach at the regional planning level

- 4.7 The sequential approach should be used at the regional level to identify broad areas for future development that avoid flood risk. Where development is necessary in flood risk areas then this should be justified through the Sustainability Appraisal process for the Regional Spatial Strategy.

Applying the sequential approach to other sources of flooding

- 4.8 PPS25 states that a development proposal in any of the three flood zones must take into account the likelihood of flooding from other sources as well as from rivers and the sea. The principle of locating development in lower risk areas should be applied to other sources of flooding using the broader source-pathway-receptor approach outlined in chapter 3.
- 4.9 Information on the probability of other forms of flooding may not always be available and in many situations the physical processes and pathways which may lead to flooding may be poorly understood. However, early engagement with key stakeholders should identify areas

that are at risk from other sources of flooding including surface water flooding. Such information is likely to be measured and stored in ways that are quite different to river flow and tidal data used to generate the Environment Agency indicative flood zone map. Close cooperation with sewerage undertakers is essential where surface water flooding is an issue.

- 4.10 To map flood risk probability from other sources of flooding for RFRAs and SFRAs, all available information and judgement (assumptions where information is lacking) should be used to identify those areas in which risk from other sources of flooding is likely to be an important consideration. LPAs should use the sequential approach to steer new development away from areas at risk from other sources of flooding.
- 4.11 Where information is available, other forms of flooding should be treated consistently with river flooding in mapping probability and assessing vulnerability to apply the Sequential and Exception Tests.
- 4.12 From July 2009, the Environment Agency has made available to LPAs in England mapped data showing areas susceptible to surface water flooding, for strategic, broad-scale land use planning purposes. Whilst these maps should not be used as a definite indication of risk, it is recommended that LPAs draw on this data as it highlights those areas where the potential for surface water flooding needs particular further assessment and scrutiny.

Case study

London Borough of Redbridge – Level 1 and 2 SFRAAs taking account of other forms of flooding

AECOM were commissioned by the London Borough of Redbridge to do a Level 1 and 2 SFRA. For two watercourses (Cran Brook and Loxford Water) no flood zone mapping existed to enable the LPA to Sequentially Test site allocations.

Both watercourses are culverted for a large proportion of their route and also form part of the Thames Water sewer network. These factors make flood modelling complicated. Also, it was known and reported in historical maps that both rivers suffered from a combination of surface water and fluvial flooding.

AECOM adopted an innovative approach to flood modelling. They obtained Thames Water's 1-D model and adapted it to recreate the overland flow patterns which would occur once the culverts were full and surcharging. This enabled the creation of maps for Flood Zones 2, 3a and 3b including the impacts of climate change.



Images showing the Cran Brook, Ilford, London Borough of Redbridge. Images courtesy of AECOM

THE SEQUENTIAL TEST

- 4.13 The Sequential Test is a key component of the hierarchical approach to avoiding and managing flood risk. The Sequential Test is covered in detail in PPS25, paragraphs 16-17 and annex D, paragraphs D1-D8 and tables D.1, D.2 and D.3.
- 4.14 The Sequential Test is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk.

Defining the geographical area the Sequential Test should be applied to

- 4.15 At the regional level the area covered will be the region and should be used to define broad locations and locational criteria for development in the Regional Spatial Strategy.
- 4.16 At the sub-regional level it may be possible for several LPAs to join together to review development options for a sub-region such as in the Thames Gateway. This has the potential for broadening the scope for opportunities to reduce flood risk and put the more vulnerable development in lower flood risk areas.
- 4.17 At the local level the Sequential Test should be applied to the whole LPA area, as there may be lower risk areas which are unsustainable for development in other ways.
- 4.18 For individual planning applications where there has been no Sequential Testing of the allocations in the Local Development Documents (LDD), the area to apply the Sequential Test will be defined by local circumstances relating to the catchment area for the development. For some development this is clear, for example, a school, hospital or doctor's surgery. For others it may be identified from other local plan policies such as the need for affordable housing within a town centre, or that a specific area had been identified for regeneration. For example, where there are large areas in Flood Zones 2 and 3, and development is needed in those areas to sustain the existing community, sites outside them would not be reasonable alternatives. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the LPA boundary, and could extend to several regions.
- 4.19 When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken in considering, for example, planning applications for extensions of existing business premises, such as farm holdings, where it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere. It is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. In all cases the developer must justify with evidence to the LPA what area of search has been used when making the application. This will allow the LPA to undertake the Sequential Test as part of considering the application. Ultimately the LPA would still need to be satisfied in all cases that the proposed development is safe and would not lead to increased flood risk elsewhere. Advice on applying the Sequential Test is available as part of the Environment Agency's standing advice.

Applying the Sequential Test at the local planning level

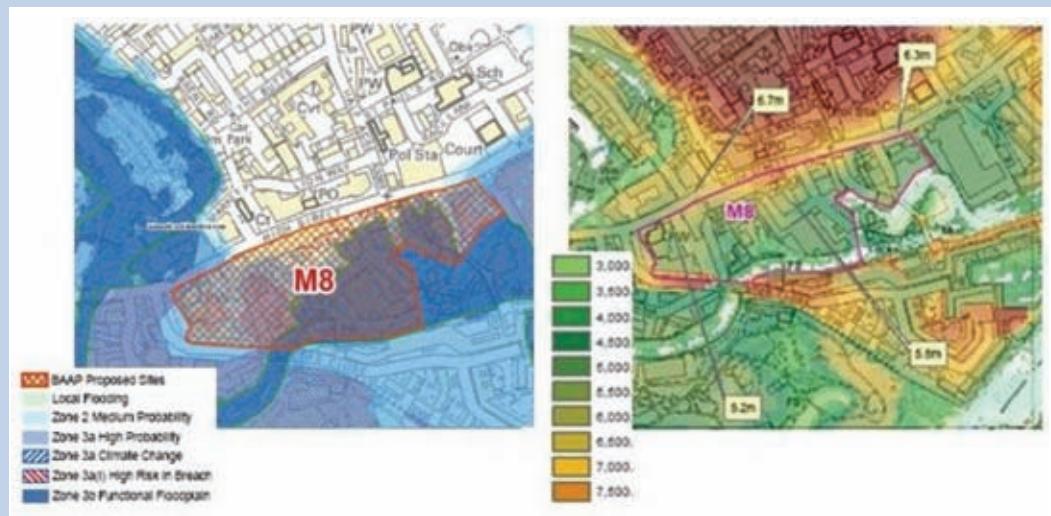
- 4.20 A LPA allocating land for development must demonstrate that it has considered the range of possible options in conjunction with the flood zone information from the SFRA and vulnerability of development and has applied the Sequential Test, and where necessary the Exception Test, in the site allocation process (see figure 4.1). Evidence should be provided through the Sustainability Appraisal process.

Case study

How the SFRA has been used in applying the Sequential Test in the London Borough of Hounslow

The London Borough of Hounslow's Level 1 and 2 SFRA covers all sources of flooding and provides the information to apply the Sequential Test rigorously when considering development in areas at risk of flooding.

The SFRA was used to assess the level of flood risk at proposed sites in the Brentford Area Action Plan. Information from the SFRA led to three sites being omitted and a further three examined in detail to determine what criteria would be needed to pass the Exception Test. For example, criteria for reducing flood risk were to reduce the building footprint, set the development back from the river to make space for water and ensuring the development was 'safe'. Residential development was located in areas at least risk of flooding within the site and the 'less vulnerable' uses in the higher flood risk areas. Informed by the Level 2 SFRA, the decision on whether to allocate the sites was then taken as part of the Sustainability Appraisal of the Plan (see Appendix E Brentford Preferred Options – Flooding Sequential Test and Exceptions Test).



Courtesy of the London Borough of Hounslow & Jacobs

Web address for LB of Hounslow SFRA documents
www.hounslow.gov.uk/strategic_flood_risk_assessment.pdf
http://www.hounslow.gov.uk/baap_sfra.pdf
http://www.hounslow.gov.uk/brentford_area_sustainability_appraisal.pdf

Case study

London Borough of Enfield SFRA – an example of how the SFRA has been used in applying the Sequential Test

The Environment Agency is producing Catchment Flood Management Plans (CFMP) for all river catchments across the country. The Thames CFMP sets out the strategic direction for flood risk management across the region, and it is intended that these documents be used by the Environment Agency to work with partner organisations to help manage flood risk within river catchments.

The Environment Agency decided to run a pilot project to look at how the CFMP could be applied on the ground within the London Borough of Enfield. In this pilot project the planning process and redevelopment are seen as having a key role to play in helping to deliver the aims of the CFMP and ultimately in reducing the likelihood and consequences of flooding.

The Agency, working with the London Borough of Enfield as the LPA and a major developer in the borough, is seeking to use the planning process to reduce flood risk in key areas of Enfield and deliver some of the key aims of the Thames CFMP. This has involved working with the LPA's Planning Policy team to influence and inform their policy documents and the development of their core strategy policies, as well as providing guidance to the policy team on the application of PPS25.

The LPA has used its Level 1 SFRA to undertake a Sequential Test across two scales. Firstly, the SFRA was used to Sequentially Test four large Area Action Plans (AAPs). Two of the AAPs cover the Lee Valley throughout the Eastern Boundary of the borough and are seen as an important area for redevelopment by the Greater London Authority. The Sequential Test explained the wider planning reasons behind the selection of the AAPs, and set out the general approach for sequentially testing within each AAP to ensure redevelopment is compliant with PPS25. A Level 2 SFRA is now being undertaken to further refine these more detailed Sequential Tests and will help ensure that new development is located in the least risky location, and measures put in place to ensure that flood risk is reduced.

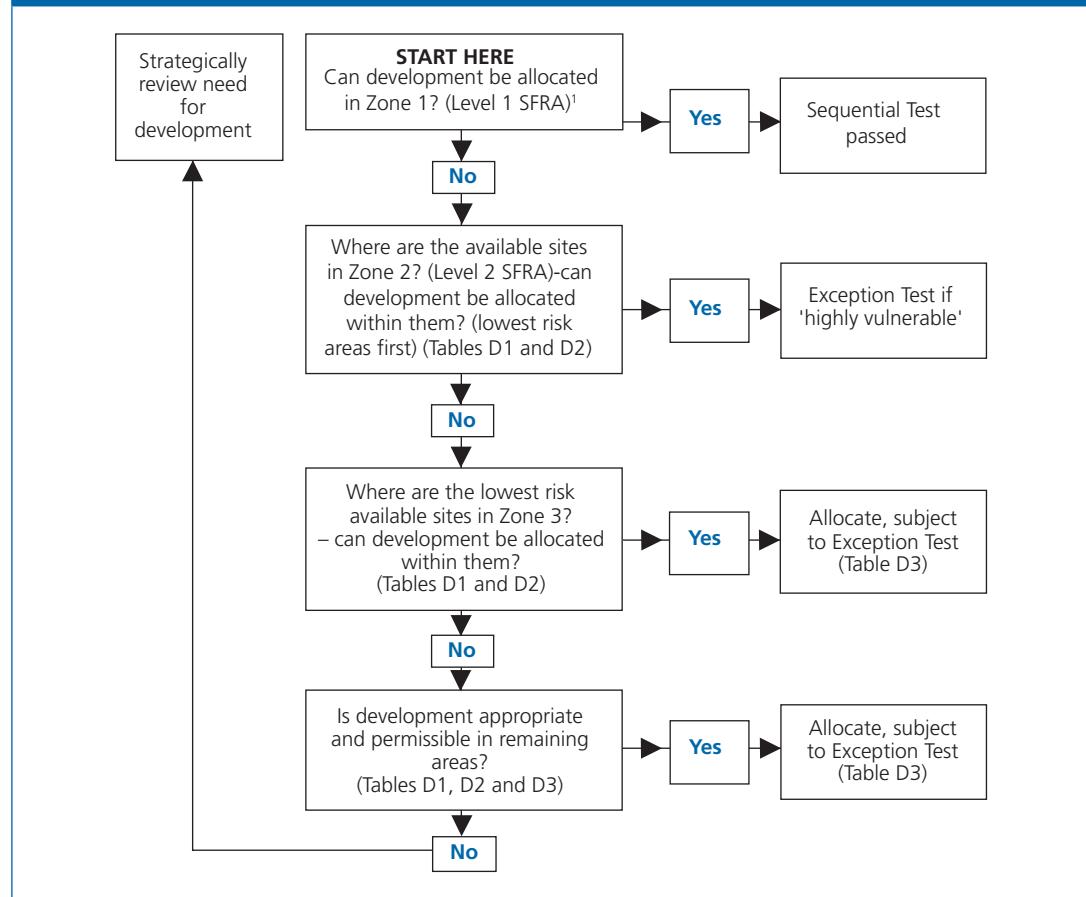
The Agency has also been working closely with the developer and their consultants on the master-planning of a key opportunity area in the borough where there are areas of high flood risk. Consideration of flood risk at the early stage of the master-planning process will enable the location, layout and design of the development to deliver maximum reductions in flood risk.

Image courtesy of the London Borough of Enfield



- 4.21 Planning Policy Statement 3 *Housing* (Communities and Local Government, 2006) sets out a local plan-led approach to housing. However, there will be circumstances where applications are brought forward for housing on sites not identified in plans. In such circumstances, LPAs will need to apply the Sequential Test for flood risk (see paragraphs 4.33 to 4.35).

Figure 4.1 Application of the Sequential Test at the Local level for LDD preparation



Note

¹ Other sources of flooding need to be considered in Flood Zone 1

- 4.22 As at the beginning of 2009, over 85 per cent of district and unitary local authorities in England were found, as a minimum, to have completed a Level 1 SFRA, with more progressing to completion by the end of the year. It may be the case that LPAs have not yet taken these into account in sequentially testing existing allocations or allocating new sites for development in their Plans, either because existing LDDs have not been reviewed yet, or

because the LDD is still going through its statutory process and is not yet in place. Allocations of sites for development should be reassessed through sequential testing, informed by a SFRA, when LDDs are reviewed, or in finalising LDDs, as appropriate. If LDDs are reviewed, or are in the process of being finalised, and no evidence is provided that flood risk has been taken into account through the Sustainability Appraisal process, the plan could be deemed to be unsound. It is not expected that LPAs should revisit existing allocations until their LDDs are reviewed.

Applying the Sequential Test for individual planning applications

- 4.23 Planning applications should be determined in accordance with development plan policies. Where plans and policies have been sequentially tested using evidence from SFRA the application should be relatively straight forward. The site-specific flood risk assessment will show how the proposal meets the requirements of PPS25 and the plan policies.
- 4.24 Where applications are brought forward on sites not allocated in the plan, LPAs should consider the flood risk implications of the proposal, including applying the Sequential Test.
- 4.25 Where a site has not yet been sequentially tested in the LDD, the Sequential Test will need to be applied at the individual site level. In these cases the developer will need to provide evidence to the LPA that there are no other reasonably available sites which could be considered as being suitable and appropriate for the development that is proposed, where that development could then be located. The LPA applies the Sequential Test to the application. If the proposed development is needed for wider sustainable development reasons in flood risk areas it must then satisfy the three criteria of the Exception Test, set out in PPS25 (annex D, paragraph D9), to ensure that the development would be safe for its occupants, and would not increase flood risk.
- 4.26 Another instance when the Sequential Test will need to be applied to individual planning applications is where the use of the site being proposed is not in accordance with LDD allocations and policies. For example, if housing is proposed on a site allocated for less vulnerable industrial uses.
- 4.27 It is the responsibility of the developer to assemble the evidence for their application to allow the LPA's planning officer to carry out the Sequential Test. This is likely to include evidence:
 - on the flood risk to the site. The LPA's SFRA should build on the Environment Agency Flood Map and include flooding from all sources. Site-specific FRAs may also be available from previous applications made);
 - on the availability of 'reasonably available' (suitable developable and deliverable)⁷ sites in the relevant area with a lower flood risk that could be used for the development;
 - the vulnerability classification of the development, bearing in mind that a mixed use development could contain various vulnerabilities (table D.2. of PPS25);

⁷ "Developable" and "deliverable" sites are as defined in Planning Policy Statement 3 Housing (CLG 2006)

- if it is likely that the Exception Test will need to be applied, evidence to show that wider sustainability benefits to the community outweighs the flood risk; and
- that the development is safe and residual flood risk can be overcome to the satisfaction of the Environment Agency and other stakeholders.

Example of a planning appeal decision

Star Road, Caversham, Reading Borough – Example of a failed Sequential Test

The proposal was for four residential dwellings on a site in Flood Zone 3 in a predominately residential area of Caversham. The local authority refused the application as it failed to appropriately apply the Sequential Test as the applicant had not considered the whole of the borough, instead limiting the search for alternative sites to the Caversham area of the town. The applicant appealed the decision.

The Inspector stated in the appeal report; “Nothing leads me to consider that the area of Caversham would suffice for this test, either in having an essential requirement for this type of development, or in providing essential services for the development”.

The inspector concluded that as the appellant had failed to demonstrate that there were no other reasonably available sites where a development of four houses could be located at a lower risk of flooding the application did not pass the Sequential Test and dismissed the appeal.

- 4.28 Developers seeking to develop in flood risk areas should undertake pre-application discussions with the LPA, Environment Agency and other relevant stakeholders to scope out the availability of other sites that would meet the functional requirements of the application, and what evidence will be needed to show that consideration has been given to alternative locations in lower risk areas, so that the LPA can properly apply the Sequential Test.
- 4.29 The Sequential Test will show whether there are any reasonably available sites for the type and scale of proposed development in a lower flood risk zone or at a lower flood risk than the application site.
- 4.30 ‘Reasonably available’ alternative sites can be identified from evidence based documents which feed into the development of the LDDs e.g. *Strategic Housing Land Availability Assessments* required by PPS3.
- 4.31 Now that the process of RFRAs/SFRAs is nearly complete and LDDs are reviewed applying the Sequential Test, it would be expected that the need to apply the Sequential Test at the individual planning application level will reduce. However, there may still be instances where the Sequential Test will need to be applied at the planning application stage e.g. where windfall sites are not in accordance with LDD plans and polices.
- 4.32 The EA and stakeholders will work together on the application of the Sequential Test.

Case study

Doncaster – an example of successful local application of the Sequential Test

Doncaster Council's Forward Planners worked closely with the Environment Agency to produce their 'Flood Risk Policy Guidance Note' to aid Sequential Test implementation. The note has been approved by Council members and has been afforded weight by the Planning Inspectorate in a number of dismissed appeals. The note is a 'living document' to allow for improvements to be made, but will eventually be translated into an Supplementary Planning Document.

The note clarifies how national guidance on the Sequential Test will be applied to the Doncaster area. It resolves common queries about when and where it must be applied, who has responsibility for undertaking it, and how it will be applied for common development types.

The note has promoted understanding and consistency between Local Authority Development Control Officers, given applicants a better idea of what to include in their applications, and given developers greater certainty, early in the process, about whether their development is likely to pass the Sequential Test or not. Ultimately, it has resulted in a number of developments being successfully steered away from flood risk areas.



Flooding in Rostholme, Doncaster, June 2007. Image courtesy of petersmith.com

Windfall Sites

- 4.33 Any proposal for development on a ‘windfall’ site will by definition differ to a site allocated in a development plan that has been sequentially tested.
- 4.34 LPAs should, through the completion of SFRA, develop policies in their LDDs on how windfall sites should be treated in flood risk terms. Through the Sequential Test, LPAs should identify areas where windfall development would be constituted as appropriate development i.e. defining the type of windfall development which would be acceptable in certain flood risk areas and what the broad criteria should be for submitting a planning application under these circumstances. In planning for housing, PPS3 explains that LPAs should not make allowances for windfalls in plans for the first 10 years of land supply, unless they can demonstrate genuine local circumstances that prevent specific sites being identified. Windfall sites should be subject to the same consideration of flood risk as other housing development.
- 4.35 The Sequential Test should be applied to windfall sites, unless the area in which they occur has been sequentially tested on the basis of a SFRA. Where the Sequential Test has not been applied to the area, proposals will need to be dealt with on an individual site basis and the developer will need to provide evidence to the LPA that they have adequately considered other reasonably available sites. This will involve considering windfall sites against other sites allocated as suitable for housing in plans.

Applying the Sequential Test to areas requiring redevelopment or regeneration

- 4.36 PPS25 requires the application of the Sequential Test to all planning applications in flood risk areas, including those on previously developed land, unless the area or site has already been allocated through a Sequential Test informed by a SFRA.
- 4.37 Where redevelopment is required to maintain the sustainability of the local community, the LPA should consider flood risk at the earliest stage in formulating a redevelopment strategy. This strategic approach should create opportunities to reduce flood risk to the community. For example, there may be opportunities to locate the higher vulnerability class uses (table D.2. PPS25) to areas of the lowest flood risk. There should be opportunities to build in increased flood storage, flood flow routes and sustainable drainage elements at the early stages of planning for redevelopment.
- 4.38 Where redevelopment is ongoing as part of an existing regeneration strategy in Flood Zones 2 or 3, it has to be accepted that the redevelopment cannot go anywhere else, as there are no other reasonably available sites (this will still need to be set out clearly in the FRA). Nevertheless, the sequential approach should still be applied within the regeneration area, and it may even be appropriate in some cases for a formal sequential test to be applied within large areas. Regeneration should not be halted or compromised when a scheme is already partially complete. The applicant will need to show that the three parts of the Exception Test are passed. As the site is part of a regeneration strategy it is very likely that it will pass the first

two parts of the Exception Test, i.e. the development is required for sustainability reasons and is more than likely to be on previously developed land. The developer still needs to satisfy the final part of the Exception Test, that the development will be safe and will not increase flood risk elsewhere. Evidence should be provided in the FRA that the sequential approach and all three parts of the Exception Test have been considered within the strategy area. Depending on how far the regeneration strategy has developed there may still be opportunities through design and layout to minimise flood risk and where possible reduce it. The FRA should show that opportunities to substitute lower vulnerability uses in higher risk areas and place housing development in lower risk areas have been taken wherever possible.

Renewable energy projects

- 4.39 Specific national planning policy in Planning Policy Statement 22 *Renewable Energy* advises how, given the particular factors that relate to renewable energy projects, LPAs should not use a sequential approach in the consideration of such proposals. Accordingly, the PPS25 sequential test should not be applied to proposals for new wind turbines. In addition, whilst wind turbines in a high flood risk zone, being considered to fall within 'essential infrastructure' (see paragraph 4.72 below) would be subject to the PPS25 exception test, it is proposed that the second element of the exception test (requiring the development to be on developable previously developed land where possible) should not to be applied. This is because PPS22 states that LPAs should not give priority to the re-use of previously developed land for renewable technology developments. The other two elements of the Exception Test should still apply. These proposals have formed part of a consultation on proposed limited amendments to PPS25 carried out by Communities and Local Government which closed on 3 November 2009. The Government aims to publish the proposed amendments to PPS25 in Spring 2010.

Redevelopment of an existing single property

- 4.40 Where an individual proposes to redevelop their property in an existing flood risk area the consideration of alternative sites is not likely to be a realistic option. The planning applicant should state why there is no alternative available to them to develop. If the site is large enough there may be options to relocate the development to parts of the site at lower risk. However, the applicant will need to show how the development passes the Exception Test. This will show how the development has been made safe through design and flood resistant and resilient construction and that it does not increase flood risk elsewhere. For example, an existing bungalow could be replaced with a building having living accommodation on the first floor (above predicted flood levels) to reduce the risk to the residents. While it will generally not be possible to change and improve access arrangements beyond the boundary of the property, and so access may not become fully safe, applicants should investigate how risks associated with access can be reduced as part of the redevelopment.

- 4.41 It is important that where there is a proposal to create additional dwellings then it will need to be considered as a new development according to the increased vulnerability that would be created as a result. It would be reasonable for an LPA to require an applicant to assess alternative sites through application of the Sequential Test.

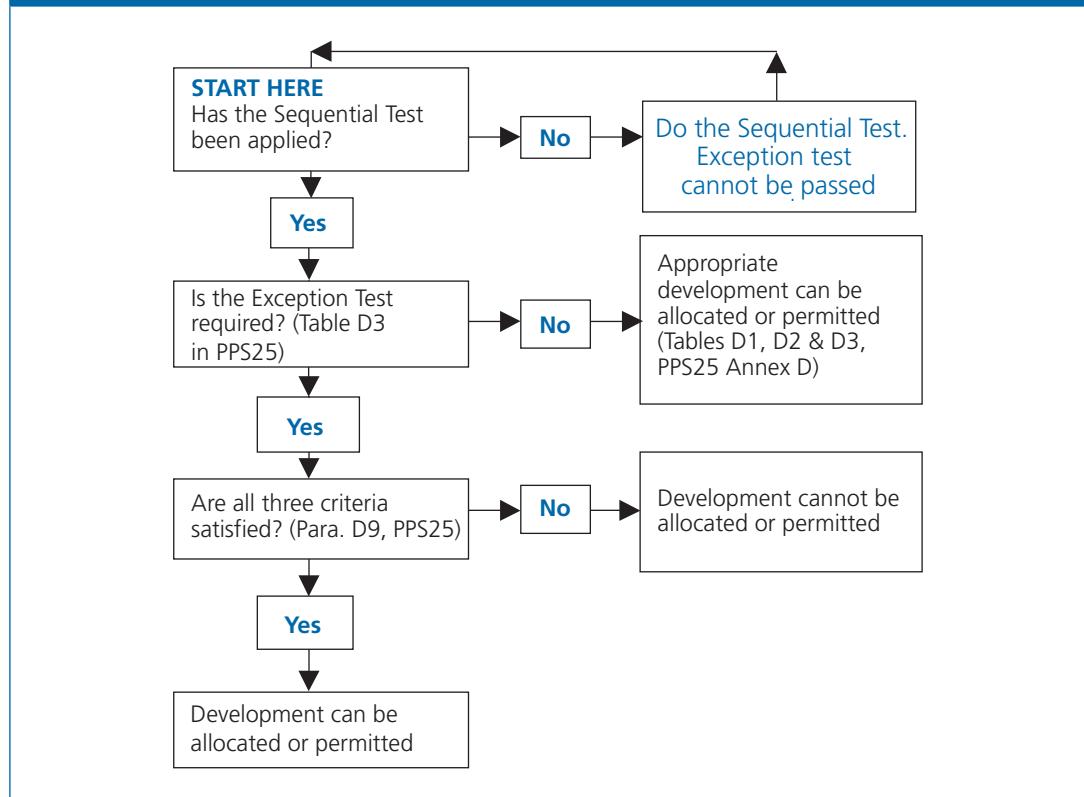
Change of use

- 4.42 PPS25 states in paragraph D15 that *change of use should not be subject to the sequential and exception tests but will still need to meet the requirements of a site-specific flood risk assessment*. LPAs when formulating LDDs should bear in mind that change in use may involve an increase in flood risk if the vulnerability classification of the development is changed, as reflected in table D.2 of PPS25. For example, a change of use from industrial use to residential use will increase the vulnerability classification from less vulnerable to more vulnerable. The LPA should consider when formulating LDD policy, what changes of use will be acceptable taking into account the findings of the SFRA. This is likely to depend on whether developments can be designed to be safe (see paragraph 4.52 onwards) and that there is safe access and egress.
- 4.43 In some instances, a proposal may come forward for a change of use of land to a caravan, camping or mobile home site that only involves minor development. Under paragraph D15 of PPS25, such a proposal should not be subject to the Sequential or Exception Tests, though it would still have to meet the requirements for FRAs and flood risk reduction. However, paragraph D19 of PPS25 notes that land used for caravans, camping, mobile homes and similar types of occupancy give rise to special problems in relation to flooding. Such sites should be regarded as ‘highly vulnerable’ if intended for permanent occupation, or ‘more vulnerable’ if for temporary occupation. PPS25 paragraph D21 advises that in either case, the Sequential and Exception Tests should be used by decision-makers, where applicable.
- 4.44 In any case where a proposal which would normally fall under PPS25 paragraph D15 involves a change of use to a caravan and/or camping site, or other form of occupancy covered by paragraphs D19-21, the policy in paragraph D21 should prevail and the Sequential Test and Exception Test applied, as applicable. This is in line with the key policy objectives in paragraph 5 of PPS25.
- 4.45 At the planning application stage, the developer will need to show in the FRA that future users of the development will not be placed in danger from flood hazards throughout the lifetime of the development. Depending on the risk, mitigation measures may be needed. It is for the applicant to show that the change of use meets the objectives of PPS25 policy such as (for instance), how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development.

THE EXCEPTION TEST

- 4.46 Application of the Sequential Test should ensure that more vulnerable property types, such as residential housing (see table D.2 of PPS25), will not be allocated to areas at high risk of flooding. In exceptional circumstances, there may be valid reasons for a development type which is not compatible with the level of flood risk at a particular site to be considered. In these circumstances the LPA or developer must demonstrate that the development passes all elements of the Exception Test. The Exception Test should only be applied following application of the Sequential Test (paragraph D10, PPS25). There are three parts, (paragraph D9 of PPS25) all of which must be fulfilled before the Exception Test can be passed.
- 4.47 In particular, when considering the allocation of sites in Flood Zone 3, the LPA should consider whether it is likely that any development could be designed to be safe from flooding in a manner which does not increase flood risk elsewhere. The need to design developments to appropriately manage flood risk can have significant impacts on the visual appearance, cost and viability of developments. It is, therefore, crucial that the potential feasibility of providing flood risk management measures is considered in broad terms when allocating sites in flood risk areas (see chapter 6 for further guidance on design issues).
- 4.48 Planning applications that are submitted as windfall sites where the Sequential Test has already been applied satisfactorily will also be subject to the Exception Test in the circumstances set out in Table D.1 in PPS25. When applying the Exception Test for planning applications the developer is expected to demonstrate evidence that will allow the LPA to decide whether the application delivers wider sustainability benefits that outweigh the flood risk implications of developing a site. To help assist in the application of the Exception Test to these sites, LPAs are advised to create a series of locally targeted sustainability checklists, based on the objectives of their LDD Sustainability Appraisal framework (Appendix 9 *Sustainability Appraisal of RSSs and LDDs* (ODPM, 2005). In the absence of a Sustainability Appraisal (SA), the checklists should reflect the Government's sustainability strategy.

Figure 4.2 Application of the Exception Test



Exception Test, Part a): wider sustainable benefits

- 4.49 If a potential site allocation or a planning application fails to score positively against the aims and objectives of the SA or LDD policy respectively, the local planning authority (LPA) should consider whether the use of planning conditions and/or Section 106 agreements could make it do so. Where this is not possible, part a) of the Exception Test has not been satisfied and the allocation/planning permission should be refused.
- 4.50 In the absence of a SA, the developer/LPA will have to provide a reasoned justification detailing how the planning application provides wider sustainability benefits to the community that outweigh flood risk. LPAs may consider the use of a sustainability checklist for this purpose.

Exception Test, Part b): previously developed land

- 4.51 PPS3 provides guidance on part b) of the test.

Exception Test, Part c): safe development

- 4.52 It is the responsibility of the developer to prepare a comprehensive flood risk management strategy for the site to ensure the site is safe, covering:
- the design of any flood defence infrastructure;
 - access and egress;
 - operation and maintenance;
 - design of development to manage and reduce flood risk wherever possible;
 - resident awareness;
 - flood warning; and
 - evacuation procedures and funding arrangements.

What is safe?

- 4.53 Consideration of health and safety issues should be a fundamental aspect of the design and construction of new developments, and developers must comply with the Construction (Design and Management) Regulations 2007. The design, construction, operation and maintenance of new developments must comply with all relevant health and safety legislation, and these issues should be considered as part of a FRA.

- 4.54 PPS25 (paragraph 5) requires that wherever development is permitted in flood risk areas that it must be safe, for the lifetime of the development (paragraph 2), taking into account climate change. Paragraph 8 of PPS25 confirms the requirement for safe access and escape routes and the safe management of any residual risk. New developments should be designed and constructed such that the health, safety and welfare of people are appropriately managed. This is of particular relevance to developments which require the application of the Exception Test.
- 4.55 There are a number of ways that a new development can be made safe by:
- avoiding flood risk by not developing in areas at risk from floods;
 - substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
 - providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
 - mitigating the potential impacts of flooding through design and resilient construction.
- 4.56 Wider safety issues need to be considered at the strategic level. If infrastructure fails then people may not be able to stay in their homes and will have to be moved. Flood warnings and evacuation issues therefore need to be factored into design.
- 4.57 When considering safety, specific local circumstances need to be taken into account, including:
- the characteristics of a possible flood event, e.g. the type and source of flooding and frequency, depth, velocity and speed of onset;
 - the safety of people connected with the development. This should cover both the safety of people within the building if it floods and also the safety of people around the building and in adjacent areas. This includes the ability to safely access and exit the building during a design flood and the ability of residents and users to evacuate the building before an extreme flood;
 - the structural safety of the building; and
 - the impact of a flood on the service provided to the development, e.g. water, electricity and fuel supplies.
- 4.58 Planning should seek to ensure that communities are sustainable and that certain sections of society are not unnecessarily excluded, such as the elderly and those with mobility issues. For example, the sequential approach should be used to identify areas of lowest risk for residential care homes where there are extensive areas in Flood Zone 3 and particular attention to access issues in their design will be needed to make them safe.

Access and egress

- 4.59 PPS25 requires that, where important to the overall safety of a proposed development, safe access and escape is available to and from new developments in flood risk areas (paragraph 8 of PPS25). This is likely to be part of a requirement to pass the Exception Test. Where access and egress is a potential issue this should be discussed with the LPA and Environment Agency at the earliest stage, as this can affect the overall design of the development. It can be difficult to ‘design in’ satisfactory access routes retrospectively. Access considerations should include the voluntary and free movement of people during a design flood, as well as the potential for evacuation⁸ before a more extreme flood.
- 4.60 Access routes should allow occupants to safely access and exit their dwellings in design flood conditions. Vehicular access to allow the emergency services to safely reach the development during design flood conditions will also normally be required. An important consideration for access and egress is that it must be designed to be functional for changing circumstances over the design life of the development.
- 4.61 Wherever possible, safe access routes should be provided that are located above design flood levels. Where this is not possible, limited depths of flooding may be acceptable, provided that the proposed access is designed with appropriate signage etc., to make it safe. The acceptable flood depth for safe access will vary depending on flood velocities and the risk of debris within the flood water. Even low levels of flooding can pose a risk to people in situ (for reasons including the presence of unseen hazards and contaminants in floodwater, the dangers posed when attempting to escape from flooded buildings and the risk that people remaining may require medical attention).
- 4.62 Developers should ensure that appropriate evacuation and flood response procedures are in place to manage the residual risk associated with an extreme flood event to the satisfaction of the LPA. In locations where there is a residual risk of flooding due to the presence of defences (see chapter 7) judgements on whether a proposal can be regarded as safe will need to consider the feasibility of evacuation from the area should it be flooded. In advising the LPA, the emergency services are unlikely to regard developments that increase the scale of any rescue that might be required as being safe. Even with defences in place, if the probability of inundation is high, safe access and egress should be maintained for the lifetime of the development.

⁸ Evacuation is where flood warnings provided by the Environment Agency can enable timely evacuation of residents to take place unaided (i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises). Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible.

- 4.63 The practicality of safe evacuation from an area will depend on:
- the type of flood risk present, and the extent to which advance warning can be given in a flood event;
 - the number of people that would require evacuation from the area potentially at risk;
 - the adequacy of both evacuation routes and identified places that people could be evacuated to (and taking into account the length of time that the evacuation may need to last); and
 - sufficiently detailed and up to date evacuation plans being in place for the locality that address these and related issues.
- 4.64 Effective emergency planning for floods (through the work of the local resilience forums) is a key component of the Government's emerging National Flood Emergency Framework⁹. If adequate and up-to-date evacuation plans exist for areas potentially at risk, it will be more practical for emergency planners and the emergency services to provide an opinion on the merits of specific development proposals.
- 4.65 If evacuation routes are not immediately obvious they should be signposted, and these signs, along with the route itself, will need to be maintained.
- 4.66 While provisions such as safe refuges and raised walkways to help cope with flood events can play a role in reducing the overall level of risk posed by a flood, they do not in themselves make a development safe, as they relate more to a rescue situation than to effective evacuation in advance of a flood occurring.
- 4.67 Proposals that would increase the number of people living or working in areas of potential flood risk require particularly careful consideration, as they could increase the scale of any evacuation required. To mitigate this impact it is especially important to look at ways in which the development could help to reduce the overall consequences of flooding in the locality, either through its design (recognising that some forms of development may be more resistant or resilient to floods than others) or through off-site works that benefit the area more generally. Examples are given in Chapter 6.
- 4.68 The Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes – Clarification of Table 13.1 of FD2320/TR2 and Figure FD2321/TR1, published in May 2008, provides useful guidance on the danger to people for different combinations of depth and velocity.
- 4.69 Design issues are dealt with in chapter 6.

⁹ A National Flood Emergency Framework: Proposals for Consultation (Defra, December 2008)

FLOOD RISK VULNERABILITY CLASSIFICATIONS

- 4.70 As certain types of development and the people who use and live in them are more at risk from flooding than others, PPS25 links the probability of flooding to the vulnerability of types of development (PPS25 paragraph 17 and annex D, table D.2).
- 4.71 Table D.2 divides the vulnerability of development into five broad categories (essential infrastructure, highly vulnerable, more vulnerable, less vulnerable and water compatible development) which reflect the level of risk to users. This takes account of both the type of development and also the vulnerability of its users (children, the elderly and people with mobility problems may have more difficulty escaping from fast flowing water). By using table D.2 (PPS25) in conjunction with table D.1 (PPS25) the vulnerability of development is considered as part of the sequential approach.
- 4.72 Communities and Local Government has published for consultation proposed amendments clarifying aspects of PPS25 policy which would affect the application of the policy to the 'essential infrastructure' category in table D.2, including water and sewage treatment works, emergency services facilities, bulk storage facilities, wind turbines and the identification of functional floodplains. The aim is to finalise these proposed amendments to PPS25 in Spring 2010, and will be reflected in further iterations of this Practice Guide.
- 4.73 Where a land use is not specifically referred to in table D.2, it should be allocated to the most appropriate vulnerability classification based on comparison with the characteristics of other uses in the table, informed by consideration of the risks from flooding. Some developments may contain different elements of vulnerability (e.g. a mixed development with housing, roads, parking, schools, open space), and the highest vulnerability category should be used unless the development is considered in its component parts. Doing the latter is encouraged, since it allows application of the sequential approach within the development, by putting open space in areas of highest flood risk for example.
- 4.74 Defra and the Environment Agency R & D Document '*Flood Risk Assessment Guidance for New Development*' FD2320 provides guidance on this topic area. Ultimately, it is the responsibility of the planning authorities to decide what level of risk is acceptable.
- 4.75 In the following sections clarification is given on how to deal with applying the Sequential Test and Exception Test to certain uses.

Emergency services facilities

- 4.76 Police, fire and ambulance stations and hospitals need to be located within their catchment even where it may be at high risk of flooding. Overall risk to life may be greater than the risk from floods if response times for emergency services are longer. Table D.2 in PPS25 recognises that there is a balance needed between preventing emergency services' control systems and equipment being disabled in a flood, whilst providing emergency service cover to existing communities already located in flood risk zones. The flooding in Carlisle (2005) and Hull (2007) illustrated the impacts of emergency services that could not operate at times of flooding. It is therefore important that emergency services have clear strategies to manage their operability during a flooding event. Flood risk should be a key consideration to the location of emergency service provision. Emergency services can be located in flood risk areas providing the premises they occupy are not required to be operational during flood events. If facilities are identified as needing to be operational during flood events they should be classified as 'highly vulnerable' and located outside Flood Zones 3a and 3b. This particularly applies to features such as control centres, which while operational are not so bound to certain locations as emergency vehicle premises.

Water compatible development

- 4.77 Some development which is 'water compatible' may need to include elements of other vulnerability classifications in order to operate, e.g. Ministry of Defence installations which may require some element of accommodation to be operational. However, the development still needs to be designed to ensure the safety of occupants, with evacuation procedures clearly defined. It must not increase flood risk to others or affect the functionality of the floodplain.

Basements

- 4.78 Basements are defined as self-contained, with no free internal access upstairs in an event of flood water coming down outside access routes.
- 4.79 Basement dwellings are defined as 'highly vulnerable' in table D.2 of PPS25 because they are particularly vulnerable to all forms of flooding. The summer 2007 floods showed that surface water flooding can pose a serious risk to users of basements, but other forms of flooding, such as groundwater flooding, can be equally dangerous. Basements are at high risk because they are likely to flood first, inundate rapidly, and escape may be difficult, particularly for people with mobility impairments. If basements flood there is not only the risk of damage to the property but also a risk to life. Resilient design may also be difficult to implement, for example, locating a useable electricity supply above predicted flood levels.

- 4.80 Where there is high development pressure for new basements or conversion of basements to living accommodation, LPAs should, as informed by the outcomes of the SFRA, formulate policy towards basement development. This could be done by preparing a supplementary planning document on subterranean development. If a SFRA highlights that there are surface water flooding issues which requires major investment which will not be carried out in the short-term, a precautionary approach should be applied.
- 4.81 Basement development should only be permitted in areas at flood risk if it passes the Exception Test, so the basement will be safe. A basement should have unrestricted access to an upper level that people can escape to at all times. However, it should not create new pathways for flood water to existing residents.

Critical infrastructure

- 4.82 Critical infrastructure such as electricity substations and water treatment works that have to be in flood risk areas on the basis of having applied the sequential test, should be designed to remain operational during floods, including access, particularly where this is necessary on a continuous basis.

Tank storage facilities

- 4.83 Planners should have regard to the need to locate some bulk storage facilities such as oil products and chemical substances which require Hazardous Substances Consent next to port facilities.
- 4.84 Table D.2 (PPS25) classifies strategic utility infrastructure as 'Essential Infrastructure'. This means that on the basis of table D.3 (PPS25) which aligns flood zone compatibility with flood risk vulnerability, if the Sequential Test is applied and the Exception Test is passed this infrastructure can be built in Flood Zones 3a and 3b. Table D.2 classifies installations requiring Hazardous Substances Consent as 'highly vulnerable'. Table D.3 shows that this type of development is incompatible with Flood Zones 3a and 3b.
- 4.85 Where there is a need to co-locate this type of development with port facilities, such as wharves and existing infrastructure, then this type of facility will need to be classified as 'Essential Infrastructure'. To be considered as 'Essential Infrastructure' the Sequential Test must show that there are no other reasonably available sites in areas of lower flood risk on which they could be located and still provide the functions and operational requirements they are intended to provide. This should be applied to a wide area, possibly across several regions, or nationwide for highly specialised facilities. The Exception Test would then need to be passed with evidence provided that the need for the development outweighs the flood risk; that they would remain operational and safe at times of flood and would not increase flood risk, and would not impede water flows. The development must satisfy these tests in order to be permitted.

- 4.86 The need for location at a port must also be demonstrated, including an explanation of why a development cannot be located remotely, in a site of lower flood risk and linked by pipeline, for example. If it is shown that there is no need for co-location with other facilities, such installations should be treated as ‘highly vulnerable’.

FUNCTIONAL FLOODPLAIN

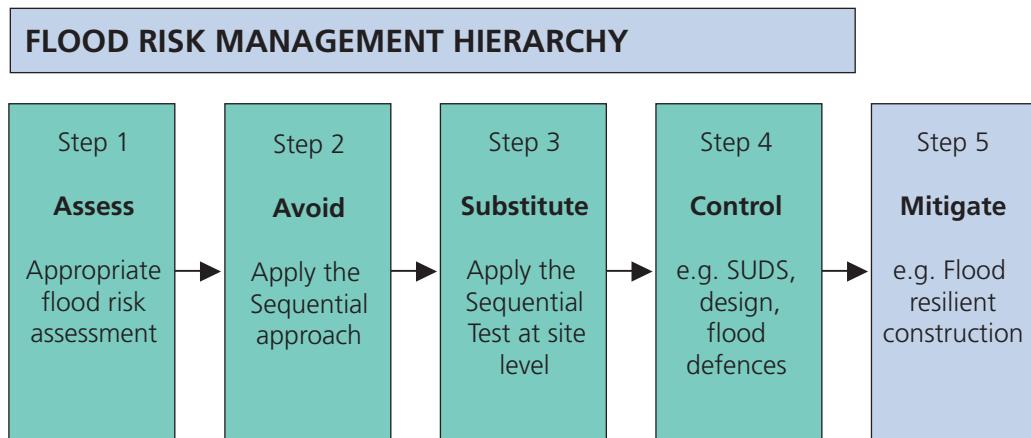
- 4.87 PPS25 (annex D table D.1) defines functional floodplain as Flood Zone 3b. The key part of the definition is:
- land where water has to flow or be stored in times of flood.**
- 4.88 The functional floodplain includes water conveyance routes and flood storage areas (sometimes referred to as washlands).
- 4.89 LPAs should identify areas of functional floodplain in their SFRA in discussion with the Environment Agency. A functional floodplain is a very important planning tool in making space for flood waters when flooding occurs. Table D.1 in PPS25 details the limited types of development that are acceptable in Flood Zone 3b and generally development should be directed away from these areas. This should be done on a river catchment and coastal cell basis using the Environment Agency’s Catchment Flood Management Plans and Shoreline Management Plans. Where a SFRA has not defined the functional floodplain it should be done through collaborative discussion between the developer, LPA and Environment Agency.
- 4.90 The definition in PPS25 allows flexibility to make allowance for local circumstances and should not be defined on rigid probability parameters. Areas which would naturally flood with an annual exceedence probability of 1 in 20 (5 per cent) or greater, but which are prevented from doing so by existing infrastructure or solid buildings, will not normally be defined as functional floodplain.
- 4.91 Developed areas are not generally part of the functional floodplain. Only water compatible and essential infrastructure (the latter requiring the Exception Test to be passed) are considered suitable development types in the functional floodplain.
- 4.92 However, PPS25 does not differentiate between developed and undeveloped areas. This is because some developed areas may still provide an important flood storage and conveyance function, such as a car park that has been designed to flood periodically to preserve flood storage volumes at a riverside commercial development. Roads and other linear spaces can act as flow routes and the functionality of such areas should be considered when defining Flood Zones 3a and 3b, taking into account strategic flood risk management policies.

- 4.93 The functional floodplain may also include areas intended to provide transmission and storage of water from other sources of flooding (e.g. surface water).
- 4.94 The area defined as functional floodplain should take into account the effects of defences and other flood risk management infrastructure. Some areas, such as flood storage areas, may flood at a lower frequency than other parts of Flood Zone 3b, but should still be classified as functional for the part that they play in managing the impacts of large scale floods.
- 4.95 There may be opportunities to reinstate areas which can operate as functional floodplain. Previously developed land adjacent to water courses may provide opportunities to incorporate space for flood water to reduce flood risk to new and existing development.

FURTHER INFORMATION AND REFERENCES

- Consultation of proposed amendments to Planning Policy Statement 25, Development and Flood Risk, Communities and Local Government, 2009.*
- Construction (Design and Management) Regulations 2007, HSE, 2007.
- Flood Risk Assessment Guidance for New Development Phase 2. R&D Report FD 2320, DEFRA & Environment Agency, 2005.*
- Flood Risk to People Phase 2 Interim Report. R&D Technical Report FD 2321/IR1. DEFRA/ Environment Agency, 2004.*
- Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.
- Planning Policy Statement 3, *Housing*, Communities and Local Government, 2006.
- Planning Policy Statement 12, *Local Spatial Planning*, Communities and Local Government, 2008.
- Planning Policy Statement 22, *Renewable Energy*, ODPM 2004.
- Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1, Environment Agency and HR Wallingford, 2008.
- Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents*, ODPM, 2005.
- The Strategic Housing Land Availability Assessment Practice Guide*, Communities and Local Government, 2007.
- The Pitt Review – Learning Lessons from the 2007 Floods*, The Cabinet Office, 2007.

5 Managing surface water



INTRODUCTION

- 5.1 The purpose of this chapter is to:
- explain the importance of taking surface water management into account when assessing flood risk and planning new development; and
 - consider how the planning system can encourage the use of Sustainable Drainage Systems (SUDS) and the development of surface water plans.
- This will ensure that surface water management is better understood and embedded in decision-making at all levels of the planning process.
- 5.2 Around two-thirds of the flooding in summer 2007 was due to surface water (Environment Agency, 2007). With climate change predicted to cause more frequent, short-duration, high intensity rainfall and more frequent occurrences of long-duration rainfall, surface water flooding is likely to be an increasing problem.
- 5.3 Sustainable drainage systems, or SUDS, can better manage the risk of surface water flooding, as well as improving water quality by reducing the amount and rate of water flow by infiltration, storage, attenuation and slow conveyance.
- 5.4 The Pitt Review into the lessons learnt from the 2007 floods made several recommendations regarding surface water management which included new roles and responsibilities for local authorities on surface water flooding. This included a recognition of the importance of Surface Water Management Plans and resolving the adoption and maintenance of sustainable drainage systems.
- 5.5 Surface water flooding often happens quickly and is difficult to predict. It occurs when natural and man-made drainage systems have insufficient capacity to deal with the volume

of rainfall. The critical factors in surface water flooding are the volume of rainfall, its intensity, where it falls, topography and the permeability of the surface onto which it falls. In urban areas sudden and intense rainfall cannot drain away as quickly as it can in rural areas where vegetation and soil can slow water flowing over the surface.

- 5.6 Conventional surface water drainage uses underground piped systems designed to remove surface water from a site as quickly as possible. This may result in flooding problems downstream and reduce the recharging of groundwater. Conventional drainage can also create a direct pathway for pollutants from urban areas to pass into watercourses and groundwater.

THE ROLE OF THE PLANNING SYSTEM IN SURFACE WATER MANAGEMENT

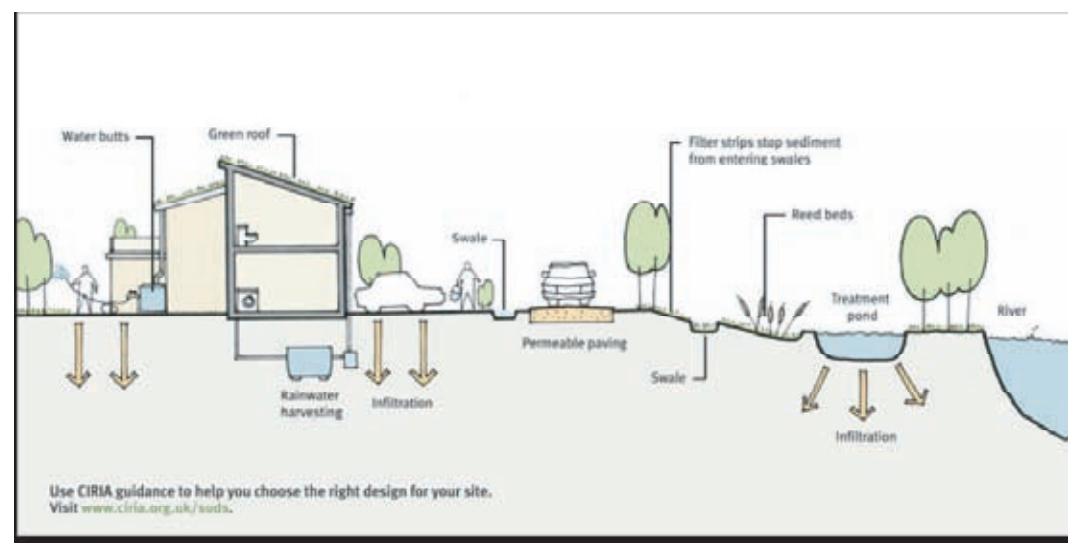
- 5.7 PPS25 (annex F) requires that flood risk assessments take account of all types of flooding, including surface water flooding. This includes development sites in Flood Zone 1, which could have implications for downstream flooding due to increased run-off, as well as affecting surface water run-off within the site itself.
- 5.8 The management of surface water flooding is a developing area of flood risk management and it is important to consider both the flood risk to the proposed development as well as the potential impacts on areas adjacent to and downstream of the development. Surface water should therefore be a central consideration in the first four steps of the flood risk management hierarchy.
- | | |
|-------------------|--|
| Assess | – risks associated with surface water through regional, strategic and site-specific flood risk assessments and Surface Water Management Plans where completed. |
| Avoid | – risks from surface water by controlling water at source using SUDS and locating development away from risk areas. |
| Substitute | – apply the sequential approach to locate more vulnerable development in lowest risk areas. |
| Control | – use SUDS and implement Surface Water Management Plans to manage and reduce risk within the development and downstream. |
- 5.9 For new developments, the best way of reducing flood risk within the development is to:
- control the water at source through sustainable drainage systems (SUDS).
 - consider exceedance i.e. what flow paths will be taken by excess surface water (*'the major drainage system'*) when the capacity of the drainage system is exceeded.

MANAGING SURFACE WATER AT SOURCE: SUSTAINABLE DRAINAGE SYSTEMS

- 5.10 Sustainable drainage systems (SUDS) are a sequence of control structures designed to drain surface water in a more sustainable fashion than conventional techniques.
- 5.11 SUDS mimic natural drainage and reduce the amount and rate of water flow by
- infiltration into the ground,
 - holding water in storage areas, and
 - slowing the flow of water.
- 5.12 Examples are shown in the table below:

Figure 5.1 Suitability of SUDS techniques to achieve these aims			
Techniques	Infiltration to reduce run-off	Holding water in storage areas	Slowing down the movement of water
Green roofs		•	•
Permeable paving	•		•
Rainwater harvesting		•	
Swales	•	•	•
Detention basins	•	•	•
Ponds		•	•
Wetlands		•	•

Figure 5.2 Illustration of various sustainable drainage techniques



(Source: CIRIA)

- 5.13 SUDS achieve multiple objectives; they remove pollutants from urban run-off at source, control surface water run-off from developments, ensure that new developments do not increase flood risk downstream, and combine water management with green space which can increase amenity, recreation and biodiversity value.
- 5.14 To realise the greatest improvement in water quality and flood risk management, SUDS components should be used in combination, often referred to as the SUDS Management Train. (http://www.ciria.org/suds/suds_management_train.htm). The management train is a hierarchy, having three elements:
- ‘Source Control’ within an individual building plot or section of highway. Any surface water which cannot be wholly dealt with within the plot would drain to the second element.
 - ‘Local Control’ which would service any need for collective drainage between plots and/or highways. Any surface water which cannot be wholly dealt with through Local Control would drain to the third element.
 - ‘Regional Control’ which would service run-off from a large area of development.

ROLE AND RESPONSIBILITIES OF PLANNING BODIES/AUTHORITIES

- 5.15 PPS1; *Delivering sustainable development* and PPS25 (paragraphs 8 and F8) require regional planning bodies (RPBs) and local planning authorities (LPAs) to promote SUDS.
- 5.16 Regional Spatial Strategies should include policies to encourage sustainable drainage. Regional Flood Risk Appraisals (RFRAs) should include a broad-scale consideration of surface water management, focusing on regionally-significant issues. This could include areas which have suffered from surface water flooding or potentially could do so as identified in Strategic Flood Risk Assessments (SFRAs).
- 5.17 The LPAs' SFRA should identify surface water drainage issues, using evidence from Surface Water Management Plans where they have been developed, and the types of measure, which may be appropriate to manage them, taking account of location, site opportunities, constraints and geology. LPAs should encourage sustainable drainage practices in their local development documents (LDDs). Priority should be given to the use of SUDS and where they are not deemed appropriate, justification should be given for not using them. LPAs can develop supplementary planning documents that set out the principles of SUDS and provide guidance on how they would expect to see sustainable drainage accommodated in a development. An example of this is the supplementary planning guidance to support Local Plan policy prepared by Gloucester City Council, which as well as providing background to the SUDS approach also gives information on how the policy may be implemented. (<http://www.goucester.gov.uk/CouncilServices/Planning/LDF/LocalPlanPages/SPG1-SustainableUrbanDrainageSystems.aspx>)
- 5.18 Where possible, highways authorities should be engaged in the design of SUDS and surface water management for the development, as roads can contribute to run-off as well as provide opportunities for the incorporation of SUDS. Local authorities should also consider the use of local or adjacent public and green spaces, such as parks, as part of SUDS design, particularly when designing for exceedance. Discharges to local water courses should be considered. However as this can have implications for water quality (by washing pollutants into water courses), the Environment Agency and/or navigation authorities should also be engaged in discussions.

Case study

Krishna Avanti School, Camrose Avenue, London Borough of Harrow – example of a good surface water Flood Risk Assessment

In January 2007 the Environment Agency was asked to comment on an Environmental Statement which assessed the environmental impacts of turning two hectares (out of a four hectare playing field) into a primary school.



The site is not in the floodplain or next to a watercourse but it is bigger than one hectare in size. The Agency therefore requested that a Flood Risk Assessment be undertaken to assess the impacts of the development on surface water runoff.

By working closely with the local planning authority and the developer a sustainable drainage system was developed, and it was designed to ensure that runoff from the site mimicked that of an undeveloped site, achieving greenfield runoff rates.

The site's drainage system includes the use of ponds, green roofs on some of the buildings and rainwater harvesting systems. These green roofs and ponds not only reduce flood risk to the development and surrounding area but they also provide wildlife habitat and can help improve water quality. The pond doubles up as an educational resource and enables the children to undertake pond-dipping. The rainwater harvesting system enables rainwater to be re-used in the site's sanitation system and when maintaining the school gardens.



Images courtesy of I-Foundation

Case study

The Prince's Foundation project at Upton, Northampton – an example of SUDS in a well designed and relatively dense new development

Upton is an urban extension currently being developed on the South-West fringe of Northampton. It is an example of where a Sustainable Urban Drainage System (SUDS) has been successfully incorporated into a sustainable mixed use walkable neighbourhood through effective design and masterplanning .

The Prince's Foundation for the Built Environment worked closely with English Partnerships, Northampton Borough Council and consultants EDAW and Alan Baxter & Associates, on the creation of a masterplan and design code to ensure a high standard of urbanism. The SUDS mitigates the potential for hazardous runoff, flooding and consequent environmental damage not only on site, but in the wider surrounding Nene Valley. The strategy to limit and control surface water runoff is achieved through:

- Water butts, green roofs and permeable paving within courtyards, with restricted discharge into the public water drainage system.
- An open green network of swales and pipes that run along the street and provide attenuation and transfer of surface water through the system.
- Linked storage ponds that are located around playing fields at the end of the system which store surface drainage and allow for controlled discharge.

Due to the site's relatively steep gradient the swales are designed either parallel to contour lines to maximise storage and surface area for infiltration or they are aligned to follow the slope with weirs installed to control surface water, increase storage volume and allow easy maintenance. Also streets that are aligned north-south have swales in the centre whilst streets aligned east-west have swales on the northern side of the street. This achieves maximum exposure of sunlight and improves the function and biodiversity of the system.

High quality open green spaces are achieved with the swale and pond network providing 'green fingers' extending from the country park into the public realm, facilitating habitat creation and enhancing local biodiversity in the area. Pedestrian permeability is increased with regular crossings and links across the road providing continuous and safe pedestrian circulation throughout the area. Health and safety has been a prioritisation and a management strategy of improving public awareness and understanding of the risks of surface water within the public realm has been implemented.

Continued

The Upton masterplan and SUDS is part of and connects with an expanding green infrastructure for the Northampton area, and promotes substantial benefits for habitat and biodiversity. Since installation the system has been shown to perform well during flooding events.

More information on the scheme can be found at http://www.princes_foundation.org/index.php?id=173



Image courtesy of The Prince's Foundation for the Built Environment

ROLE AND RESPONSIBILITIES OF DEVELOPERS

Developer considerations of when to use SUDS

- 5.19 Developers should consider surface water management alongside other flood risk issues when selecting sites for development. Developers should incorporate SUDS in their development plans at an early stage, because SUDS have a significant impact on the shape of the development. Developers should also consider the type of SUDS which would be appropriate for the site, together with flood routes within and off the site.

- 5.20 A range of SUDS options is described in annex F of PPS25. Not all will be appropriate for individual development sites. However, a sustainable drainage approach should be possible on almost every site. Which SUDS are applicable will be dependant on the local opportunities and constraints offered by a site, informed by the SFRA and/or Surface Water Management Plan.

Case study

Met Office Relocation, Exeter – an example of the incorporation of a range of sustainable drainage measures into a new development

The new Meteorological Office building is located on a greenfield site on the edge of Exeter. Surface water management measures were required to drain the site whilst maintaining run-off rates at greenfield run-off rates.

Surface water management was achieved through the use of a combination of permeable paved areas, filter drains, swales, traditional piped drainage systems, detention basins and balancing ponds. Extreme event green corridors were provided to route exceedence flood waters away from the buildings. Water from the balancing ponds is extracted for use in toilet flushing.

Right: Balancing pond outside Met Office, (image courtesy of Arup).



- 5.21 A broad overview of the SUDS philosophy and an analysis of how to marry SUDS to a specific site is provided in CIRIA publication C609, *SUDS – hydraulic structural and water quality advice*, 2004. CIRIA publication C697, *The SUDS Manual* (2007) provides further detailed information.

5.22 To get the most benefit from SUDS they must be considered as early as possible in the planning process and over as wide an area as possible. There may be opportunities to alleviate surface water flooding in adjacent and downstream areas, as well as in the development site. When assessing the use of SUDS within a site there are particular issues which need to be considered:

- Land Take
- Health and Safety, and
- Adaptation and maintenance.

Land take

5.23 Some SUDS techniques may require significant land take. However, consideration of SUDS at the early design stages can increase the opportunities for the use of SUDS, by incorporating the SUDS into the site layout. Techniques such as green roofs and permeable pavements can be used in high-density urban developments and make a significant contribution to attenuating surface water run-off without needing more space than required for conventional roofing and paving. Developers can also make dual use of green space areas within the development, combining water storage with amenity areas and biodiversity e.g. (Manor Park, Sheffield). HR Wallingford's *Use of SUDS in high density developments* looks at which SUDS methods are most effective for a limited area. To ensure that space can be provided for SUDS and that the most appropriate SUDS system and layout is developed, it is essential that:

- There is early consideration of SUDS at the overall concept stage.
- LPAs make allowance for SUDS features when considering site densities.

5.24 Developers, particularly when undertaking master plans for developments, will need to allow for sufficient land for SUDS features to be designed in at the outset, as it is much more difficult and costly to incorporate these once detailed design is underway.

Health and safety

- 5.25 The design and construction of all drainage systems must comply with the Construction (Design and Management) Regulations 2007. SUDS, like other conventional systems, must also comply with health and safety legislation.
- 5.26 The risk of SUDS to public safety can be managed and reduced with careful design. Ponds with shallow side slopes, shallow shelving edges and strategically placed barrier vegetation are at least as safe as many other watercourses, ponds and lakes that are unfenced in parks and similar locations. Features such as swales and porous surfaces present no more risk than standard landscaping.

- 5.27 The developer will need to carry out a safety audit or risk assessment of any SUDS scheme early in the process to design out risks to workers and the public.

Adoption and maintenance

- 5.28 When planning SUDS, developers need to design for maintenance of the SUDS, so that they continue to provide effective drainage for properties. A poorly maintained SUDS can increase flood risk rather than reduce it. Local authorities and developers should work together to make arrangement for adoption ahead of the introduction of new formal adoption arrangements that are currently being put forward by the Government, which are dependent on prospective new legislation.
- 5.29 In some circumstances it may be appropriate to secure the arrangements through a planning agreement under section 106 of the Town and Country Planning Act 1990, which may also include arrangements for funding maintenance for a specific period. It is encouraging that a number of LPAs are already using some of the above routes to secure adoption or robust long-term management and maintenance.
- 5.30 In order to encourage adaptation, developers should also:
- Ensure early liaison and consultation, talking with relevant stakeholders to agree the most viable outcome.
 - Use the Interim Code of Practice for Sustainable Drainage Systems (see paragraph 5.31 below).
 - Consider connecting surface water to the public sewerage system (either a combined sewer or surface water sewer) *only* after exploring the use of SUDS to manage some or all of the surface water outfalls. SUDS should be used where possible. In situations where a connection to a sewer is unavoidable, Source Control SUDS should still be employed where possible.
- 5.31 The National SUDS Working Group (NSWG) comprising central government, local government, regulators, non-Governmental Organisations (NGOs) and the construction and water industries has been established to promote the widespread use of SUDS in England and Wales (<http://www.ciria.org/suds/icop.htm>). The NSWG has developed an Interim Code of Practice for SUDS (NSWG, 2004) to address problems of SUDS adoption. This code of practice is complemented by CIRIA publication C625 *Model agreements for SUDS*. Model agreements produced are outlined in figure 5.3.

Case study

Sheffield – Housing run-off management, Manor Fields Park

Developed in the context of an emerging new district park for the Manor and Castle area of Sheffield, this scheme manages the run-off from a 300 dwelling new housing development.

The regeneration of these deprived areas of Sheffield has included the demolition of extensive areas of housing and a subsequent difficult rebuilding programme. Alongside this has been a need to address the poor open space network of the area.

Consideration of Manor Fields site as a potential SUDS venue was put forward initially by Sheffield Wildlife Trust. Subsequently the Council Parks Development team and the Green Estate company (a social enterprise formed by the Trust and Manor and Castle Development Trust) have developed the scheme with the developer, Bellway Homes.

The defining driver for taking the open space route for managing surface run-off was the considerable costs associated with building a conventional connection of the onsite pipe network to the surface water sewer. This was due to topographic constraints.

The resultant scheme design development was managed by the Park's team with expertise from Robert Bray Associates. Delivery was by Bellway appointed contractors.

The scheme consists of a series of basins positioned at different levels down the sloping topography of the park. Each managing an increasing size of storm event and improving water quality down the system. There is also a dry grass basin doubling as a recreational space which is designed to manage the 1 in 100 year storm event. Discharge is at Greenfield run-off rate for the area (5litres/sec/Ha).

Management arrangements were through a commuted sum from the developer with the Council adopting. Delivery of management is through a management agreement with the Green Estate company.

The scheme performed very effectively in the June 2007 storms will the large recreational space occupied with water. The only concern is with polluted run-off entering park from diffuse sources as well as misconnections and disposal down gulleys.

Continued

Sheffield – Housing run-off management, Manor Fields Park (continued)

Overall the scheme delivered many benefits to park including reclamation of derelict land, revenue for management, recreational space, biodiversity and community interest.



Images courtesy of Sheffield City Council

Figure 5.3 Model agreements for use with the Interim Code of Practice for SUDS

Reference	Title and description
ICoP SUDS MA1	Planning obligation – incorporating SUDS provisions Implementation and maintenance of SUDS either as a planning obligation under Section 106 of the Town and Country Planning Act 1990 or as a condition attached to planning permission.
ICoP SUDS MA2	SUDS maintenance framework agreement Legal framework that defines which body takes over and maintains the SUDS.
ICoP SUDS MA3	Model discharge agreement A model deed in relation to owners of SUDS facilities granting sewerage undertakers rights in perpetuity to discharge, flood and maintain in default.

- 5.32 Further information on the Interim Code of Practice, CIRIA publication C625 and a copy of the model agreements can be found on CIRIA's SUDS website.

ENVIRONMENTAL IMPROVEMENTS & ISSUES FOR PLANNING

- 5.33 SUDS are important for the achievement of sustainable development objectives and can significantly improve environmental quality and reduce surface water run-off. The greatest benefits are achieved when SUDS are part of the design from the earliest stages of projects. Good implementation of SUDS has the potential to stimulate good urban design and to unlock a range of other sustainability opportunities, such as the improvement of water quality.

Case study

Woodberry Down Estate, London Borough of Hackney

In the London Borough of Hackney a large brownfield regeneration development was proposed entirely in Flood Zone 1. The developer approached the Environment Agency at an early stage to discuss design issues to incorporate SUDS and achieve a reduction in surface water run-off.

Through the close working relationship between the developer, Council and Environment Agency, the developer has managed to achieve the equivalent of greenfield run-off rates, facilitated by extensive SUDS such as swales, green roofs, permeable paving and some cellular storage. A Design Code incorporating SUDS was established for the whole estate which enabled drainage details to be built into the whole development process. This enabled the planning process from a drainage perspective to be straightforward, and without any delays.



Images courtesy of London Borough of Hackney

Figure 5.4 Some benefits of SUDS and issues for planning

Feature	Benefits	Issues for planning
Green roofs	Attenuated run-off, improved aesthetics, climate change adaptation.	Visual appearance. Dissemination of ongoing management requirements.
Water butts	Attenuated run-off.	Design in space for water butts.
Porous and pervious paving	Infiltration to promote attenuation and groundwater recharge, treatment by detention, treatment by filtration. Can also be used as storage before discharging downstream, if infiltration not appropriate.	Using the right material for the use. Visual appearance. Traffic loading.
Rainwater harvesting	Attenuated run-off, water conservation.	Building design.
Filter strips	Green links/corridors through a development, run-off attenuation, filtering of contaminants.	Land take and visual integration into development. Multi-functionality. Adequate for predicted run-off.
Swales	Can be planted with trees and shrubs, provides green links/corridors, improved visual amenity, conveyance of storm water.	Land take. Multi-functionality. Adequate for predicted run-off. Health and safety. Improved amenity value.
Infiltration basins	Potentially compatible with dual-use e.g. sports pitches, play areas, wildlife habitat. Treatment by detention and filtration.	Land take. Multi-functionality – provision of open space in development. Health and safety.
Detention basins	Can be designed as an amenity or wildlife habitat. Treatment by detention.	Land take. Multi-functionality. Health and safety.
Retention ponds	Open water bodies which can significantly enhance the visual amenity of a development. Treatment by detention. Wildlife habitat. Can abstract water for re-use e.g. irrigation. Fishing, boating and other water sports.	Land take. Multi-functionality. Health and safety. Improve amenity value, including the restoration of habitat and/or environmental enhancement.
Wetlands	Provide a range of habitats for plants and wildlife. Biological treatment linear wetlands can also provide green corridors.	Land take. Multi-functionality. Health and Safety. Strategic planning for biodiversity. Improve amenity value, including restoration of habitat and/or environmental enforcement.

Case study

Lamb Drove, Cambourne, Demonstration site

The Lamb Drove project has been run by Cambridgeshire County Council as part of the Flows project. It is located on the southern side of Cambourne, a new settlement approximately 8 miles west of Cambridge, and comprises 35 dwellings on a 1 acre site.

Through an integrated system of sustainable drainage features the site has brought ecological and social benefits to the residents. The SUDS implemented include permeable paving, detention basins, swales, green roofs, water butts and flood proofing.

The site is now being monitored for a period of two years to assess the performance of the SUDS measures that have been installed in terms of quantity, quality and ecological benefit. This includes continuous monitoring of water flows and quarterly sampling of water quality at both the SUDS site and a control site that has a conventional drainage system. In addition ecological assessments and questionnaires to assess the views of the residents are being conducted at the start and end of the monitoring period. The initial results are very encouraging showing significant attenuation of water volumes by the SUDS measures in comparison to the control site.

Detention basin at Lamb Drove development, Cambridgeshire (images courtesy of Royal Haskoning).



Managing surface water pathways and impact on receptors

- 5.34 “*Flood risk, especially in built up areas, can be managed most effectively if there is an understanding of the way the floods arise and have an impact on the various drainage systems. Such an understanding should enable better use to be made of above ground pathways and storage for extreme events*”. *Making Space for Water*, Defra.

ROLE OF THE STRATEGIC FLOOD RISK ASSESSMENT (SFRA)

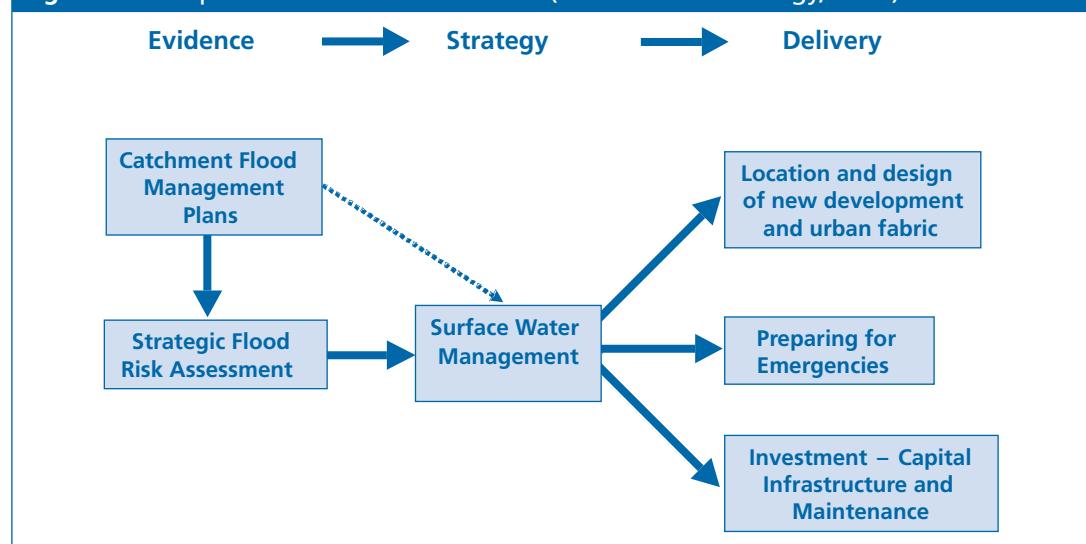
- 5.35 An SFRA should identify areas at risk from surface water flooding as part of defining areas of highest flood risk. Information on surface water flooding should be gathered from a variety of sources including historical flooding records, an assessment of drainage assets and the use of hydraulic modelling of urban rivers, sewers and overland path flows. Stakeholders including Local Authorities, Sewerage Undertakers, the Environment Agency, Highways Authorities, Internal Drainage Boards, developers and local residents should share information. Information should also be incorporated from Catchment Flood Management Plans. The information gathered in the SFRA forms the basis of applying the Sequential Test to ensure that new development is located in lower flood risk areas where possible.

SURFACE WATER MANAGEMENT PLANS AND HOW THEY INTEGRATE INTO THE PLANNING SYSTEM

- 5.36 Opportunities for local authorities and the other key stakeholders to develop surface water management plans (SWMPs) are also being developed by Government as part of the Water Strategy *Future Water* (Defra 2008). SWMPs have an important role in developing a coordinated strategic approach to managing surface water drainage and reducing flood risk. They should reflect the future proposals of all key stakeholders and provide a clear delivery plan. They may also provide a way to integrate the requirements of forthcoming River Basin Management Plans, the first phase of which are to be published in December 2009, into spatial planning. SWMPs should focus on managing flood risk and optimising the provision of SUDS.
- 5.37 Detailed guidance on the preparation of SWMPs is available from Defra in Surface Water Management Plan Technical Guidance: Living draft version 1 February 2009 (see <http://www.defra.gov.uk/environ/fcd/policy/swmp-guide.pdf>). The guidance takes account of lessons learned from 15 Integrated Urban Drainage pilots undertaken between January 2007 and June 2008, and includes many references to other sources of good practice and research in surface water management, as well as input from the Defra project steering group for Improving Surface Water Drainage.
- 5.38 This guidance is due to be revised towards the end of 2009 and will incorporate lessons learnt from six pilot first edition SWMPs and feedback from practitioners using the guidance. Future updates and information on SWMPs will be available at: <http://www.defra.gov.uk/environment/flooding/manage/surfacewater/index.htm>.

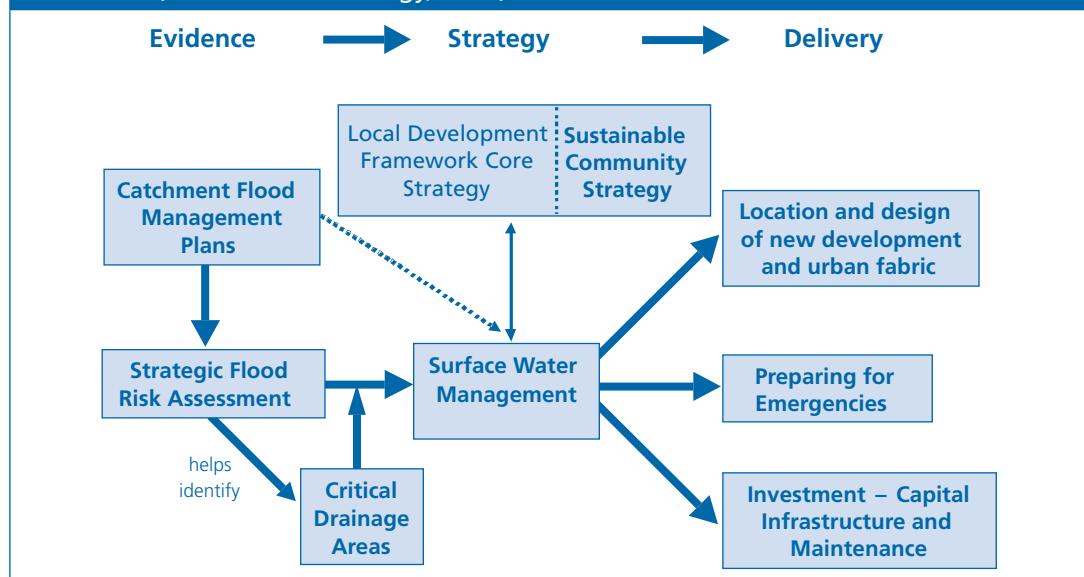
- 5.39 The Environment Agency, with the support of Defra, Water UK, UKWIR and others, published on 31 October 2009 their report outlining a research framework to direct new research, development and demonstration projects to support the effective implementation of Integrated Urban Drainage (Research framework – The Implementation of Integrated Urban Drainage, Science Report SC070064/SR). The framework is intended to help an understanding of the greatest research needs related to Integrated Urban Drainage, and the time horizon over which the research can be turned into benefits, such as practical knowledge and tools.
- 5.40 Paragraph 6 of PPS25 encourages LPAs to prepare a SWMP to help reduce the impacts of flooding through new development. SWMPs will build on SFRAs, Catchment Flood Management Plans, Shoreline Management Plans and River Basin Management Plans, and will aim to provide cost-beneficial solutions for the areas at greatest risk of surface water flooding. LPAs should work in partnership with key stakeholders, including local authority drainage and resilience experts, the Environment Agency, water and sewerage companies and Internal Drainage Boards (where they are present).

Figure 5.5 Proposed Surface Water Model (Defra Water Strategy, 2008)



- 5.41 Planners at the strategic and development control levels can then develop strategies to ensure effective surface water management in the future. SWMPs should inform the preparation by LPAs of their Core Strategy documents. In this way Core Strategies should include appropriate policies on flooding and surface water drainage. Core Strategy development plan documents may be found unsound at public examination if flooding and drainage issues have not been properly addressed. SWMPs do not form part of the statutory spatial planning system, but have important links with it. Figure 5.6 sets out the relationship between these plans and documents.
- 5.42 The LPA's strategic planning policies and approach to surface water flood risk will be reflected in the Core Strategy of the Local Development Framework (LDF). The evidence base for this will be the SFRA, which will help identify critical drainage areas where a Surface Water Management Plan (SWMP) may be needed. The SWMP may contribute to the evidence base to support LDF policies on surface water drainage and provide the foundation for a Supplementary Planning Document (SPD).
- 5.43 In areas of high growth and areas with particular flood risk, it might be appropriate for a SWMP to inform a 'surface water supplementary planning document'. In this way, a SWMP can usefully feed into a supplementary planning document at a specific point in time, whilst the SWMP can continue to be developed and used as a 'hands on' management tool by a number of stakeholders where appropriate.

**Figure 5.6 Potential role of Surface Water Management Plans in spatial planning
(Defra Water Strategy, 2008)**



Case study

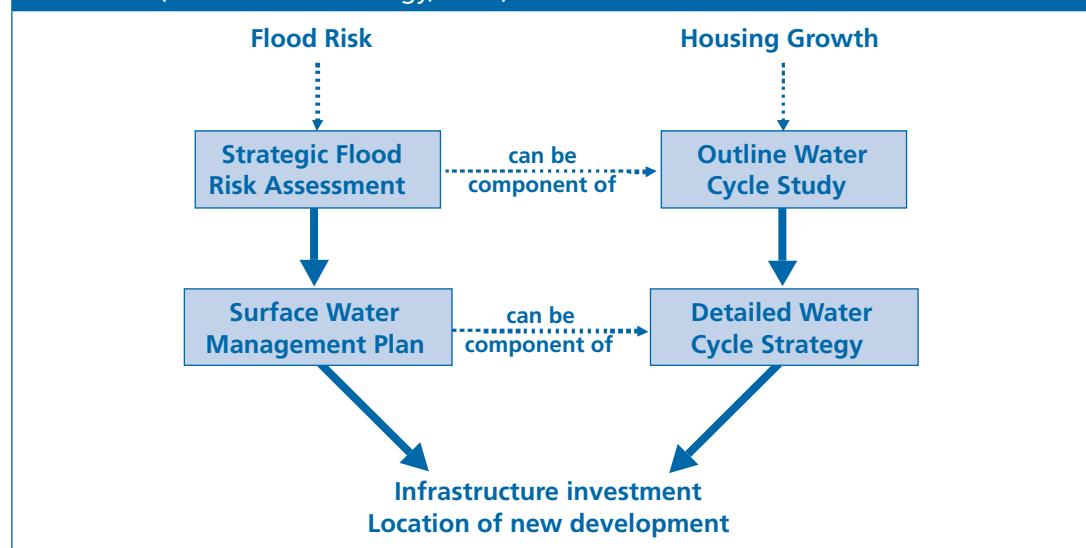
Kerrier District Council Surface Water Management Plan

Kerrier District Council commissioned a Surface Water Management Plan (SWMP) to improve understanding of the impacts of regeneration on the existing drainage infrastructure. The Council, the regeneration company and the Environment Agency worked together to produce an effective plan to help deliver urban regeneration and improve the drainage infrastructure.

The SWMP provides a 'route map' to maximise the development potential of the area, so that the optimum use can be made of brownfield land, supported by a viable drainage infrastructure. The SWMP tackled contaminated land, below ground mine working and combined sewers already being at capacity. This has had two complementary advantages, enabling regeneration and protecting the environment. Planning officers, the Environment Agency and developers benefited by taking a strategic view, enabling issues to be resolved in advance, saving time and costs and creating certainty. Environmental benefits include improving water quality and reducing flood risk downstream by redirecting surface water flows out of combined sewers into SUDS. Additionally, reducing erosion of contaminated soils will reduce the risk of contamination in rivers and the coast.

- 5.44 SWMPs and SFRAs also have close links to water cycle studies and water cycle strategies. Water cycle studies are a means of assessing the environment and infrastructure capacity for water supply, sewage disposal, flood risk management and surface water drainage. They help to plan for water more sustainably by, amongst other things, bringing together all water and planning evidence under a single framework; improving the understanding of the environmental and physical constraints to development; and identifying water cycle planning policies and a water cycle strategy to help all partners plan for a sustainable future water environment. Water cycle study guidance has been produced by the Environment Agency (see <http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf>). In areas of high housing growth, water cycle studies and water cycle strategies will play important roles in developing a programme for enabling the required improvements to water services infrastructure to be provided. Figure 5.7 sets out the links between these plans and documents.

Figure 5.7 Links between Water Cycle Studies and Surface Water Management Plans
(Defra Water Strategy, 2008)



Surface water management plans: purpose and outcomes

- 5.45 The key purposes of a SWMP are:
- ensuring that allocations within an area are properly supported by adequate surface water management;
 - providing a common framework for stakeholders to agree responsibilities for tackling existing drainage problems and preventing future problems;
 - where development pressures are high it can be part of a Water Cycle Strategy; and
 - demonstrating how capital investment, infrastructure and maintenance can deliver the required surface water management.
- 5.46 Defra's draft Surface Water Management Plan Technical Guidance provides further information for local authorities and their partners on how to produce a SWMP. It is envisaged that the main outputs, processes and benefits arising from SWMPs should be:
- A shared and improved understanding among partners and the public about the source pathway and receptors of surface water flooding, as well as the location, ownership status, protection and purpose of surface water drainage infrastructure (e.g. sewers, drains, culverted watercourses, ditches, rivers, above ground flow routes, detention ponds, etc.).
 - A shared understanding among partners and stakeholders of current and future risks which combines knowledge of the locations, likelihoods and consequences of surface water flooding.

- A map showing surface water flood risk that can be used by Local Resilience Forums (planning for emergencies) and planning authorities (looking to allocate land to different uses).
- A process of options appraisal where the feasibility, cost, effectiveness and public acceptability of different measures are tested and compared, in order to identify the most cost beneficial means of reducing flood risk.
- The identification of preferred options to reduce the risk of flooding with a programmed delivery plan which clarifies the responsibilities of each partner to deliver their component. Also the delivery plan should outline how residual risk will be managed.
- A SWMP which informs the preparation by LPAs of appropriate policies on surface water drainage for inclusion in local development documents.
- Periodic review of the SWMP to gauge progress in tackling the most serious surface water flood risk problems.

SITE – SPECIFIC SURFACE WATER MANAGEMENT

- 5.47 Surface water management issues should be covered in a site-specific Flood Risk Assessment (FRA) (see chapter 3 and the FRA checklist, appendix B) to accompany a planning application. Surface water management is a material planning consideration and a key component of design, and will need to be considered at the earliest possible stage in the planning and design process, in consultation with the LPA, sewerage undertakers, Environment Agency and other relevant bodies.
- 5.48 The first point of reference for a site drainage or surface water management strategy for a new development site should be policies in LDDs and Supplementary Planning Documents (SPDs), and any site-specific guidance within the SFRA or SWMP. The key requirements for new development are outlined below.

Site drainage within the development

- 5.49 The FRA accompanying the planning application should show how surface water management is functioning on the site at present and how it is to be undertaken in the new development. Drainage of rainwater from the roofs of buildings and paved areas around buildings should comply with the 2002 amendment to Approved Document H – *Drainage and waste disposal*, of the Building Regulations (BR part H). Development should comply with the Building Regulations Part C, *Resistance to moisture and weather*, with regard to maintaining the integrity of existing land drainage arrangements on development sites.
- 5.50 All sewers that will subsequently be adopted by the sewerage undertaker must be designed and built in accordance with the requirements of Sewers for Adoption, Edition 6 (WRc 2006). This document provides guidance on suitable return periods for use in the design of sewerage systems for various development types. In general terms, sewers should be designed to ensure that no flooding occurs above ground level for events with a return-period of 30 years.

Designing for exceedance

- 5.51 For events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes. No flooding of property should occur as a result of a one in 100 year storm event (including an appropriate allowance for climate change). In principle, a well-designed surface water drainage system should ensure that there is little or no residual risk of property flooding occurring during events well in excess of the return-period for which the sewer system itself is designed. This is called designing for event exceedance. It includes avoiding obstructions that might inhibit overland flow. A high level of detail may be required, for example, the impact of kerb heights on the free passage of water can be significant. Further guidance on this and designing safe and sustainable flood conveyance routes and storage is provided in *Designing for exceedance in urban drainage – good practice* (CIRIA publication C635).
- 5.52 Section 106 of the Water Industry Act 1991 provides a right for new development to connect foul and surface water drainage from premises to public sewers. This can place an additional strain on existing drainage and sewer networks and have a range of other adverse environmental impacts. This automatic right to connect also reduces the incentives to look at alternative ways of managing surface water e.g. SUDS. As part of Government's water strategy, '*Future Water*', the right to connect was reviewed as part of the *Improving Surface Water Drainage* Consultation of February 2008. The consultation indicated support for the amendment of Section 106, and Defra is currently taking this forward.

Off-site impacts of the development

- 5.53 PPS25 (paragraph 5) makes it clear that off-site impacts should not increase flood risk elsewhere.
- 5.54 For the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) event, including an appropriate allowance for climate change, the developed rate of run-off into a watercourse, or other receiving water body, should be no greater than the existing rate of run-off for the same event. Run-off from previously-developed sites should be compared with existing rates, not greenfield rates for the site before it was developed. Developers are, however, strongly encouraged to reduce run-off rates from previously-developed sites as much as is reasonably practicable. Volumes of run-off should also be reduced wherever possible using infiltration and attenuation techniques. Interim guidance on calculation of site run-off rates can be found at http://www.ciria.org/suds/pdf/preliminary_rainfall_runoff_mgt_for_development.pdf

HOUSEHOLDER PERMITTED DEVELOPMENT RIGHTS

- 5.55 Changes were made to the Town and Country Planning (General Permitted Development) Order 1995 so that as from 1 October 2008, householders who wish to lay impermeable surfaces in their front gardens, where the surface area exceeds five square metres, need to obtain specific planning permission. Householders can, however, lay permeable surfaces through permitted development rights without the need to apply for planning permission. Guidance to advise householders of the options for achieving permeability in front gardens and meeting the condition for permitted development status was published by Communities and Local Government in May 2009.
- 5.56 For commercial and other non-domestic premises, the Government has consulted on a change to permitted development rights in England in July 2009. (See: <http://www.communities.gov.uk/documents/planningandbuilding/pdf/improvingdevelopmentconsult.pdf>). The Government proposes to grant new permitted development rights to shops, offices and institutions to be able to lay up to 50 square metres of permeable hard-surfacing without the need to apply for planning permission. For industrial and warehousing premises, the proposal is akin to that for domestic front gardens, so that permeable hard-surfacing (unless there is a risk of contamination) would not need planning permission.
- 5.57 Where it is considered to be a local problem, LPAs might consider whether there is a case in a flood risk area to also remove permitted development rights for impermeable surfacing of gardens other than front gardens, or for impermeable surfacing of private roads, by making a direction under article 4 of the 1995 General Permitted Development Order.

FURTHER INFORMATION AND REFERENCES

LANDFoRM (a local authority network on drainage and flood risk management – website <http://www.ciria.org/landform/>) has been developed to promote the sharing of knowledge and experience within the planning community and other key stakeholders to find solutions. The website provides a useful source of information on various aspects of drainage including policy and regulation, technical information and research.

Assessment of the social impacts of Sustainable Drainage Systems in the UK, SR 622, HR Wallingford, 2003.

BS EN 752-4: Drain and Sewer Systems Outside Buildings, Part 4, British Standards, 1998.

Construction (Design and Management) Regulations 2007, HSE, 2007.

Construction Industry Research Information Association (CIRIA) website for Sustainable Drainage Systems: www.ciria.org/suds

Consultation on Improving Permitted Development, Communities and Local Government, July 2009.

Consultation on Improving Surface Water Drainage (Part of the Government's Water Strategy), DEFRA, 2008.

Control of pollution from highway drainage discharge Report R142, CIRIA, 1994.

Design of flood storage reservoirs, Book B014, CIRIA, 1993.

Designing for exceedance in urban drainage – good practice, Report C635 CIRIA, 2006.

Directive on the assessment & management of flood risks (Floods Directive) European Directive 2007/60/EC.

Guidance on the permeable surfacing of front gardens, Communities and Local Government, May 2009.

Harvesting rainwater for domestic uses: an information guide – Environment Agency, 2003.

Infiltration drainage – manual of good practice, Report R156, CIRIA, 1996.

Interim Code of Practice for SUDS, NSWG, 2004.

Making Space for Water, DEFRA.

Maximising the ecological benefits of sustainable drainage schemes, Report SR 625, HR Wallingford, 2003.

Model agreements for sustainable water management systems, Report C625, CIRIA, 2004.

Planning Policy Statement 1, *Delivering Sustainable Development*, ODPM, 2005.

Pollutant removal ability of grassed surface water channels and swales; Literature review and identification of potential monitoring sites, Highways Agency, 2006.

Preliminary rainfall runoff management for development Defra/Environment Agency R & D project W5-074/TR1, HR Wallingford, 2004.

Rainwater and grey-water use in buildings, Report C539, CIRIA, 2001.

Research Framework – The Implementation of Integrated Urban Drainage, Science Report (SC070064/SR) and Summary (SC070064/SS), Environment Agency, October 2009.

Review of the design and management of constructed wetlands, Report R180, CIRIA, 1998.

Sewers for Adoption 6th Edition (SfA6), published by WRc for Water UK, 2006.

Soakaway Design, BRE Digest 365, 1991.

Source control using constructed pervious surfaces. Hydraulic, structural and water quality performance issues, Report C582, CIRIA, 2001.

SUDS – A hydraulic structural and water quality advice, Report C609, CIRIA 2004.

Surface Water Management Plan Technical Guidance: Living draft version 1, Defra, February 2009.

The Building Regulations 2000. *Approved Document C – Site preparation and the resistance to contaminates and moisture*, ODPM, 2006.

The Building Regulations 2000. *Approved Document H – Drainage and Waste Disposal*, ODPM, 2006.

The Highways Act, 1980, HMSO, 1980.

The Pitt Review – Learning Lessons from the 2007 Floods, The Cabinet Office, 2007.

The SUDS Manual, Report C697, CIRIA, 2007.

The Town and Country Planning (General Permitted Development) Order 1995.

The Town and Country Planning Act 1990, HMSO, 1990.

Use of SUDS in High Density Developments, Guidance manual, R. Kellagher, Ref SR666. HR Wallingford, 2005.

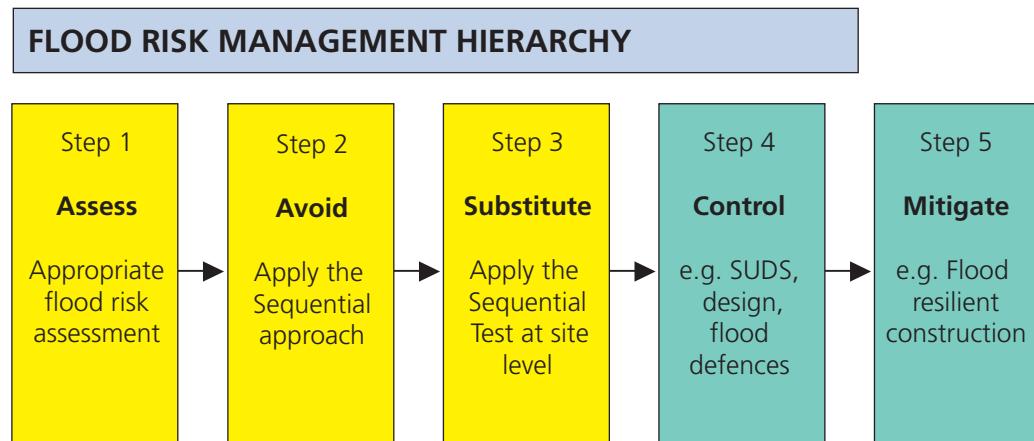
Water Framework Directive, WFD 2000/60/EC.

Water Cycle Study Guidance, Environment Agency, 2009.

Water Industry Act, 1991, HMSO, 1991.

Water Strategy – Future Water, DEFRA, 2008.

6 Risk management by design



INTRODUCTION

- 6.1 The purpose of this chapter is to provide guidance to planners and developers on how to manage flood risk through design of development. It covers the risk management options which can be considered to ensure that developments will be safe and not increase flood risk elsewhere.
- 6.2 Risk management by design should only be considered after the sequential approach has been applied to development proposals. By following the hierarchical approach described in earlier chapters, planners should always try to locate development in areas of lowest flood risk first. Only when it has been established that there are no suitable alternative options in lower risk areas should design solutions be considered to exceptionally allow development to proceed in flood risk areas. Where design solutions are considered appropriate, they need to meet the policy objectives of PPS25 (paragraph 5) that it must be safe without increasing flood risk elsewhere and where possible reduce flood risk overall.
- 6.3 A range of measures can be used to manage flood risk at development sites. A local planning authority (LPA), using the information from a Strategic Flood Risk Assessment (SFRA) should establish the design criteria developers will need to meet through Local Development Document (LDD) policy. Developers should discuss proposals at the earliest possible stage with the LPA, Environment Agency and other key stakeholders so that design issues can be agreed and innovative design solutions considered if necessary. Further advice can be found in the 'LifE Handbook', published in February 2009 by Baca Architects and BRE, which aims to promote good design solutions to help manage and reduce flood risk. Professional advice is likely to be needed, particularly for structural measures, such as walls and embankments.

RISK MANAGEMENT OPTIONS FOR NEW DEVELOPMENT SITES

- 6.4 A number of measures which can be used to manage flood risk at new development sites are discussed below. Appendix A3 in Construction Industry Research Information Association (CIRIA) (2004) Report C624 *Development and flood risk – guidance for the construction industry* provides further details of mitigation measures for flood risk management and the Acclimatise report *Adapting to climate change – lessons for London* for the London Climate Change Partnership (2006) gives some useful overseas examples.
- 6.5 Important flood risk factors to consider which will influence the design of new developments are:
- flood mechanism (how the site would flood);
 - predicted flood level;
 - duration;
 - frequency;
 - velocity of flood water;
 - depth; and
 - amount of warning time of flooding.

Flood avoidance

- 6.6 The best way to avoid flood risk is to locate the development outside areas of flood risk i.e. Flood Zone 1.

Site Layout

- 6.7 Where the Sequential Test shows that there are no suitable available alternative sites in lower flood risk areas and development is required, the sequential approach should be applied within the development site to locate the most vulnerable elements of a development in the lowest risk areas (see chapter 4 above and table D.2 of annex D, PPS25). This will be identified from a detailed site-specific flood risk assessment (FRA). Residential areas may contain a variety of land uses, including dwellings, vehicle and pedestrian access, parking areas, shops, schools and other community facilities. Layout should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with more flood-compatible development (parking, open space etc.) in the highest risk areas.
- 6.8 In designing site layout the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide important flood conveyance and storage as well as providing connected green spaces with consequent social and environmental benefits (see HR Wallingford reports SR 622 and SR 625 and CIRIA report C635). This green infrastructure has the potential to raise the profile and profitability of a development and contribute to other sustainability objectives.

- 6.9 Landscaping of public access areas subject to flooding should allow for easy access to higher land as flood waters rise and avoid local features that could become isolated islands. Fences, hedges and walls should be designed so that they do not cause obstructions to escape routes.

Case study

Diglis Water, Worcester City Council

Diglis Water is a mixed use development with over 400 dwellings on a brownfield site on the edge of the River Severn close to Worcester City Centre. It is an important regeneration site bringing derelict and contaminated land back into use.



Diglis site pre development

The developers, Taylor Wimpey, the owners, British Waterways, the Environment Agency and Worcester City Council have between them created a development which passes the stringent flood risk policies of the Council and improves the management of the floodplain.

Flood mitigation measures include the lowering of the sheet piling on the riverbank, lowering levels and setting back the line of development to create a riverside park. This will significantly improve flood flow at a pinch point in the floodplain. Floor levels have been raised above predicted flood levels which take climate change into account and dry access has been provided. The scheme was subject to a FRA and an Environmental Impact Assessment.

Images courtesy of Worcester City Council and LDA Design.



- 6.10 Any essential structures, such as shelters and seats, should be designed to be flood resilient and firmly attached to the ground. The planning permission should make provision for future management of such areas through planning conditions or Section 106 agreements, with particular regard to safety signing, permitted and prohibited structures and the management of vegetation.
- 6.11 PPS25 requires safe access and escape to be available to and from new developments in flood risk areas (paragraph 8 of PPS25 and chapter 4 of this practice guide).
- 6.12 Where large areas are identified for development, a SFRA or FRA should identify key flow routes which can be planned on a strategic basis. This facilitates linking of surface water drainage systems and making allowance for exceedance of piped systems. It also enables these to be safeguarded for the future by protecting them from development and other obstruction. Development proposals should design for key flow routes. The Government's '*Living draft Surface Water Management Plan Technical Guidance – Version 1*', referred to in paragraph 5.37 of this Guide, was developed to inform LPAs on how to approach the development of a surface water management plan, particularly in areas of high risk of surface water flooding. (See: <http://www.defra.gov.uk/environment/flooding/manage/surfacewater/plans.htm>).
- 6.13 Car parking may be appropriate in areas subject to flooding, provided flood warning is available and signs are in place. Car parks should ideally not be subject to flood depths in excess of 300mm depth since vehicles can be moved by water of this depth (see *Guide to the management of floodplains to reduce flood risk SR 599* HR Wallingford 2003). Car parks located in areas that flood to greater depths should be designed to prevent vehicles floating out of the car park (at Boscastle in August 2004, vehicles floated out of the car park and contributed to the obstruction of bridge openings).
- 6.14 When considering car parking within flood risk areas, the ability of people to move their cars within the flood warning time should be considered. Long-term and residential car parking is unlikely to be acceptable in areas which regularly flood to a significant depth, due to the risk of car owners being away from the area and being unable to move their cars when a flood occurs. Like other forms of development, flood risk should be avoided if possible. If this is not feasible, the FRA should detail how the design makes the car park safe.

Raising floor levels

- 6.15 Where it is not possible to avoid flood risk or minimise it through site layout, raising floor levels above the flood level is a possible option to manage flood risk to new developments. Raised floor levels can be used both as a primary flood risk management method and also to manage residual flood risk (chapter 7) but safe access must be provided (chapter 4).

- 6.16 *Designing for exceedance in urban drainage – good practice (C635)*, published by CIRIA in 2006, aims to provide best practice advice for the design and management of urban sewerage and drainage systems to reduce the impacts that arise when flows occur that exceed their capacity.
- 6.17 Provided there is adequate flood warning (chapter 7) available it may be reasonable to design development with parking or other flood-compatible uses at ground level and residential or other people-intensive use above the flood level. Where developments incorporate open space beneath the occupied level, measures such as legal agreements need to be in place to prevent inappropriate use or alteration of the ground floor that would impede flood conveyance or reduce flood storage.
- 6.18 Single-storey residential development is generally more vulnerable to flood damage and occupants do not have the opportunity to retreat to higher floor levels. Safe refuge above flood level should be designed into new developments within flood risk zones.
- 6.19 Other innovative designs such as floating houses, which are used in the Netherlands, could be considered but the LPA would need to be able to show through the Sustainability Appraisal that the Sequential Test has been satisfied, and that the developer provides evidence through the FRA that the buildings would be safe in the event of a flood and that a suitable evacuation plan had been developed if infrastructure such as electricity failed. Safe means of access will still need to be carefully considered.

Modification of ground levels

- 6.20 Risk to the development may be reduced by raising land by civil engineering operations above the level of flood risk, or to reduce the depth of flood water in extreme conditions to acceptable levels. This will need to be considered early in the design stage. Care is needed to avoid the formation of islands which would become isolated in flood conditions and to ensure there is safe access and egress. Land raising may not be viable if existing buildings or other features at existing ground level need to be retained. Any proposal to modify ground levels will have to demonstrate in the FRA that there is no increase in flood risk to the development itself, or to any existing buildings which are known to, or are likely to flood. The calculation of the impacts on floodplain storage volumes should be included in the FRA, which should show how the overall design mitigates any impacts.
- 6.21 Unless the development is located in an area which is subject to tidal flooding and which serves no conveyance function, land raising must be accompanied by compensatory provision of flood storage either on site or in the vicinity of the site. (*Development and Flood Risk – Guidance for the Construction Industry Report C624*, CIRIA, 2004).

6.22 The following general considerations apply:

- normally, compensation works will not increase the land available on a site for development – instead they merely reconfigure it for more convenient use. If an increase in the area of land is required for development, additional compensatory flood storage off-site may be needed to ensure flood risk to others does not increase. The overall approach will need to be covered in design and reflected in the FRA;
- compensation schemes offer opportunities for enhancing biodiversity and ecological value, and providing amenity and recreational space. Schemes should preserve and wherever possible enhance the ecological and amenity value of the site; and
- any potential archaeological, heritage and contaminated land constraints should be assessed if modifications of ground levels are proposed.

Case study

Taunton, Town Centre Regeneration

Flood risk was identified early as a major constraint to the much needed redevelopment of Taunton town centre. 'Taunton Vision' was set up with key partners Taunton Deane Borough Council, Environment Agency, Somerset County Council, South West of England Regional Development Agency and the Government Office for the South West, to agree strategic options and to reduce flood risk in the long-term.

Taking a strategic approach, upstream floodplain storage compensation to replace all of that lost through the town centre reach of the River Tone due to redevelopment proposals was shown to be a better, more sustainable option than an individual site by site approach. This was clearly demonstrated by studies which were able to draw on long-term data to provide a detailed understanding of flood risk. The upstream compensation solution will also give additional amenity benefits through a landscaping scheme to enhance this public open space area.



Continued

Taunton, Town Centre Regeneration (continued)

Images courtesy of the Environment Agency

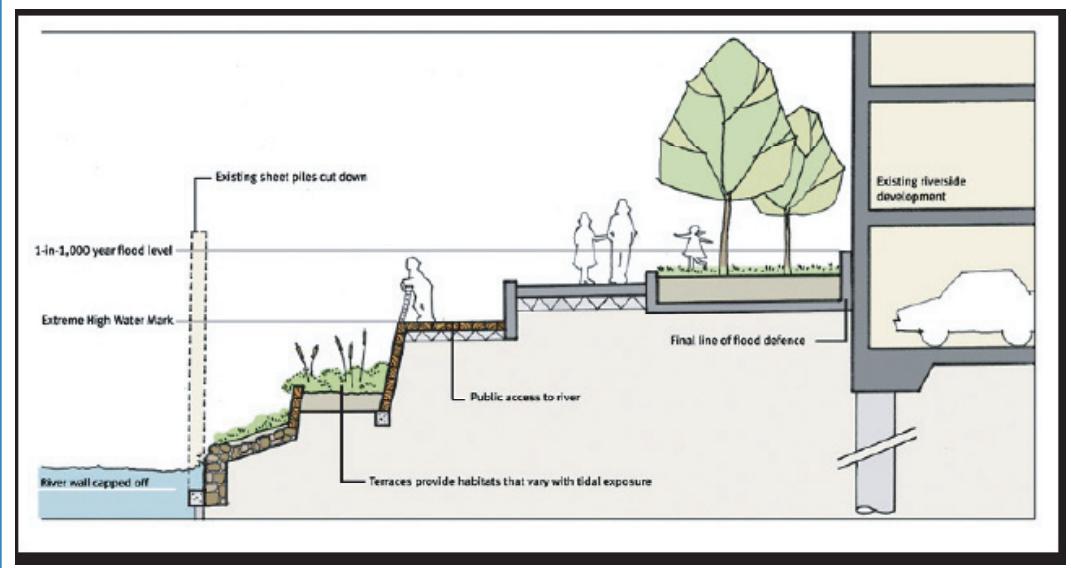
Considering flood risk from the outset in developing regeneration options for Taunton town centre has had the following benefits;

- Strategic development of options was possible, meeting the objectives of Making Space for Water and the needs of Taunton. A piecemeal approach would not have resulted in the same beneficial outcomes.
- All parties were fully committed to working together and seeking solutions which included taking account of wider socio-economic issues, so greatest gain was made from investment and development proposals achieved multiple objectives.
- Investment decisions became much clearer with more certainty on funding for flood risk management measures.
- Using the best data and local knowledge provided robust and shared understanding of flood risk to make this strategic approach possible.

Development behind floodwalls and embankments

- 6.23 PPS25 annex G, paragraphs G2 and G3 explains the consideration that should be given to development behind flood defences or other infrastructure which acts as a flood defence. Wherever possible the construction of new defences to enable development to take place should be avoided, so that residual risks are not created (chapter 7). Developers proposing this solution will need to show that other options, such as upstream storage and attenuation of flows, have been considered, justify why they are not feasible and that the proposal is compatible with the long-term plans for general flood risk management in the area, such as Catchment Flood Management Plans, Shoreline Management Plans and Internal Drainage Board management.

Figure 6.1 An example of making space for water in designing new development



(Source: CIRIA)

Upstream flood storage

- 6.24 The provision of upstream flood storage, either on or off the line of a river or watercourse, may be an effective way to manage water levels at a development site. Such upstream storage areas can consist of flood storage reservoirs, controlled washlands or less formal (and less hydraulically efficient) flood storage areas such as wetlands. Such facilities also have the potential to provide additional habitat and amenity uses.
- 6.25 Where the land to be used for flood storage, and all areas affected by operation of the facility, are not within the ownership of those promoting the scheme, affected parties must be consulted, their agreements secured and any necessary compensation (financial or otherwise) agreed. The Environment Agency can provide technical advice on how this is managed in some of its schemes where this relates to publicly-funded flood alleviation schemes incorporating flood storage areas. The developer is responsible for all the design and legal agreements.

Case study

Norton Fitzwarren Dam – a good example of upstream storage

The Environment Agency has been working with Taunton Deane Borough Council since 2000 to ensure regeneration of a major brownfield site in a high risk flood zone, earmarked for approximately 400 dwellings, could be made safe. The agreed solution was an on-line attenuation dam on the Halse Water, which would also protect 100 existing 'at risk' properties from flooding.

The dam which cost approximately £5.5 million was provided by the house builder as a planning requirement of their development. The dam which is subject to the requirements of the Reservoirs Act, is 450 metres long, 5.5 metres high and can hold 750,000m³ of flood water. It has been operational since January 2008. Subject to a number of conditions, the Agency will take over the ownership and operation of the dam in about three years time, with a commuted sum payment of approximately £1million.

This scheme reduces downstream flood flows in a tributary of the River Tone, protecting brownfield development nearby and other existing property in a suburb of Taunton. It does not markedly reduce peak flood flows through Taunton centre itself as the River Tone is not directly affected by the dam.



Image courtesy of the Environment Agency

Case study

The Avenue Site, Chesterfield – example of organisations working together to help reduce flood risk and create wetland habitats

This ongoing project is involving the restoration and de-contamination of a former major coking works to the south of Chesterfield by the East Midlands Development Agency (EMDA). The restored site will incorporate sustainable drainage systems, significant areas of new wetland, a flood storage area and a restored section of the River Rother. The project will result in reductions in flood risk downstream in Chesterfield.

A steering group comprising, amongst others, EMDA, the Environment Agency and Derbyshire Wildlife Trust (DWT), continue to guide this project and DWT will be paid a commuted sum for maintenance of the new wetland habitat on completion.

Wetland areas at The Avenue Site, (image courtesy of Brian Sims)



Developer contributions

- 6.26 Developer contributions to flood risk management are covered in annex G, paragraph G4 of PPS25. In some cases it may be reasonable for the developer to contribute (in full or in part) to the upgrade or redesign and replacement of existing flood defences, or to flood alleviation schemes which provide benefit to the wider community. An example is provided below.

Case study

Calder Park, Wakefield, and Newton Abbot, Devon – examples of developer contributions to a flood alleviation scheme

In order to ensure the Calder Park development was safe, in granting planning permission the local planning authority required the developer through planning conditions to construct a flood embankment, primarily to protect the new development, but also to form a major component of a storage reservoir for the Wakefield Flood Alleviation Scheme. The developer was committed to a condition that prevented phased development extending into the floodplain until the flood alleviation works had been completed. This also saved approximately £1 million that otherwise would have to be spent as public expenditure.



Images courtesy of the Environment Agency

In Newton Abbot, Devon, to permit a supermarket development to go ahead, it was necessary to widen the river channel to improve capacity, construct a new highway bridge and raise the land for the retail site, plus other works. This provided over £4million worth of benefits to housing and other properties in areas at risk of flooding in the town. The new river corridor also improved the footpath and created a cycleway.



Images courtesy of the Environment Agency

BUILDING DESIGN

- 6.27 The final step (step 5) in the flood risk management hierarchy is to mitigate through building design. This represents the least preferred option for new development as although buildings can be designed for reducing the impacts of flooding, hazards still remain, particularly for access and utility supply.
- 6.28 Communities and Local Government have published guidance on *Improving the Flood Performance of New Buildings: flood resilient construction* (2007). This provides detailed guidance on approaches to building design regarding flood risk, particularly in chapters 4 (design strategies), 5 (avoidance and resistance design options) and 6 (guidance on flood resilient design and construction). The guide identifies a hierarchy of building design which fits within step 5 of the flood risk management hierarchy of this practice guide. The other steps in this practice guide, (assess, avoid, substitute and control) need to have been considered first before using the hierarchy below:
- Flood avoidance.** Where it is not possible to locate a building in an area of lower flood risk, constructing a building and its surrounds (at site level) to avoid it being flooded (e.g. by raising it above flood level). This is covered in paragraphs 6.15 onwards above).
- Flood resistance.** Constructing a building to prevent floodwater entering the building and damaging its fabric (see paragraph 6.30 onwards below).
- Flood resilience.** Constructing a building to reduce the impact of flood water entering the building (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated (see paragraph 6.30 onwards).
- Flood repairable.** Constructing a building so that elements that are damaged by flood water can be easily repaired or replaced (see paragraph 6.36).
- 6.29 Buildings should be designed to withstand the effects of flooding. In areas of high velocity water, buildings should be structurally designed to withstand the expected water pressures, potential debris impacts and erosion which may occur during a flood event. Particular care should be taken in the design of any building located in a Rapid Inundation Zone (see chapter 7).

Case study

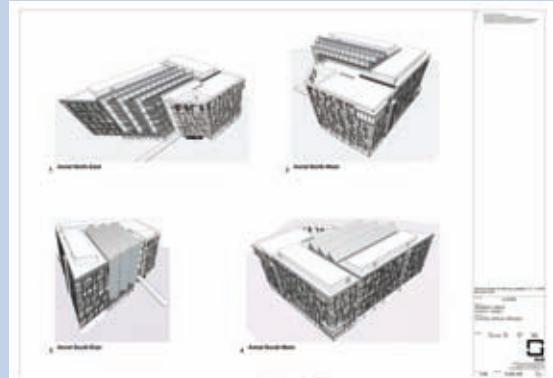
University Campus, Ipswich – an example of how the PPS25 Exception Test was passed through innovative design

The University Campus Suffolk (Ipswich Campus), is a new academic development in Ipswich. In September 2008 the Waterfront building opened adjacent to the Ipswich Wet Dock and construction has now commenced for the second phase of developments at University Quay. The first module of the academic building and adjacent student accommodation are due to open in the autumn of 2010.

The six storey academic building and student union aspect of the development site is located within Flood Zone 3 and is at risk of tidal flooding from the adjacent dock and Orwell estuary. The Flood Risk Assessment has shown that the site could be subject to very high flood hazard in the 0.5% annual exceedance flood probability at the end of the design life when considering both breaching and overtopping of existing flood defences. The proposal contains a high level bridge link to the adjacent student accommodation to the east which fronts Duke Street. In the event of flooding there will be a safe route from the academic building (a “more vulnerable” development with reference to Table D2 in Annex D to PPS25) to Duke Street, without the users of the building being exposed directly to the flood hazard. From Duke Street there will be a safe, unaided access and egress route to and from the site.

This proposal shows a good example of how part c) of the PPS25 Exception Test can be overcome to make a development safe through innovative design.

Images courtesy of RMJM



Case study

Buckingham Riverside – an example of creating additional flood storage with the use of an underground car park



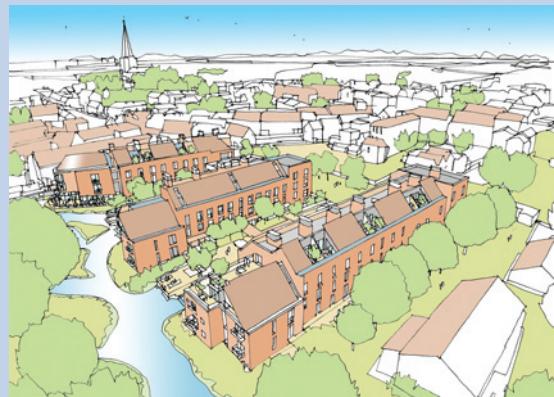
The comprehensive regeneration and development of this site of just under 1 hectare in the centre of the market town of Buckingham had been an aspiration of the Council and the town for many years. But over half the site, which gently slopes down to the Great Ouse River, was affected by flood risk.

The successful design employed a cut and fill construction, to create a large basement area across most of the site, which was to be used for car parking. The ground floor slab and all the accommodation above

was well above any flood level and dry access and egress was provided. The car park was designed to prevent flooding on more frequent events, with the use of a low wall to the river side. But in the event of a 1% probability flood event or worse, this wall allowed the whole of the basement car park to be inundated and act as additional flood storage. This provided a net benefit to the river corridor.

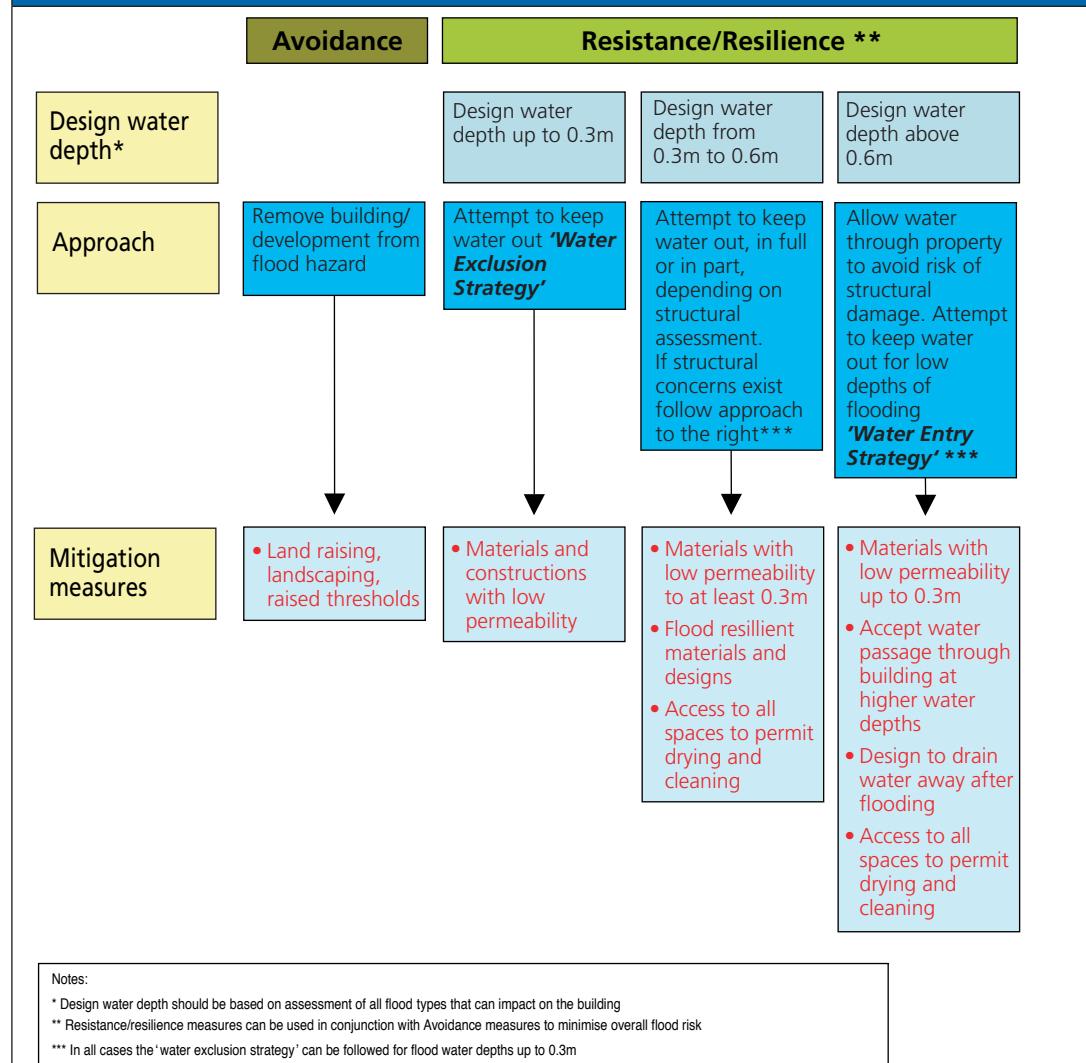
The development was registered with the Environment Agency's early warning flood system, so that vehicles could be removed with sufficient notice being given, ahead of more extreme flood events. The planning obligation accompanying the planning permission contained arrangements for clearance of the inundated areas after flood events. The scheme won the National Housing Design Award 2008. More details can be seen at: www.designforhomes.org/hda/2008/project/buck_riv.html.

Images courtesy of Niche Architects Limited



Flood resistance and resilience

- 6.30 Since any flood management measures only manage the risk of flooding rather than remove it, flood resistance and flood resilience may need to be incorporated into the design of buildings and other infrastructure behind flood defence systems. Flood resistance, or dry proofing, stops water entering a building. Flood resilience, or wet proofing, will accept that water will enter the building but through careful design will minimise damage and allow the re-occupancy of the building quickly.
- 6.31 Resistance and resilience measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:
- water-compatible and less vulnerable uses where temporary disruption is acceptable and an appropriate flood warning is provided;
 - in some instances where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable;
 - as a measure to manage residual flood risk (chapter 7); and
 - developments which are designed with raised floor levels should be constructed using flood resilient methods to above the predicted extreme flood level.
- 6.32 In order to decide which resilience measures would be effective, it is necessary to know the potential depth and duration of flooding that is likely to occur. *Improving the flood performance of new buildings: flood resilient construction* (Communities and Local Government, 2007) gives guidance on flood proofing measures that are applicable to different ranges of flood depths outside a building, i.e:
- less than 0.3m
 - above 0.3m but less than 0.6m
 - above 0.6m.
- 6.33 This is because the pressure exerted by greater depths of water, or where it is flooded for a long time, can result in the failure of flood resistant construction, either by seepage of water through walls and barriers, or causing structural damage. Flood resistance becomes more practicable for shallower water, and buildings affected by deep water will need to consider resilience.
- 6.34 Figure 6.2 summarises the overall rationale behind the design strategies.

Figure 6.2 Rationale for flood resilient and/or resistant design strategies

Source: Adapted from Communities and Local Government 2007 Improving the Flood Performance of New Buildings, figure 4.1) http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

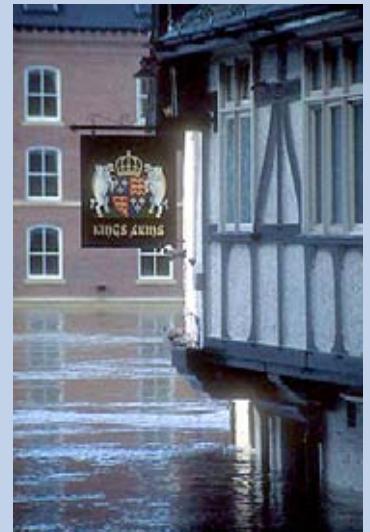
- 6.35 Flood resistance measures should be used with caution. To work successfully, people must have the knowledge and ability to ensure the flood resistance elements (such as barriers, drop in boards, or wall mounted plates to cover air bricks) are put in place and maintained in a good state. Warning systems will be needed to ensure that adequate time is allowed to deploy any resistance measure. This approach would not be suitable in areas of surface water flooding which can occur very quickly. The impact of the loss of flood storage, including the requirement for the provision of compensatory flood storage, should be considered if it is intended that a proposed development should use flood resistance methods to prevent flooding of a building.

Case study

Kings Arms, York – example of how an existing listed property can be modified to increase its flood resilience

This historic pub is located on the riverside in the centre of York and has a long history of flooding. Following a major flood in November 2000, the pub was modified to make it less susceptible to damage by floodwater. Demountable gates on the doors prevent the pub from flooding during more regular events, but these are overtopped by more significant floods. The interior fittings, masonry floor and walls are all of flood resilient design. Sumps at each doorway allow water which has not drained away to be pumped out of the building after the event. A major, but rapid, clean-up operation allows the pub to re-open the day after the flood has receded.

*King's Arms during August 2000 floods
(image courtesy of Ian Britton)*



Drinking establishments are defined as 'more vulnerable' in PPS25 and there is a presumption against locating new pubs of this kind in locations at risk of flooding. Very occasionally, for instance in the case of modifications to existing historic pubs requiring planning permission, it may be possible to apply the Exception Test. In these circumstances very careful consideration will need to be given to flood warning, evacuation and public health issues.



24 hours after flooding the King's Arms is back in business again.



The frames for demountable gates fitted to the doors of the King's Arms pub, (images courtesy of Will McBain)

- 6.36 Flood repairable construction is important to avoid people being excluded from their homes for long periods after flooding has occurred, and the stress and potential health problems this can cause. (CIRIA guidance *Repairing buildings following flooding*).

TAKING CLIMATE CHANGE INTO ACCOUNT IN THE DESIGN OF FLOOD RISK MANAGEMENT MEASURES

- 6.37 Defra suggest two principal approaches for taking climate change into consideration in the design of flood risk management measures:
- the Precautionary Approach: This involves inclusion of a specific quantified allowance for changes in climatic variables based on the best scientific evidence currently available; and
 - the Managed Adaptive Approach: This involves identifying the sensitivity of results based on existing climatic conditions to potential changes that could occur as a result of climate change impacts, in order to allow designers and decision-makers to identify an appropriate, location-specific response.
- 6.38 Research into sea level rise has provided a greater degree of confidence in the allowances recommended in the Defra guidance for rises in sea level (see table B.1, PPS25). The design of any flood risk management measures in tidal areas should use the precautionary approach and incorporate a specific allowance for sea level rise.
- 6.39 When using the indicative sensitivity ranges in PPS25 table B.2, consideration should be given to adopting the managed adaptive approach. This approach allows for adaptation of flood risk management measures in the future and is therefore inherently more flexible. The approach is appropriate in cases where:
- the site design takes specific account of the potential need to adapt the flood risk management measures at a future date, and
 - ongoing responsibility can readily be assigned to tracking the change in risk, managing this and ensuring that the necessary adaptations are made over the lifetime of the development.
- 6.40 This approach is unlikely to be appropriate for use where adaptive changes will be very expensive or complicated to apply retrospectively and where ownership is expected to be in multiple hands without one organisation able to take overall responsibility. For example, in setting finished floor levels for residential development or designing new bridges or culverts, adoption of the Precautionary Approach may be more appropriate.
- 6.41 Further guidance on the application of these allowances is provided in the *Economic Appraisal Supplementary Note to Operating Authorities – Climate change impacts* (Defra 2006). The changes to UK Climate Change Projections (UKCP09) published in June 2009, and the advice on the implications for the planning process, as set out in paragraphs 3.96 to 3.98 of this Guide, should also be borne in mind in considering climate change.

DESIGN OF FLOOD PROTECTION INFRASTRUCTURE, TAKING ACCOUNT OF UNCERTAINTY AND FREEBOARD ALLOWANCES

- 6.42 There are numerous sources of uncertainty in managing flood risk in the design of infrastructure to protect development sites from flooding to an acceptable standard. Expert advice should be sought to ensure that flood risk management measures are appropriately covered.
- 6.43 Traditionally, *fluvial* flood defences have been designed on the basis of best estimates of predicted water level, with the final level of the flood defences incorporating a freeboard allowance (the difference between the flood defence level and the design flood level), as follows:
- | | |
|-----------------------------------|-------|
| Hard defences (floodwalls) | 300mm |
| Soft defences (flood embankments) | 500mm |
- 6.44 This approach may be valid for some development sites, but the designer should always be aware of the sensitivity of design flood levels to inaccuracies in the estimation process and of the potential implications of any physical processes, such as settlement of the structure or waves increasing water levels.
- 6.45 Current practice for the design of flood alleviation schemes takes a more sophisticated approach to the calculation of freeboard, which takes account both of hydrological and hydraulic uncertainty and physical processes, such as settlement and wear and tear. The *Fluvial Freeboard Design Guide* (Environment Agency, 2000) describes application of this approach, which may be applicable to larger developments, or where there is a high degree of uncertainty.
- 6.46 The freeboard on coastal and estuarine flood defences, or defences at the edge of major washlands must make an appropriate allowance for wave overtopping and predictions of increased storminess.
- 6.47 Where a specific allowance is to be made for climate change effects, these should be added to the design flood levels and the freeboard then added on top.
- 6.48 Where significant additional freeboard can be provided at little extra cost these opportunities should always be taken.

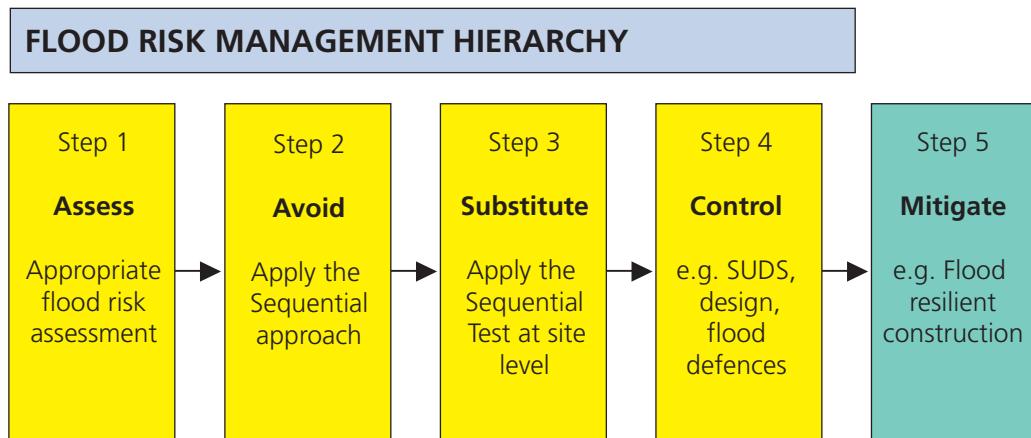
INSURANCE ISSUES

- 6.49 Developers and planners should consider the future insurability of new developments at the earliest stage possible in the planning process. The Association of British Insurers published in January 2009, *Climate Adaptation: Guidance on Insurance Issues for New Developments*, to help developers ensure their properties are as flood-proof as possible and insurable – see: <http://www.abi.org.uk/content/contentfilemanager.aspx?contentid=24988>.

FURTHER INFORMATION AND REFERENCES

- Adapting to Climate Change – Lessons for London*, London Climate Change Partnership, 2006.
- Climate Adaptation: Guidance on insurance issues for new developments*, Association of British Insurers, 2009.
- Construction (Design Management) Regulations, HSE, 2007.
- Designing for exceedance in urban drainage – good practice* (C635), CIRIA, 2006
- Development and Flood Risk – Guidance for the Construction Industry*, Report C624, CIRIA, 2004.
- Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts* (FCDPAG3), DEFRA, 2006.
- Fluvial Freeboard Guidance Note*, Environment Agency, 2000.
- Guide to the Management of Floodplains to Reduce Flood Risk* (SR599)
H. R. Wallingford, 2003.
- Improving the Flood Performance of New Building: Flood resilience construction*, Communities and Local Government, 2007.
- Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.
- Repairing Buildings Following Flooding*, CIRIA, 2007.
- The Life Handbook*: Baca Architects and BRE, February 2009.
- Water Strategy, Future Water*, DEFRA, 2008.

7 Residual risk



INTRODUCTION

- 7.1 The purpose of this chapter is to provide guidance on the residual risks which remain when developing in flood risk areas at the various levels of the planning process. PPS25, annex G covers residual risk and gives information to ensure developments are designed to be safe.
- 7.2 Development should not be located in flood risk areas unless the Sequential Test, and where necessary, the Exception Test have shown that it is necessary. Where this is the case, a mitigation strategy to deal with residual risk is required to ensure that any development will be safe. Residual risks are the risks remaining after applying the sequential approach and taking action to control risk. Residual risks need to be considered as part of flood risk assessments at all levels of the planning process.
- 7.3 Flood risk to people and property associated with such development can be managed but it can never be completely removed; a residual risk will remain after flood management or mitigation measures have been put in place. Examples of residual flood risk include:
- the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, failure of a flap-valve, overtopping of an upstream storage area, or failure of a pumped drainage system; or
 - a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the piped drainage cannot cope with.
- 7.4 Areas behind flood defences are at particular risk from rapid onset of fast-flowing and deep water flooding, with little or no warning if defences are overtopped or breached.
- 7.5 The costs of managing residual risk may be low compared to the damage they avoid. Measures to manage residual risk may enhance the value of the development.

RESIDUAL RISK IN STRATEGIC FLOOD RISK ASSESSMENTS (SFRA)

- 7.6 Where residual risk is relatively uniform, such as within a large area protected by embanked flood defences, the SFRA should indicate the nature and severity of the risk remaining, and provide guidance for issues to be covered in site-specific FRAs (see chapter 3). It is appropriate for Local Development Documents (LDDs) to contain policies relating to the management of residual risk in a specified area. Where necessary, local planning authorities (LPAs) should use information on identified residual risk to state in LDD policies their preferred mitigation strategy in relation to urban form, risk management and where flood mitigation measures are likely to have wider sustainable design implications. British Waterways should be consulted in those circumstances where a SFRA will need to assess the residual risks from canals. In areas where there is the potential for small-scale residential redevelopment, the LPA should carry out risk and breach analyses to be able to provide design guidance to potential applicants.

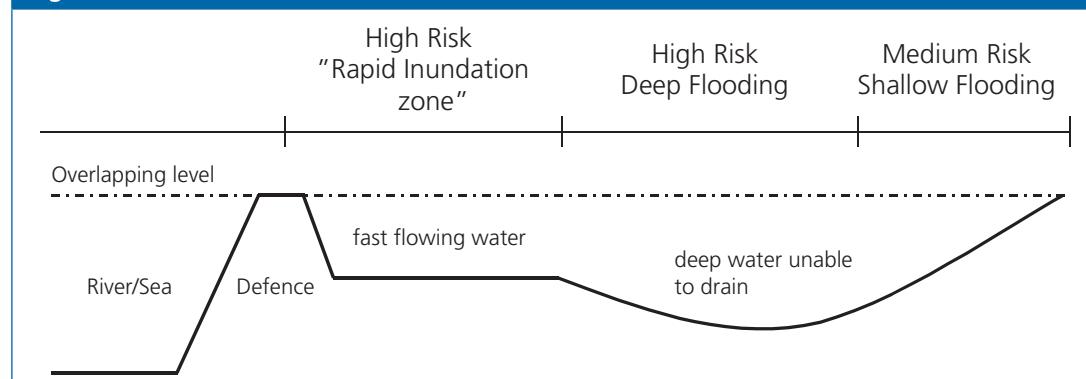
RESIDUAL RISK IN SITE SPECIFIC FLOOD RISK ASSESSMENTS (FRAs)

- 7.7 Developers should identify residual risk as part of their FRA (see chapter 3). Like other parts of the FRA the assessment should be proportionate to the scale of the development and the risks involved. The SFRA should be the starting point for obtaining information on the residual risk. As with all aspects of development and flood risk, this is best considered early in the development process so that measures to manage residual risk can be incorporated into site layout to make the best use of developable land.
- 7.8 Measures to manage residual flood risk include:
- developer contributions towards publicly-funded flood alleviation schemes;
 - flood resilience and resistance measures;
 - flood warning and evacuation plans; and
 - designing new sustainable drainage systems taking account of storm events which exceed the design standard.
- 7.9 Designing for exceedance of site drainage systems is covered in chapter 5. The first two measures are discussed in chapter 6. Flood Warning and Evacuation Plans are discussed below.

RESIDUAL FLOOD RISK BEHIND FLOOD DEFENCES

- 7.10 The residual flood risk behind a flood defence depends on:
- depth of flooding;
 - speed of flow of flood water;
 - local flow paths;
 - speed of onset of the flood;
 - distance from the defences (as distance from a defence typically has an effect on velocities and the rate of onset of flooding); and
 - duration of the flood and how water will be removed.
- 7.11 Guidance on the level of risk related to distance and flood depth for overtopping and breaching scenarios is provided in *Guidance note S3.2 Risks to people behind defences. Flood Risk in Assessment Guidance for New Development Phase 2 R&D Technical report FD2320* (Defra, 2005). This approach is illustrated in the following diagram.

Figure 7.1 Risk zones behind a river or sea defence*

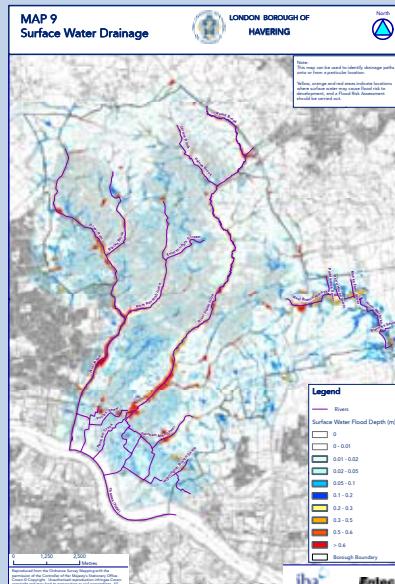


Note: This figure is a simplification and accurate mapping of residual risk levels behind flood defences requires consideration of local factors.

- 7.12 A Rapid Inundation Zone is an area which is at risk of rapid flooding should a flood defence structure be breached or overtopped. The zones at highest risk of rapid inundation are typically located close behind the flood defences. New development should be sited away from existing flood defences except in exceptional circumstances, where a flood risk assessment shows how the building and its users will be made safe.

Case study

London Borough of Havering Level 1 and Level 2 SFRA.



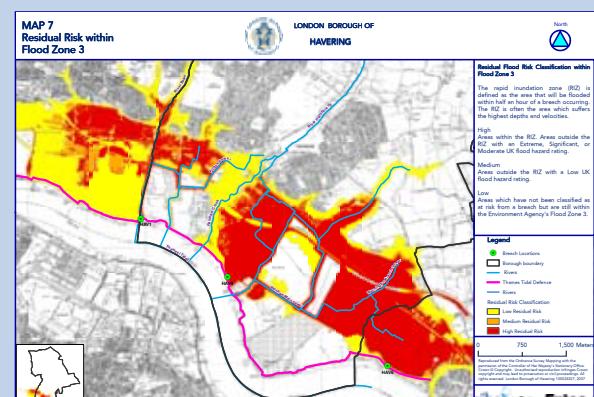
In November 2007 the London Borough of Havering completed a Level 1 and 2 SFRA. The SFRA identified significant areas at flood risk within the Borough, with the three main risks being fluvial, tidal and surface water flooding. A close working partnership between the local planning authority, the consultant and the Environment Agency meant that this complex and effective SFRA was completed within a comparatively short two-month timescale.

Tidal flood risk was found to be extensive, but at present Havering is fully defended against the 0.1% annual probability extreme tide level, including an allowance for climate change. The SFRA undertook detailed breach mapping which looked at defence breach, gate failure and overtopping. The breach mapping concentrated on six locations and used a combination of techniques. The main output of this model for each breach included: flow direction, depths, water levels, velocities and UK flood hazard index for the duration of the event. This modelling enabled the calculation of the likely degree of flood

hazard (in terms of flood velocity, depths and UK flood hazard index) within the tidal Flood Zone area. This could be used for planning purposes to derive a delineation of residual risk within Flood Zone 3 classifying areas of risk as 'high', 'medium' or 'low'.

The SFRA also used the consultants' modelling software to model surface water flooding from an intense storm across the catchments contributing to the Borough. This provided an indication of drainage paths for the whole Borough. The red areas (on the map above) can be interpreted as indicative of areas where surface water flooding is likely to be a risk, for example, susceptibility to problems such as impassable roads or risk of flooding to ground floors and basements.

The SFRA made strong policy recommendations based on the Thames Catchment Flood Management Plan and the Thames Estuary (TE)2100 programme. It also made sound recommendations for all site allocations, based on an assessment of residual flood risk.



Images courtesy of JBAG Consulting and London Borough of Havering

- 7.13 In assessing the residual flood risk associated with overtopping or breaching of a flood defence, the following factors should be taken into account:
- how the flood defence infrastructure protecting an area might fail. Temporary or demountable defences have a particularly high risk of failure (as they may not be deployed rapidly enough, or may not be watertight);
 - the standard of protection and design freeboard of the flood defence;
 - the potential of the defence to fail, including the condition of the flood defence and the potential for human interference;
 - the height of the flood defence structure and retained water levels compared to ground levels. Generally the higher a defence is and the greater the depth of water it retains, the more serious and far-reaching the consequences of breaching will be;
 - where breach(es) in the flood defences might occur, and their width;
 - how long it would take for the operating authority and/or defence owner to close the breach;
 - how long it would take for water to drain from the flooded area following an overtopping or breach event;
 - the topography of the land and depth of the flooding behind the flood defence;
 - the velocity of flood water flowing across the site following a breach or overtopping of the defences;
 - the lead time available before depth and velocity of flood water become hazardous to people; and
 - the capability of emergency planning to mitigate the risks identified.

Case study

York – an example of the residual risk of flood gates not being closed.

The historic city of York has long suffered from flooding problems. Many properties have been built in the floodplain and the Environment Agency has carried out flood alleviation works in the past. Due to the layout of the existing developments, it was not possible to build continuous floodwalls through the city centre. Use was therefore made of watertight flood gates in a number of locations. There is sufficient warning time to allow these to be operated ahead of a flood, but the presence of these gates increases the residual risk of a flood occurring. The failure of a single gate can have widespread consequences and management of this risk places an increased operational burden on the Environment Agency.

Some of the gates are located in the gardens of individual properties and rely on the owner closing the gate on receipt of a warning.

Environment Agency staff have to be deployed to check that the gates are closed or to close them themselves if the owner fails to. This is not considered to be a sustainable solution for new developments and is a particular problem if a failure to operate the flood gates affects several properties.

Flood gates on individual properties, York, (image courtesy of Will McBain)



- 7.14 The extent of a breach will be a significant factor in the impact it has. Yorkshire & Humber Assembly (2004) provided suggested breach parameters for flood defence failure in their region, although actual likely breach extents at any given structure is likely to depend on the method of construction, defence height and other local factors. Estimation of likely breach parameters will often be based on professional judgment and should be agreed with the Environment Agency or relevant operating authority.
- 7.15 As part of the assessment of flood risk, the condition of any defences needs to be considered with the organisation that is responsible for them. The nominal standard of protection of a defence can be reduced if the defence is in poor condition and it may be appropriate for developers to contribute to their repair or upgrade. The Environment Agency may be able to provide information on the condition of existing flood defences from the National Flooding

and Coastal Defence Database (NFCDD). Surveys may be required to provide information on likely failure conditions. This could include consideration of:

- the composition and condition of a flood bank;
- the structural condition of a flood defence wall; and
- a mechanical and electrical inspection of a pumping station/penstock.

OTHER INFRASTRUCTURE ACTING AS A FLOOD DEFENCE

- 7.16 Road and rail embankments and other linear infrastructure may hold back water or create enclosures to form flood storage areas. This may or may not be by deliberate design. Raised embankments may offer a degree of flood protection. However, such structures should only be relied upon to protect new development following a FRA, which should investigate:
- whether the embankment is made of suitable materials to prevent seepage of water through it, and is physically strong enough to withstand the pressure of water on one side;
 - whether there are any culverts through the embankment or other gaps or holes that would let flood water through;
 - the performance of the structure during any recorded historical flood event;
 - the long-term Asset Management Plan provided by the owner of the embankment; and
 - whether by holding water back, a structure may fall under the regulation requirements of The Reservoirs Act 1975.

ASSESSING/MANAGING RESIDUAL RISK FROM RESERVOIRS AND OTHER ARTIFICIAL WATER RETAINING STRUCTURES

- 7.17 The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. Since 2004, the Environment Agency has regulated reservoirs that are covered by the Reservoirs Act 1975 (those reservoirs or other bodies retaining more than 25,000 cubic metres of water above the natural ground level). The Health and Safety Executive regulate those below this figure where they form part of commercial activity.
- 7.18 Emergency planning for flooding from reservoirs has three parts:
- An inundation map: Prepared by the Environment Agency, this identifies the extent and severity of flooding which could result from an uncontrolled release of water.

- An on-site reservoir emergency plan: Prepared by the reservoir undertaker, this plan sets out what they will do in an emergency to try to contain and limit the effects of the incident. It will include a plan for communicating with external organisations, mainly the emergency services.
 - An off-site reservoir emergency plan: Prepared by the Local Resilience Forum, this sets out what the emergency services will do to warn and protect people and property downstream in the event of an incident which could lead to dam failure.
- 7.19 The accidental uncontrolled escape of water from an impounding or other reservoir can threaten life and property. Greater security is required against dam failure where there is a severe threat of loss of life and extensive damage, and lower security where the threat is less severe. Based on this, dams are formally categorised – see *Floods and Reservoir Safety 3rd Edition* (ICE, 1996) for more details. Developers and LPAs should be aware that increased development downstream of a reservoir can change its category, leading to more onerous requirements on the undertaker, which may need to be addressed by the developer.
- 7.20 The Pitt Review into the 2007 summer floods recommended that the Government should produce inundation maps for all large raised reservoirs. This is being undertaken by the Environment Agency. Inundation maps show the effects on the downstream catchment of a dam breach. A trial has been carried out on a number of reservoirs in the north west of England, supported by Government Office North West, to define the specification for national inundation mapping. When the mapping is completed at the end of 2009, all large raised reservoirs in England (and Wales) will have an inundation map showing the consequences if their dam failed. This will help emergency planners to prepare off-site emergency plans and identify critical infrastructure that may be at risk.
- 7.21 The LPA will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir, either when allocating sites or considering individual applications. LPAs will also need to evaluate in SFRAs and when applying the Sequential Test how an impounding reservoir will modify existing flood risk in the event of a flood in the catchment it is located within, and/or whether emergency draw-down of the reservoir (as happened at Ulley Reservoir, Yorkshire in summer 2007) will add to the extent of flooding.
- 7.22 How much of the output of reservoir flood plans will be in the public domain is still being considered, but available information about flood risk should be considered as part of the sequential approach to development.
- 7.23 Prior to such plans being made available, LPAs when preparing SFRAs and applying the Sequential Test, should consult the reservoir undertakers and the Environment Agency. The consequences of failure should be considered, identifying the flood risk pathways and receptors that exist downstream. Reservoir Plans will provide better information on this in due course. Details of undertakers of large raised reservoirs are available on the public register of reservoirs from the Environment Agency's local area offices.

ASSESSING OTHER RESIDUAL FLOOD RISKS

- 7.24 Other sources of flooding, such as blocked drains, surface water run-off and groundwater flooding, may also pose a residual risk and must be managed in new developments. FRAs should include evidence on how these residual flood risks will be managed. Water collecting behind a raised defence, as a result of surface water for example, cannot discharge to a watercourse while levels remain high, and so will be trapped for the duration of the flood. This could be overcome by pumping the surface water into the watercourse. However, the effect of this on the existing flood flows in the receiving watercourse will need to be assessed.

FLOOD WARNING AND EVACUATION PLANS

- 7.25 One of the considerations to ensure that any new development is safe is whether adequate flood warnings would be available and that people using the development will act on them, to keep safe. Depending on the nature of the development and the severity of flooding, this may entail retreating to a safe place of refuge within the development, leaving the development by a signed safe access route to dry ground beyond the flooded area, or preparing for rescue by the emergency services to safe locations previously identified by the local authority in their emergency planning role.
- 7.26 The Environment Agency operates a flood warning system for existing properties currently at risk of flooding to enable householders to protect life or take action to manage the effect of flooding on property. New development should not rely on flood warning alone as the only way of managing residual risk, and active planning for response to floods is needed. The Environment Agency can give warning about the possibility of an overtopping event, but it is almost impossible to do so for a breach in flood defences and for surface water flooding events.
- 7.27 Developments which include areas which are designed to flood (e.g. ground floor car parking and amenity areas) will need to provide appropriate flood warning and instructions so users and residents are safe in a flood. As a minimum, adequate passive flood warning should be provided, with signs highlighting the susceptibility to flooding and clearly signed evacuation routes. The maintenance of signs and keeping evacuation routes clear should be covered in the FRA and can be secured through a planning condition.
- 7.28 Warnings must be clear to vulnerable people, including those with impaired hearing or sight and those with restricted mobility. Evacuation plans and warnings must be communicated, so they can be acted upon at any site that has transient occupants such as campsites, caravan sites and holiday facilities, and also buildings such as hotels, hostels, prisons and police cells. It should be assumed that the occupiers lack local knowledge and will have to evacuate following signs, or on the instruction of staff.

Figure 7.2 Flood warning and evacuation plans should include:**How flood warning is to be provided, such as:**

- availability of existing flood warning systems;
- rate of onset of flooding and available flood warning time; and
- how flood warning is given.

What will be done to protect the development and contents, such as:

- how easily damaged items (including parked cars) will be relocated;
- the availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc; and
- the time taken to respond to a flood warning.

Ensuring safe occupancy and access to and from the development, such as:

- occupant awareness of the likely frequency and duration of flood events;
- safe access to and from the development;
- ability to maintain key services during an event;
- vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
- expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.).

- 7.29 Flood warning and evacuation plans will need to take account of the likely impacts of climate change by being aware of the likely implications e.g. increased water depths and the impact on how people can be evacuated.
- 7.30 The local authority's emergency planning officer should be able to provide advice to developers producing an evacuation plan. Local Resilience Forums (see paragraph H11, PPS25) should take account of flood risk, including the resilience of emergency infrastructure required to operate during floods.
- 7.31 There is no statutory requirement on the Environment Agency or the emergency services to approve evacuation plans. The LPA is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with local authority emergency planning staff.

- 7.32 It is important to have accurate information on the flood risk and vulnerability of essential infrastructure (e.g. water treatment works) to allow for effective emergency planning. Any new development proposals involving essential infrastructure will need to involve Local Resilience Forums to ensure they are kept up to date. The SFRA can provide both emergency planners and Local Resilience Forums with information on flood risk. Hull City Council's SFRA makes a recommendation to ensure emergency planning is aware of flood risk and its implications.

Case Study

Hull City Council SFRA recommendation regarding emergency planning

The SFRA recommends that: *Hull City Council should incorporate the findings of the SFRA within the Emergency Plan for the City of Hull, in consultation with its key stakeholders. This should specifically identify strategic evacuation routes ('red routes') to enable emergency services to continue work during a flood event. The flood risk to key command centres and emergency facilities, and the adequacy of the level of protection which they are afforded, should be assessed using this SFRA.*

The Emergency Plan should identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas which are capable of remaining operational during flood events. Based on the findings of this SFRA, there may be some works required, e.g. road raising, to enable the implementation of the Emergency Plan.

Legal agreements should be sought where necessary to ensure that any maintenance requirements are carried forward in perpetuity.

Courtesy of Hull CC

http://www.hullcc.gov.uk/portal/page?_pageid=221,578325&_dad=portal&_schema=PORTAL

- 7.33 Where there are emergency planning issues such as evacuation plans, the LPA should work with the Environment Agency and emergency planning officers, and where necessary, emergency services and Local Resilience Forums (see paragraph 2.60).

FURTHER INFORMATION & REFERENCES

Developing a New Government Strategy for Flood & Coastal Erosion Risk Management: Flood Warning and Forecasting, EA/DEFRA, July 2004.

Flood Risk Assessment Guidance for New Development, Phase 2, R&D Technical report FD2320, DEFRA and Environment Agency, 2005.

Floods and Reservoir Safety 3rd Edition, ICE, 1996.

Hull City Council Strategic Flood Risk Assessment, Hull CC, 2007.

Making Space for Water, DEFRA.

Planning Policy Statement 25, *Development and Flood Risk*, Communities and Local Government, 2006.

Preparing for floods. ODPM, 2003.

Reservoir Safety (Environment Agency website):

<http://www.environment-agency.gov.uk/business/sectors/32427.aspx> ;

and for reservoir flood plans specifically:

<http://www.environment-agency.gov.uk/business/sectors/64249.aspx> .

Appendix A: PPS25 in context with other national planning policy

- A1. The structure and operation of the spatial planning system in England is set out in *The Planning System: General Principles* (ODPM, Feb 2005). National planning policies are set out in Planning Policy Statements (PPSs) and Planning Policy Guidance notes (PPGs), Minerals Policy Statements (MPSs) and Minerals Planning Guidance Notes (MPGs), Circulars and Parliamentary Statements. All existing PPSs and accompanying guidance documents, where these have been prepared, can be downloaded from the Communities and Local Government website (www.communities.gov.uk).
- A2. The most significant of these documents in terms of flood risk are:
- **PPS1 Delivering Sustainable Development** (Feb 2005) sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. Issues covered include climate change, sea level rise and the avoidance of flood risk. Key objectives for design policies should include ensuring that developments are sustainable, durable and adaptable (including taking account of natural hazards such as flooding) (paragraph 36).
 - **Planning and Climate Change – Supplement to Planning Policy Statement 1** (December 2007). This PPS supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. The PPS expects regional and local plans to secure new development, shape places that minimise vulnerability and provide resilience to climate change, and in ways that are consistent with social cohesion and inclusion. The aim is to consult on a revised climate change PPS at the beginning of 2010.
 - **PPS3 Housing** (Nov 2006) underpins the delivery of the Government's strategic housing policy objectives and the goal to ensure that everyone has the opportunity to live in a decent home, which they can afford in a community where they want to live. In doing so PPS3 should deliver housing policies which seek to minimise environmental impact, taking account of climate change and flood risk.
 - **PPS7 Sustainable Development in Rural Areas** (Aug 2004) sets out the Government's planning policies for rural areas, including country towns and villages and the wider, largely undeveloped countryside up to the fringes of larger urban areas.
 - **PPS9 Biodiversity and Geological Conservation** (July 2005) sets out planning policies on protection of biodiversity and geological conservation through the planning system. Many protected areas are situated within or close to flood zones (see www.defra.gov.uk/wildlife-countryside/cl/habitats/habitats-list.pdf).
 - **PPS11 Regional Spatial Strategies** (Sept 2004) sets out the procedural policy on RSSs. All RSSs are subject to sustainability appraisal, a key requirement of the Planning and Compulsory Purchase Act, 2004. Local Development Framework Core Output Indicators 1/2005 (October 2005) and Core Output Indicators for Regional Planning (March 2005)

include an indicator on flood protection, which reflects the number of planning applications granted contrary to the advice of the Environment Agency.

- **PPS12 Local Spatial Planning** (June 2008) sets out what local spatial planning is and how it benefits communities. It explains what the key components of local spatial plans are and how plans should be prepared. It also sets out how to achieve more effective integration with other plans and strategies, such as the sustainable community strategy. Specific issues covered include the need to create a positive framework for taking account of climate change (paragraph 2.1), and the need in preparing Development Plan Documents to address environmental pressures, constraints and opportunities, such as flood risk (paragraph 5.1). One of the LDD Core Output Indicators (updated Jan 2005) is the number of planning permissions granted contrary to the advice of the Environment Agency. The Planning and Compulsory Purchase Act 2004 also requires that LDDs be subject to sustainability appraisal.
- **PPG20 Coastal planning** (September 1992) states that policies should seek to minimise development in areas at risk from flooding (paragraph 2.14). The consultation on new planning policy on development and coastal change that would replace PPG20, closed on 12 October 2009. The Government aims to finalise the policy, as a supplement to PPS25, in Spring 2010.

Appendix B: Flood Risk Assessment Checklist

SITE SPECIFIC FLOOD RISK ASSESSMENT

- B1. This checklist may be used as a guide for developers or others involved in the preparation of a planning application for development, including changes of use, for which a Flood Risk Assessment (FRA) is required. Guidance notes are provided at the end of the checklist below.
- B2. FRAs should always be proportionate to the degree of flood risk in each case and appropriate to the scale, nature and location of the proposed development or change of use. The local planning authority and the Environment Agency will be able to advise you on the detailed scope of the FRA required for your development proposal. The degree of detail to be provided will depend on the level of FRA required – see chapter 3 of this practice guide. As a minimum, it is suggested that developers/applicants should use this checklist to help them undertake a basic, level 1 FRA (screening study), as described in Figure 3.5 of this Guide. This is likely to involve answering questions 1a, 1b, 2a, 2c, 3a, and 3b in the checklist.
- B3. If as a result of this screening study, it appears that the development site does not lie within an area at risk of flooding, and that the proposed development will not increase flood risk to neighbouring land and property, or elsewhere, the information you have provided in answer to the screening study questions should provide the basis for your FRA, though the local planning authority may still require you to provide some additional information as part of the FRA to be submitted with your planning application.
- B4. If however, your screening study indicates that the development site may lie within an area at risk of flooding, or that the proposed development may increase flood risk through increased surface water run-off, you will need to undertake a level 2 and possibly a level 3 FRA (see Figure 3.5). In these instances, in undertaking the FRA, you (or anyone undertaking it on your behalf) will need to address the other more detailed questions set out in this checklist.

1 Development description and location

1a. What type of development is proposed and where will it be located? Include whether it is new development, an extension to existing development or change of use etc.

1b. What is its vulnerability classification?

1c. Is the proposed development consistent with the Local Development Documents (LDD)?
(Seek advice from the local planning authority if you are unsure about this)

1d. Provide evidence that the Sequential Test and where necessary the Exception Test has been applied in the selection of this site for this development type. (See annex D to PP25 for further advice).

1e. *[Particularly relevant to minor developments (alterations & extensions) & changes of use]* Will your proposal increase overall the number of occupants and/or users of the building/land; or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?

2. Definition of the flood hazard

2a. What sources of flooding could affect the site? (see annex C PPS25).

2b. For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available.

2c. What are the existing surface water drainage arrangements for the site?

3. Probability

3a. Which flood zone is the site within? (Check with the Environment Agency).

3b. If there is a Strategic Flood Risk Assessment (SFRA) covering this site, what does it show?

3c. What is the probability of the site flooding, taking account of the contents of the SFRA and of any further site-specific assessment?

3d. What are the existing rates and volumes of run-off generated by the site?

4. Climate change

4. How is flood risk at the site likely to be affected by climate change?

5. Detailed development proposals

5. Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding, including providing details of the development layout?

6. Flood risk management measures

6. How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime?

7. Off site impacts

7a. How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?

7b. How will you prevent run-off from the completed development causing an impact elsewhere?

8. Residual risks

8a. What flood-related risks will remain after you have implemented the measures to protect the site from flooding?

8b. How, and by whom, will these risks be managed over the lifetime of the development?

Notes and Guidance

1 Development description and location	
a	A location plan at an appropriate scale should be provided with the FRA, or cross referenced to the main application when it is submitted.
b	Vulnerability classifications are provided in table D.2, annex D of PPS25.
c	Where the site is allocated in an existing LDD the allocation should be referred to. Your Local Planning Authority planning officer should be able to provide site-specific guidance on this issue.
d	Evidence is required that the Sequential Test has been used in allocating the proposed land use proposed for the site, and that reference has been made to the relevant Strategic Flood Risk Assessment (SFRA) in selecting development type and design (See paragraphs 16-20 and annex D of PPS25). Where use of the Exception Test is required, evidence should be provided that all three elements of this test have been considered (see paragraph 20 and annex D of PPS25). Your Local Planning Authority planning officer should be able to provide site-specific guidance on this issue.

2 Definition of the flood hazard	
a	This may include hazards such as the sea, reservoirs or canals, which are remote from the site itself, but which have the potential to affect flood risk (see chapter 3 of the practice guide).
b	An appraisal of each identified source, the mechanisms that could lead to a flood occurring and the pathways that flood water would take to, and across, the site. Inundation plans, and textural commentary, for historic flood events showing any information available on the mechanisms responsible for flooding, the depth to which the site was inundated, the velocity of the flood water, the routes taken by the flood water and the rate at which flooding occurred.
c	Details of any existing surface water management measures already in place, such as sewers and drains and their capacity.
3 Probability	
a,b	The flood zones are defined in table D.1 of annex D PPS25. The planning authority can advise on the existence and status of the SFRA.
c	This may need to include: <ul style="list-style-type: none"> • a description of how any existing flood risk management measures affect the probability of a flood occurring at the site • supporting evidence and calculations for the derivation of flood levels for events with a range of annual probability • inundation plans of, and cross sections through the existing site showing flood extents and levels associated with events with a range of annual probability • a plan and description of any structures which may influence the probability of a flood occurring at the site. This may include bridges, pipes/ducts crossing a watercourse, culverts, screens, embankments or walls, overgrown or collapsing channels and their likelihood to choke with debris • details of any modelling studies completed to define the exiting degree of flood risk (see chapter 3 of the practice guide)
d	This should generally be accompanied by calculations of run-off rates and volumes from the existing site for a range of annual probability events (see chapter 4 of the practice guide).
4 Climate change	
	Annex B of PPS25 and chapters 3 and 6 of the practice guide provide guidance on how to assess the impacts of climate change.

5 The Development Proposals	
	<p>Reference should be made to table D.2 of PPS25.</p> <p>Chapter 4 of the practice guide provides guidance on how the sequential approach can be used to inform the lay-out of new development sites.</p>
6 Flood Risk Management Measures	
	<p>This should show that the flood risk management hierarchy has been followed and that flood defences are a necessary solution. This should include details of any proposed flood defences, access/egress arrangements, site drainage systems (including what consideration has been given to the use of sustainable drainage systems) and how these will be accessed, inspected, operated and maintained over the lifetime of the development. This may need to include details of any modelling work undertaken in order to derive design flood levels for the development, taking into account the presence of any new infrastructure proposed.</p>
7 Off site impacts and proposed mitigation measures	
a	<p>This should be over the lifetime of the development, taking the relevant climate change allowances into account. The assessment may need to include:</p> <ul style="list-style-type: none"> • Details of the design basis for any mitigation measures (for example, compensatory flood storage works and measures to improve flood conveyance). A description of how the design quality of these measures will be assured and of how the access, operation, inspection and maintenance issues will be managed over the lifetime of the development. • Evidence that the mitigation measures will work, generally in the form of a hydrological and hydraulic modelling report. • An assessment of the potential impact of the development on the river, estuary or sea environment and fluvial/coastal geomorphology. A description of how any impacts will be mitigated and of the likely longer-term sustainability of the proposals.
b	<p>Evidence should be provided that drainage of the site will not result in an increase in the peak rate or in the volumes of run-off generated by the site prior to the development proceeding.</p>
8 Management of residual risks	
a	<p>Designing for event exceedance on site drainage systems is covered in chapter 5 of the practice guide. Guidance on other residual risks is provided in chapter 7.</p>
b	<p>Reference should be made to flood warning and evacuation procedures, where appropriate, and to likely above ground flow routes should sewers or other conveyance systems become blocked or overloaded. This may need to include a description of the potential economic, social and environmental consequences of a flood event occurring which exceeds the design standard of the flood risk management infrastructure proposed, and of how the design has sought to minimise these – including an appraisal of health and safety issues.</p>

Appendix C: Relevant policies, plans and sources of information

- C1. There are numerous relevant planning policies, plans and sources of information on flooding in England, many of which are referred to in this practice guide. The table shown below gives examples of those relevant to Flood Risk Assessments.

Information Source	Contents	Responsible Body
Planning Policy Statement 25: Development and Flood Risk	National planning policy on development and flood risk	Communities and Local Government
Regional Flood Risk Appraisals (RFRAs)	Flood risk mapping and regional strategies	Regional Planning Bodies
Strategic Flood Risk Assessments (SFRA)	Flood risk mapping and management strategies	Local planning authorities
Regional spatial strategies (RSS)	Strategic approach to flood risk control	Regional Planning Bodies
Local Development Documents (LDDs)	Identification of areas at risk of flooding and more detailed approaches to flood risk control	Local planning authorities
Community strategies	Sustainable development aspirations	Local planning authorities
Flood risk policy statement	Statement on flood risk management policies for an area	Local planning authorities & the Environment Agency
Environment Agency Flood Map	Flood risk mapping for river and sea flooding	Environment Agency
Catchment Flood Management Plans (CFMP)	Strategy for sustainable flood defence for river catchment areas, including identification of flooding problems	Environment Agency
Shoreline Management Plans (SMP)	Policy document for sustainable coastal defence for coastal cells	Environment Agency/ Maritime Authority
Reservoir Flood Plans	Emergency planning for flooding from reservoirs	Reservoir undertaker with Environment Agency supervision
River Basin Management Plans (RBMP)	Regional and national strategies	Environment Agency

Information Source (continued)	Contents	Responsible Body
Surface Water Management Plans (SWMP)	Management of surface water	Local planning authorities
Water Level Management Plans	Identification of water level management requirements of protected wetland areas	Environment Agency
Harbour Management Plans	Sustainable use of harbours	
Sea defence scheme design reports	Design of sea defence schemes, including modelling to assess design levels	Environment Agency
Coastal Habitat Management Plans (CHAMP)	Sustainable sea defence strategies for areas that may affect internationally important wildlife sites.	Environment Agency/Natural England
Estuary Management Plans	Sustainable use of estuaries	Natural England
Heritage Coast Management Plans	Management options for Heritage Coast areas	Local planning authorities
Flood risk management scheme design reports or project appraisal reports	Design report for flood alleviation schemes, including modelling to set design levels	Environment Agency, local planning authorities & private
Annual/Biennial Reports	Identification of recent flooding problems/issues	Local authority
Sewage Plans/sewer flooding reports/drainage area studies	Identification of location of sewerage and potential problems	Sewerage undertaker
Biodiversity Action Plans (BAP)	Identification of the status and targets for habitats and species	Natural England

Abbreviations/Acronyms

AAP	Area Action Plan
AOD	Above Ordnance Datum
BR	Building Regulations
CFMP	Catchment flood management plan
CIRIA	Construction Industry Research Information Association
CIWEM	Chartered Institution of Water and Environmental Management
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EiP	Examination in Public
FCDPAG	Flood and coastal defence project appraisal guidance
FRA	Flood Risk Assessment (site-specific)
GDPO 1995	Town and Country Planning (General Development Procedures) Order 1995
GIS	Geographical Information System
ICE	Institution of Civil Engineers
IDB	Internal Drainage Board
IUD	Integrated Urban Drainage
LDL	Local development document
LDF	Local development framework
LPA	Local Planning Authority
LRF	Local Resilience Forum
MPA	Mineral Planning Authority
NFCDD	National Flood and Coastal Defence Database
NGO	Non-Governmental Organisation
NSWG	National SUDS Working Group
ODPM	(the former) Office of the Deputy Prime Minister
PPG	Planning Policy Guidance Note
PPS	Planning Policy Statement
RBMP	River Basin Management Plan
RFRA	Regional Flood Risk Appraisal
RDA	Regional Development Agency
RPB	Regional Planning Body
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal

SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SMP	Shoreline Management Plan
SPD	Supplementary Planning Document
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UKCIP	UK Climate Impact Programme
WFD	Water Framework Directive

Glossary

Annual exceedance probability	The estimated probability of a flood of given magnitude occurring or being exceeded in any year. Expressed as, for example, 1 in 100 chance or 1 per cent.
Adoption of sewers	The transfer of responsibility for the maintenance of a system of sewers to a sewerage undertaker.
Attenuation	Reduction of peak flow and increased duration of a flow event.
Catchment Flood Management Plans	A strategic planning tool through which the Environment Agency will seek to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Climate change	Long-term variations in global temperatures and weather patterns, both natural and as a result of human activity.
Consultation Direction	A Direction made under the Town and County Planning (Consultation) (England) Direction 2006 whereby a local planning authority which is proposing to grant planning permission in the face of a sustained objection on flood risk grounds by the Environment Agency, must refer the planning application through the regional Government Office to determine whether it should be called-in for a decision by the Secretary of State.
Design event	A historic or notional flood event of a given annual flood probability, against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.
Design event exceedance	Flooding resulting from an event which exceeds the magnitude for which the defences protecting a development were designed – see residual risk.
Design flood level	The maximum estimated water level during the design event.
Exceedance flood risk assessment	A study to assess the risk of a site or area being affected by exceedance flow, and to assess the impact that any changes made to a site or area will have on the exceedance flood risk.
Exceedance flow	Excess flow that emerges on the surface once the conveyance capacity of a drainage system is exceeded.
Flood action group	Local community groups who aim to ensure that all authorities work closely together to manage flood risk and to deliver an action plan to minimise flood risk within their area.
Flood defence	Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding to a specified standard of protection.
Flood and Coastal Defence Operating Authorities	The Environment Agency, local authorities and Internal Drainage Boards with legislative powers to undertake flood and coastal defence works.

Flood effect mitigation	All measures to reduce the effect of flooding on a building and its occupants including flood avoidance, flood resistance and flood resilience.
Flood Map	A map produced by the Environment Agency providing an indication of the likelihood of flooding within all areas of England and Wales, assuming there are no flood defences. Only covers river and sea flooding.
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist.
Functional floodplain	Land where water has to flow or be stored in times of flood.
Flood risk management strategy	A long-term approach setting out the objectives and options for managing flood risk, taking into account a broad range of technical, social, environmental and economic issues.
Flood risk assessment (covers all scales of assessment)	A study to assess the risk to an area or site from flooding, now and in the future, and to assess the impact that any changes or development on the site or area will have on flood risk to the site and elsewhere. It may also identify, particularly at more local levels, how to manage those changes to ensure that flood risk is not increased. PPS25 differentiates between regional, sub-regional/strategic and site-specific flood risk assessments.
Flood risk management measure	Any measure which reduces flood risk such as flood defences.
Flood Zone	A geographic area within which the flood risk is in a particular range, as defined within PPS25.
Floods Directive	A European Community Directive (2007/60/EC) of the European Parliament and Council, designed to establish a framework for the assessment and management of flood risks aiming at the reduction of the adverse consequences associated with floods on human health, the environment, cultural heritage, economic activity and infrastructure. The three main requirements of the Directive are the development of Preliminary Flood Risk Assessments (by December 2011), flood hazard and risk maps (by December 2013), and flood risk management plans (by December 2015).
Fluvial	Flooding caused by rivers.
Freeboard	The difference between the flood defence level and the design flood level.
Greenfield land	Land that has not been previously developed.
Hold the line	Maintaining the existing flood defences and control structures in their present positions and standard of protection.

Local development framework	A non-statutory term used to describe a folder of documents which includes all the local planning authority's Local Development Documents. The local development framework will also comprise the statement of community involvement, the local development scheme and the annual monitoring report.
Local Development Documents	All development plan documents which will form part of the statutory development plan, as well as supplementary planning documents which do not form part of the statutory development plan.
Local Resilience Forum	A group required under the Civil Contingencies Act, 2004 who are responsible for the co-ordination of emergency planning within local areas.
Main River	A watercourse designated on a statutory map of Main Rivers, maintained by Defra, on which the Environment Agency has permissive powers to construct and maintain flood defences.
Major development	A major development is <ul style="list-style-type: none">a) where the number of dwellings to be provided is ten or more, or the site area is 0.5 hectares or more orb) non-residential development, where the floorspace to be provided is 1,000m² or more, or the site area is 1 ha or more.
Ordinary watercourse	All rivers, streams, ditches, drains, cuts, dykes, sluices, sewers (other than public sewer) and passages through which water flows which do not form part of a Main River. Local authorities and, where relevant, Internal Drainage Boards have similar permissive powers on ordinary watercourses, as the Environment Agency has on Main Rivers.
Permitted development rights	Qualified rights to carry out certain limited forms of development without the need to make an application for planning permission, as granted under the terms of the Town and Country Planning (General Permitted Development) Order 1995.
Planning Policy Statement (PPS)	A statement of spatial planning policy issued by central Government (generally to replace older Planning Policy Guidance notes).
Pluvial	Surface flooding caused by rain.
Precautionary principle	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.

Previously-developed land (often referred to as brownfield land)	Land which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure (PPS3 annex B)
Regional Spatial Strategy (RSS)	A broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body.
Reservoir (large raised)	A reservoir that holds at least 25,000 cubic metres of water above natural ground level, as defined by the Reservoirs Act, 1975.
Resilience	Constructing the building in such a way that although flood water may enter the building, its impact is minimised, structural integrity is maintained and repair, drying & cleaning are facilitated.
Resistance	Constructing a building in such a way as to prevent flood water entering the building or damaging its fabric. This has the same meaning as flood proof.
Return period	The long-term average period between events of a given magnitude which have the same annual exceedance probability of occurring.
Residual risk	The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.
River Basin Management Plan	A management plan for all river basins required by the Water Framework Directive. These documents will establish a strategic plan for the long-term management of the River Basin District, set out objectives for waterbodies and, in broad terms, what measures are planned to meet these objectives, and act as the main reporting mechanism to the European Commission.
Run-off	The flow of water from an area caused by rainfall.
Section 106 Agreement	Section 106 of the Town and Country Planning Act 1990 (as amended) allowing local planning authorities to negotiate arrangements whereby the developer makes some undertaking if he/she obtains planning permission. These are known interchangeably as planning agreements, planning obligations or planning gain.
Section 106 (Water Industry Act 1991)	A key section of the Water Industry Act 1991, relating to the right of connection to a public sewer.
Shoreline Management Plan	A plan providing a large-scale assessment of the risk to people and to the developed, historic and natural environment associated with coastal processes. It presents a policy framework to manage these risks in a sustainable manner.
Standard of protection	The design event or standard to which a building, asset or area is protected against flooding, generally expressed as an annual exceedance probability.

Strategic Environmental Assessment (SEA) Directive	European Community Directive (2001/42/EC) on the assessment of the effects of certain plans and programmes on the environment.
Sustainable Drainage Systems	A sequence of management practices and control structures, often referred to as SUDS, designed to drain water in a more sustainable manner than some conventional techniques. Typically these are used to attenuate run-off from development sites.
Sustainability Appraisal	An integral part of the plan-making process which seeks to appraise the economic, social and environmental effects of a plan in order to inform decision-making that aligns with sustainable development principles.
Vulnerability Classes	PPS25 annex D provides a vulnerability classification to assess which uses of land maybe appropriate in each flood risk zone.
Washland	An area of the floodplain that is allowed to flood or is deliberately flooded by a river or stream for flood management purposes.
Water Framework Directive	A European Community Directive (2000/60/EC) of the European Parliament and Council designed to integrate the way water bodies are managed across Europe. It requires all inland and coastal waters to reach “good status” by 2015 through a catchment-based system of River Basin Management Plans, incorporating a programme of measures to improve the status of all natural water bodies.
Windfall sites	Sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority’s local development framework.

This practice guide is complementary to Planning Policy Statement 25 *Development and Flood Risk* and provides guidelines on how to implement development and flood risk policies by the land use planning system

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