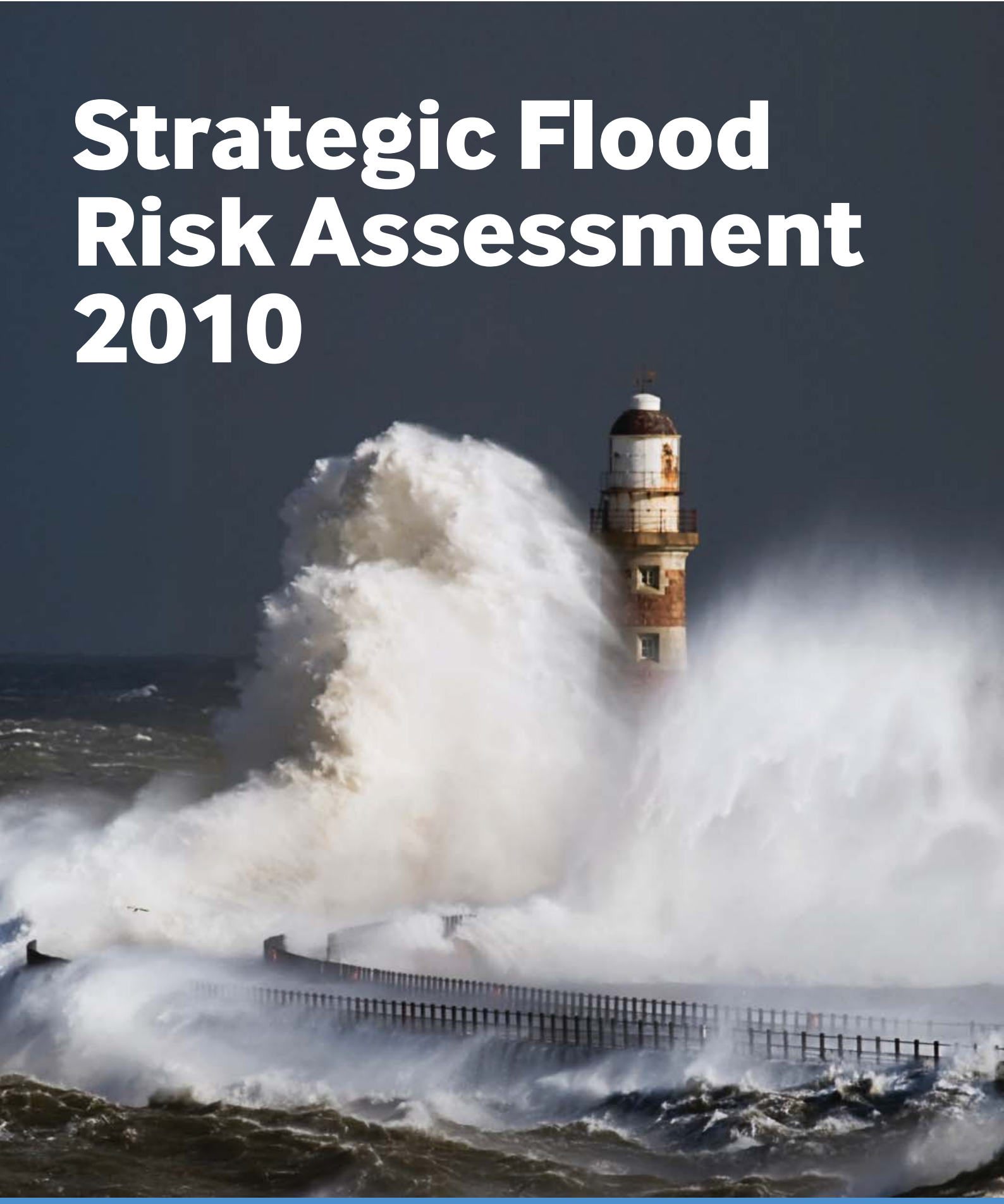
# Strategic Flood Risk Assessment 2010



Volume I: Guidance

JBA consulting

Sunderland City Council

# Sunderland City Council
# Level 1 Strategic Flood Risk Assessment
# Volume I: SFRA Guidance

## Final Report

June 2010

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# Revision History

| Revision Ref / Date Issued | Amendments | Issued to |
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# Contract

This report describes work commissioned by Sunderland City Council's Head of Planning and Environment, by a letter dated 12th May 2009. Sunderland Council's representative for the contract was Barry Luccock. Chris Isherwood and Jonathan Cooper of JBA Consulting carried out this work.

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# Purpose

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JBA Consulting has no liability regarding the use of this report except to Sunderland City Council.

# Acknowledgments

JBA would like to thank all those who provided information and data for this report. Special thanks go out to Barry Luccock and Neil Cole from Sunderland City Council and Cameron Sked and Sarah Baillie from the Environment Agency.

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# Executive Summary

## Development and Flood Risk

Sunderland City Council is required to undertake a Level 1 Strategic Flood Risk Assessment (SFRA) as an essential part of the pre-production/evidence gathering stage of the Local Development Framework (LDF) and in preparing their Local Development Documents (LDDs). The SFRA provides baseline information for use in the preparation of LDDs and the Sustainability Appraisal (SA) of LDDs for the scoping and evaluation stages.

The requirement for and guidance on the preparation of SFRAs is outlined in Planning Policy Statement 25 Development and Flood Risk (PPS25) and its Practice Guide. This requires Local Planning Authorities (LPAs) to take a more dominant role in local flood risk management. They also need to demonstrate that due regard has been given to the issue of flood risk at all levels of the planning process to avoid inappropriate development.

Local authority planners must demonstrate that a risk based, sequential approach has been applied in preparing development plans and that flood risk has been considered during the planning application process. This must be achieved through the application of the Sequential and Exception Test as outlined in PPS25.

By providing a central store for data, guidance and recommendations on flood risk issues at a local level, the SFRA is an important planning tool that enables the LPA to carry out the Sequential and Exception Test and to select and develop sustainable site allocations with regard to flood risk.

SFRAs can also provide a much broader and inclusive vehicle for integrated, strategic and local Flood Risk Management (FRM) assessment and delivery, by providing the linkage between Catchment Flood Management Plans (CFMPs), Regional Flood Risk Appraisals (RFRAs) and Surface Water Management Plans (SWMPs). The suite of flood risk policy issues and information on the scale and nature of the risks in these various documents needs to be brought into “real” settings with the SFRA tasked with improving the understanding of flood risk across the districts.

## Sunderland Level 1 SFRA Report Format

This report has been produced as a Level 1 SFRA for Sunderland City Council, in accordance with PPS25 and its Practice Guide. The Level 1 SFRA is presented across two separate volumes, and is referred to as the Sunderland City Council Level 1 SFRA Volumes I and II.

**Volume I: SFRA Guidance**

Volume I of the Sunderland Level 1 SFRA introduces the SFRA process. It is a reference document for current flood risk management drivers, national regional and local planning policy and introduced Environment Agency policy such as the Wear CFMPs and the River Tyne to Flamborough Head Shoreline Management Plan 2 (SMP2).

The report also provides a brief understanding of the mechanisms of flooding and flood risk for those new to the subject. More importantly it provides a comprehensive discussion on PPS25, the Sequential and Exception Test and links the Flood Risk Management framework within national, regional and local flood risk assessments.

This report provides significant guidance and recommendations for Spatial Planners, Development Management and Developers in how to apply the sequential approach by carrying out both the Sequential and Exception Tests and links the flood risk information provided in the Sunderland Level 1 SFRA Technical Report (Volume II) into useful step by step guidance

**Volume II: SFRA Technical Report**

Volume II provides the technical information and methods used in the assessment of flood risk across Sunderland. It initially begins with the introduction to the study area and the 'Consultation & Data Management' section, identifying key stakeholders and their involvement in the SFRA process followed by a review of important data sources within the SFRA.

The main sections within the report focus on the assessment of all sources of flooding include; fluvial, tidal, surface water, sewers, groundwater and reservoirs and other artificial sources. The Volume also introduces current flood risk management measures including the Environment Agency Flood Warning System flood defences. As discussed flood risk has many dimensions and as a result has been presented through a suite of maps. These extend the level of detail in the Environment Agency Flood Map. The SFRA maps include:

| | | |
|---|---|---|
| **SET A** | **Fluvial and Tidal Flood Risk Maps** | |
| | *PPS25 Flood Zone Map* | *2009s0243-SCC-A1 to A12* |
| | *River Wear Modelled Outlines at Fatfield* | *2009s0243-SCC-A13* |
| | *Lumley Park Burn Undefended Modelled Outlines* | *2009s0243-SCC-A14* |
| | *Lumley Park Burn Defended Modelled Outlines* | *2009s0243-SCC-A15* |
| **SET B** | **Climate Change Sensitivity Maps** | |
| | *Fatfield Climate Change Outlines* | *2009s0243-SCC-B1* |
| | *Lumley Park Burn Climate Change Outlines* | *2009s0243-SCC-B2* |
| **SET C** | **Surface Water & Sewer Flood Risk Maps** | |
| | *Areas Susceptible to Surface Water Flooding* | *2009s0243-SCC-C1* |
| | *NWL Drainage Areas* | *2009s0243-SCC-C2* |
| | *Proposed Critical Drainage Areas* | *2009s0243-SCC-C3* |
| **SET D** | **FRM Asset Maps** | |
| | *Flood Risk Management Measures* | *2009s0243-SCC-D1* |

Volume II along with the suite of SFRA maps provide the main evidence base of the Sunderland Level 1 SFRA. It has been arranged in one volume to allow technical information to be easily updated when reviewed. It is only this Volume that can be updated with new flood risk information when available.

Section 4 provides the assessment of Sunderland's proposed development sites against the Flood Zones and areas susceptible to surface water flooding zones. Sunderland City Council should use the spreadsheet developed to carryout the first pass of the Sequential Test. This volume ends with key recommendations for further work required such as Level 2 SFRAs and SWMPs which will provide Sunderland City Council with a strategic and coherent framework for managing flood risk in their area.

## Use of SFRA Data

Whilst all data collected and produced during the Sunderland Level 1 SFRA process has been supplied to Sunderland City Council (report, maps, GIS, modelled output) there should be controls on its use. It is anticipated that the SFRA report (both Volumes) and associated maps will be published on the Council website as PDFs as the central source of SFRA data and available to download.

Sunderland City Council will be able to use any modelled output for internal use. The use of this information must consider the context within which it was produced. The use of this data will fall under the license agreement between the LPA and the Environment Agency as it has been produced using Environment Agency data. It should be remembered that any modelling undertaken for the SFRA is of a strategic nature and more detailed Flood Risk Assessments (FRAs) should seek to refine the understanding of flood risk from all sources on and due to any particular site.

SFRA data should not be passed on to third parties outside of the LPA. Any third party wishing to use existing Environment Agency flood risk datasets should contact External Relations in the Environment Agency North East Region. A charge is likely to apply for the use of this data.

# List of Figures



# List of Tables

# Abbreviations

| | |
|---|---|
| ABD | Areas Benefiting from Defences |
| AEP | Annual Exceedance Probability |
| ANEC | Association of North East Councils |
| CFMP | Catchment Flood Management Plans |
| CLG | Communities and Local Government |
| CCMA | Coastal Change Management Area |
| COW | Critical Ordinary Watercourse |
| CS | Core Strategy |
| DIA | Drainage Impact Assessment |
| DPDs | Development Plan Documents |
| EU | European Union |
| FAS | Flood Alleviation Schemes |
| FEH | Flood Estimation Handbook |
| FCERM | Flood and Coastal Erosion Risk Management |
| FRA | Flood Risk Assessment |
| FRM | Flood Risk Management |
| FRMA | Flood Risk Management Area |
| FRMP | Flood Risk Management Plan |
| GI | Green Infrastructure |
| IFM | Indicative Floodplain Map |
| LDDs | Local Development Documents |
| LDF | Local Development Framework |
| LLFA | Local Lead Flood Authority |
| LPAs | Local Planning Authorities |
| NEA | North East Assembly |
| NFCDD | National Fluvial and Coastal Defence Database |
| NLRF | Northumbria Local Resilience Forum |
| NWL | Northumbrian Water Ltd |
| PFRA | Preliminary Flood Risk Assessments |
| PPG | Planning Policy Guidance |
| PPS | Planning Policy Statement |
| RBD | River Basin District |
| RBMP | River Basin Management Plan |
| RFRA | Regional Flood Risk Assessment |
| RPB | Regional Planning Bodies |
| RPG | Regional Planning Guidance |
| RSS | Regional Spatial Strategy |
| SA | Sustainability Appraisal |
| SAC | Special Areas of Conservation |
| SEA | Strategic Environmental Assessment |
| SFRA | Strategic Flood Risk Assessment |
| SMP | Shoreline Management Plans |
| SNCI | Sites of Nature Conservation Importance |
| SoP | Standard of Protection |
| SPA | Special Protection Area |
| SPD | Supplementary Planning Document |
| SSSI | Sites of Special Scientific Interest |
| SUDS | Sustainable (Urban) Drainage Systems |
| SWMP | Surface Water Management Plan |
| UDP | Unitary Development Plan |
| WCS | Water Cycle Study |
| WFD | Water Framework Directive |

# 1 Introduction

## 1.1 Commission

JBA Consulting was commissioned in on the 27th May 2009 by Sunderland City Council to undertake a review of the existing Sunderland Strategic Flood Risk Assessment (SFRA) published in 2007. This report details a Level 1 SFRA for Sunderland alone and has been prepared in accordance with current best practice, Planning Policy Statement 25 Development and Flood Risk (PPS25)[1].

PPS25 reinforced the responsibility of LPAs to ensure that flood risk is managed effectively and sustainably as an integral part of the planning process, balancing socio-economic needs, existing framework of landscape and infrastructure, and flood risk.

## 1.2 Levels of Flood Risk Assessments

Within the hierarchy of regional, strategic and site-specific flood-risk assessments, a tiered approach ensures that the level of information is appropriate to the scale and nature of the flood-risk issues and the location and type of development proposed, avoiding expensive flood modelling and development of mitigation measures where it is not necessary. As stated in PPS25 the three principle levels of assessment comprise:

- **Regional Flood Risk Appraisal (RFRA)** – a broad overview of flood risk issues across a region to influence spatial allocations for growth in housing and employment as well as to identify where flood risk management measures may be required at a regional level to support the proposed growth;
- **Strategic Flood Risk Assessment (SFRA)** – an assessment of all types of flood risk informing land use planning decisions. This will enable the LPA to apply the Sequential Test in PPS25 and allocate appropriate sites for development, whilst identifying opportunities for reducing flood risk; and
- **Site Specific Flood Risk Assessment (FRA)** – site or project specific flood risk assessment to consider all types of flood risk associated with the site and propose appropriate site management and mitigation measures to reduce flood risk to and from the site to an acceptable level.

In a plan-led system, implementation of the sequential risk-based approach requires that forward planning policy decisions in RSSs and LDF/LDDs are guided by information on flood risk to ensure that allocating inappropriate development does not unnecessarily raise expectations of landowners and developers. This should be achieved through the use of RFRAs and SFRAs, which are generally broad-brush assessments of the risk of flooding, to guide strategic planning decisions. They involve the collection and collation of data on flooding and flood-risk management from all available sources to provide information to the necessary level of detail to allow decision-makers to:

- Prepare appropriate policies for flood-risk management within RSSs and LDFs;
- Produce a strategic understanding of the scale, extent and nature of the flood risk at a community level and how that would alter with any proposed development;
- Apply a risk-based, sequential approach, providing risk data to inform the Exception Test and to confirm the compatibility between the flood risk vulnerability of the proposed allocation and the Flood Zone;
- Inform the strategic environmental assessment of RSSs and LDFs;
- Translate the national guidance into locally specific guidance, including the identification of areas of floodplain that should be safeguarded for flood management purposes
- Identify the level of detail required for site-specific flood-risk assessments in particular locations; and

1 Communities and Local Government (2010) Planning Policy Statement 25: Development and Flood Risk

- Determine the acceptability of flood risk in relation to emergency planning capability and how the existing and proposed community would respond to a flood event.

An SFRA for the Tyne and Wear Authorities (including Sunderland City Council) was produced in 2006. However, since its production further key planning guidance and flood risk information have been published or updated including the PPS25 (2010) and its Practice Guide (2009), the Pitt Review[2] and the Floods and Water Management Act 2010. Since the publication of the first PPS25 Practice Guide in 2008, SFRAs have become more than a land use planning tool, providing a much broader and inclusive vehicle for integrated, strategic and local Flood Risk Management (FRM) assessment and delivery.

The Pitt Review put the onus on SFRAs to provide the central holder for data, information and consideration for all flood risk issues relating to flooding from all sources at a local level; and provide the linkage between CFMPs, SMPs, RFRAs, SWMPs and appropriate sustainable land uses over a number of planning cycles. SFRAs are proving a pivotal vehicle in the introduction and promotion of a local authority, post Pitt Review, role in local flood management.

## 1.3 Scope & Objectives

This SFRA has been produce to update the previous SFRA (2007) to a Level 1 SFRA standard. The scope of the Sunderland City Council Level 1 SFRA includes:

- Data collection and review
- Assessment of current fluvial and tidal flood risk
- Identification of functional floodplains
- Assessment of the impact of climate change
- Assessment of flood risk from other sources
- Outputs and application of the Sequential Test
- Provide recommendations for further work

The key objectives of this SFRA are to:

- Investigate and identify the extent and severity of flood risk to the area at present and in the future, under the terms of PPS25.
- Contribute to the council's Strategic Environmental Assessments (SEA) and preparation of its LDDs
- To enable the Council to apply the Sequential Test and the Exception Test
- Provide strategic flood risk guidance and advice to planners and developers
- Help LPAs to identify specific locations where further and more detailed flood risk data and assessment work is required. This includes Level 2 SFRAs and the scope for Surface Water Management Plans and/or Water Cycle Studies
- To identify the level of detail required for site-specific FRAs.
- To inform the emergency planning process
- To improve stakeholder joint working and the sharing of data, information and the understanding of flood risk
- Be used as a reference document

## 1.4 Key Outputs

The Level 1 SFRA has been prepared in two Volumes (described in the Executive Summary) reflecting the general needs of Sunderland City Council and how best to

2 The "Pitt Review" was an independent review carried out following the severe floods of summer 2007 by Sir Michael Pitt. It provides a number of key recommendations on improving the level of information and responsibility of all stakeholders involved in flood risk management

represent the large amount of flood risk information and general regional policy. The key outputs of this SFRA according to PPS25 are:

- *"Plans showing the LPA area, Main Rivers, ordinary watercourses and flood zones, including the functional floodplain if appropriate, across the local authority area, as well as all previously allocated development sites;*
- *An assessment of the implications of climate change*
- *Areas at risk from other sources*
- *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 of existing sources of flooding, or by the generation of increased surface water run-off (by identifying Critical Drainage Areas)*
- *Guidance on the preparation of FRAs for allocated development sites*
- *Guidance on the likely applicability of sustainable drainage systems (SUDS) techniques*[3]*"*

## 1.5 Sunderland Level 1 SFRA Volume I

This Volume of the Level 1 SFRA for Sunderland City Council has been developed to provide a general overview of flood risk management responsibilities and guidance from PPS25 and its Practice Guide.

### Section 2 – Understanding of Flood Risk

This section provides a good overview of key mechanisms of flooding, how flood risk is calculated and risks to people, property and the environment. Each source of risk relating to Sunderland City Council is assessed in Volume II.

### Section 3 – The Planning Framework

This Section introduces the high level documents which drive flood risk management at a national, regional and local scale. These documents have all influenced the preparation of this SFRA and their own guidance and recommendations have informed the flood risk detail and recommendations provided in Volume II. This section also introduces regional and local policy drivers including CFMPs and SMPs which should influence the preparation of flood risk policies within the Sunderland City Council LDDs.

### Section 4 – The Sequential Approach

Section 4 provides an overview of the sequential approach to allocating development which is the backbone to PPS25 and reason for developing the Level 1 SFRA. This section introduces the Sequential Test, Flood Risk Zones, the Vulnerability Classification and the Exception Test as described in PPS25.

This section should be read by Spatial Planners, Development Control and Developers along with PPS25 and its Practice Guide. It provides a clear, concise and consistent means of assessing the feasibility and sustainability of potential development locations and to determine appropriate flood risk mitigation measures where required.

### Sections 5 – Guidance for Flood Risk Assessments

This section should be read by Development Control and Developers. It introduces the requirement of site-specific Flood Risk Assessments (FRAs), within the hierarchy of flood risk assessments as outlined in PPS25. It also develops this guidance further providing a

3 Communities & Local Government (2009) Planning Policy 25: Development and Flood Risk Practice Guide

useful flow diagram on the preparation of FRAs and drainage requirements of new developments.

### Sections 6 and 7 – Flood Risk Management and Sustainable Drainage Systems

This section introduces the concept of mitigation measures and provides a number of possible options. This section is important to both development control officers and developers in understanding what measures are possible. However, it must be noted that mitigation should always been seen as a last resort and development in flood risk areas should always be avoided where possible in the first instance.

General guidance on the adoption of SUDs is also discussed in Section 7.

### Section 8 - Emergency Planners

The final section introduces regional and local emergency plans covering Sunderland and should be read by Developers and Emergency Planners. This section also provides key recommendations in how to apply to flood risk data in Volume II and associated maps in updating and/or developing local and site-specific flood warning plans.

# 2 Understanding Flood Risk

## 2.1 Introduction

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people, human and environmental assets are present in the area which floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and the environmental and cultural heritage.

Climate change predictions are that flood risk will increase due to more frequent severe storms bringing higher intensity rainfall and increasing run-off from land and buildings. This will cause rivers and streams to experience higher than normal flood flows and levels, and sewers and drains to surcharge more frequently than at present. The focus of activity in meeting these challenges will in future be on flood risk management as opposed to simply providing flood defences. It is now widely recognised that whilst we can't always prevent flooding occurring we can manage the risks of it happening and reduce the consequences when flooding does happen.

All operating authorities (Environment Agency, Local Authorities, Internal Drainage Boards), should embrace effective flood risk management issues and actions, and aim to reduce flood risks through a variety of measures including:

- Ensuring planning activities locate vulnerable land uses away from high flood risk areas;
- Providing flood warning and emergency planning activities in flood risk areas;
- Generally raising awareness of flood risks amongst vulnerable communities;
- Constructing and maintaining appropriately designed surface water sewers and culverts;
- Using temporary and demountable flood defences and various flood prevention systems to buildings where appropriate;
- Constructing new flood defences where they are sustainable, and improving and maintaining those already existing and;
- Constructing weirs, sluices and other flood flow control/management structures.

Pro-active land use planning has a key role to play in flood risk management as it is one of the few activities that can result in the avoidance of flood risk as opposed to other activities that can only hope to reduce it. Effective flood risk management through the planning system is achieved through a hierarchy where:

- **Avoidance** of inappropriate development in high risk zones must take priority, before
- **Substitution** of lower vulnerability uses where avoidance is not possible is considered. Only if avoidance and substitution are not possible,
- **Mitigation** of the risks through a variety of techniques should be used.

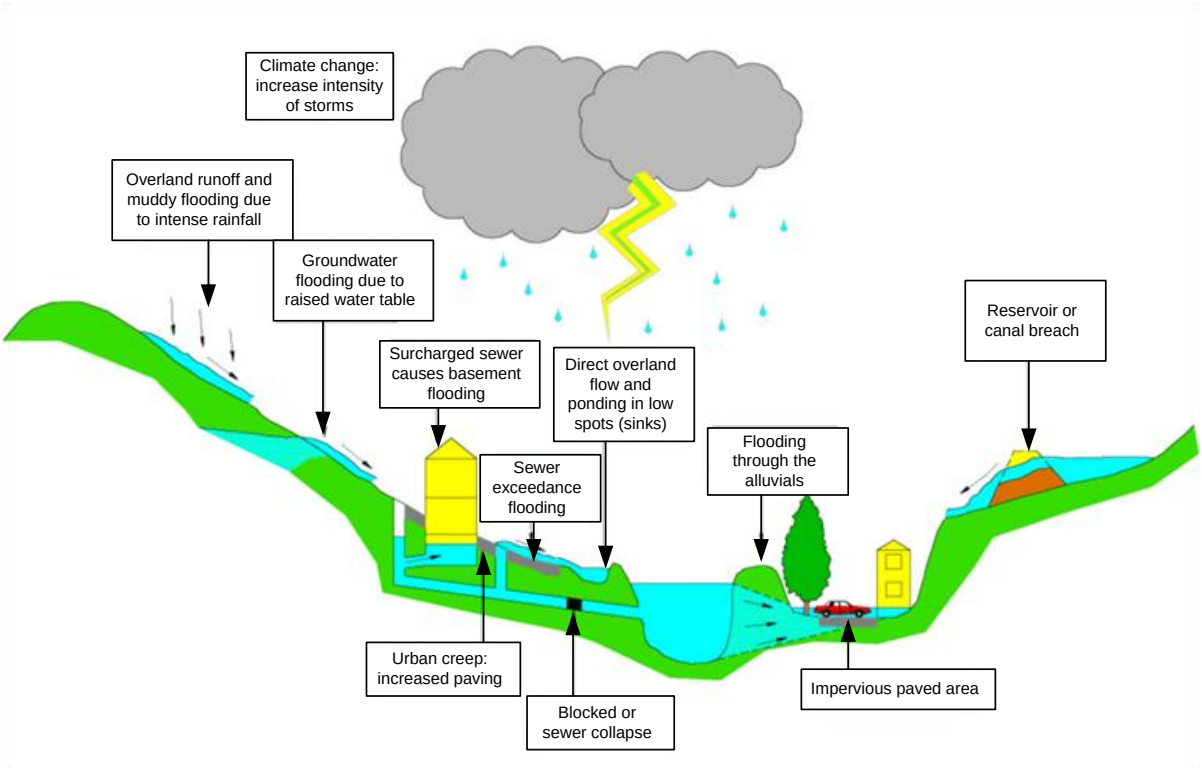
Flood risk assessment at all levels of planning and for all major developments is critical to inform decision making by planners and developers.

## 2.2 Sources of Flooding

Flooding can occur from many different and combined sources and in many different ways. Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. See Figure 2-1.

With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

**Figure 2-1: Flooding from all Sources**




Major causes of flooding include:

### 2.2.1 Fluvial Flooding

Flooding of watercourses is associated with the exceedance of channel capacity during higher flows. The process of flooding on watercourses depends on a number of characteristics associated with the catchment including; geographical location and variation in rainfall, steepness of the channel and surrounding floodplain and infiltration and rate of runoff associated with urban and rural catchments. Generally there are two main types of catchments; large and relatively flat or small and steep, the two giving two very different responses during large rainfall events.

According to PPS25,

*"in a large, relatively flat catchment, flood levels will rise slowly and natural floodplains may remain flooded for several days, acting as the natural regulator of the flow. In small, steep catchments, local intense rainfall can result in the rapid onset of deep and fast-flowing flooding with little warning. Such "flash" flooding, which may only last a few hours, can cause considerable damage and possible threat to life."*

The form of the floodplain, either natural or urbanised, can influence flooding along watercourses. The location of buildings and roads can significantly influence flood depths and velocities by altering flow directions and reducing the volume of storage within the floodplain. Critical structures such as bridge and culverts can also significantly reduce capacity creating pinch points within the floodplain. These structures are also vulnerable to blockage by natural debris within the channel or by fly tipping and waste.

### 2.2.2 Coastal Flooding

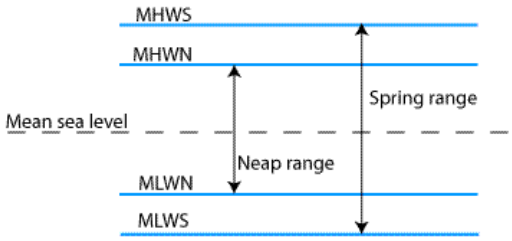
Rivers flow into the sea through estuaries. River-flow in estuaries is heavily influenced by the tidal cycle of the sea. Flooding that occurs in estuaries can be complex and difficult to predict. It is influenced not just by the volume of water travelling down the catchment through the river system but also by the height and timing of tides and tidal surges. Tidal surges are caused by regional weather conditions such as pressure systems, wind

direction and speed and local bathymetry (depth of the sea and estuary). The way the sea and river interact within the estuary not only causes a flood risk within the estuary itself, but the effects can also extend well beyond the immediate area. This is because of the effects of tide locking.

Tidal flooding can also impact the direct coastline where wave or tide heights can flood low lying coastlines or overtop coastal defences.

Tidal heights follow a range of daily and seasonal patterns, which makes the process of estimating peak tidal heights easier to carry out as outlined below:

- Mean High Water Springs[4] (MHWS)
- Mean High Water Neaps[5] (MHWN)
- Mean Low Water Springs (MLWS)
- Mean Low Water Neaps (MLWN)




The majority of coastal reaches are defended from high tides. However, there is still residual risk present as the defences can breach or overtop during server storms or extreme high tides during storm surges which are more difficult to predict. The risk associated with coastal flooding depends on a number of factors, often in combination including; the height of tides, weather systems, wind and wave conditions, topography, the effectiveness of drainage systems and the condition of flood defences.

Flooding from the sea and tidal waters is more severe than flooding from watercourses due to the hazards associated with potential flood velocities and resulting depths. Salt water flooding also causes greater damage to properties than fresh water. Due to the more serious consequence of tidal flooding, Flood Zone 3a is defined in PPS25 using a large 1 in 200 year flood probability for tidal flooding rather than a 1 in 100 year probability used for fluvial events.

### 2.2.3 Surface Water Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains in low lying areas. Any areas at risk from fluvial flooding will almost certainly be at risk from surface water flooding.

Flooding in urban areas can also be attributed to sewers. Sewers are designed to a 1 in 30 year design standard and hence sewer flooding problems will often be associated with more frequent storm events, when sewers can become blocked or fail. In the larger events that are less frequent but have a higher consequence, surface water will exceed the sewer system and flow across the surface of the land, often following the same flow paths and ponding in the same areas as overland flows.

Both ‘Making Space for Water’ and ‘Future Water’, discussed in Chapter 3, recognise the importance of integrated urban drainage and the summer flooding of 2007 highlighted that surface water flooding can cause mass distress, damage and disruption. The Foresight Report (2004) estimated that 80,000 properties are at very high risk from surface water flooding (1 in 10 chance of occurring in any one year).

The Environment Agency has recently produced a national surface water flood map called Areas Susceptible to Surface Water Flooding, which identifies areas vulnerable to surface

4 Spring Tides - The tidal effect of the sun and the moon acting in concert twice a month, when the sun, earth and moon are all in a straight line (full moon or new moon). The range of tide is larger than average
5 Neap Tides - This opposite effect occurs when the moon is at right angles to the earth-sun line (first or last quarter). The range of tide is smaller than average

water flooding during an extreme rainfall event. This is valuable at providing an indication of the likelihood of surface water flooding, which is separated into areas at less, intermediate or high risk of surface water flooding. Urban drainage modelling is a complex field, varying from simple topographic analysis, to routing of water over an elevation model (which is how the National Surface Water Flood Map has been produced), to network models of the sewer system linked to overland routing, to fully integrated river, sewer and overland models. The data, budget and time required increases with complexity. SFRAs require a strategic assessment of the likelihood of surface water flooding for which overland routing is suitable and appropriate.

It must be noted that these maps were created at a national level. Where possible flow routes underneath structures (i.e. railway embankments, motorways, bridges etc.) have been including in the underlying topography, however there maybe instances where this has not been done. Also the capacity of the sewer system in removing a volume of the rainfall or infiltration rates of Greenfield land has not been included. This is difficult at a national level, therefore it would be expected that the maps are slightly over estimating flood extents.

### 2.2.4 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from underground. This can emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especial in urban areas and pose further risks to the environment and ground stability.

Groundwater flooding can persists over a number of weeks and poses a significant but localised issue that has attracted an increasing amount of public concern in recent years. In most cases groundwater flooding cannot be easily managed or lasting solutions engineered although, the impact on buildings can be mitigated against through various measures.

There are several mechanisms which produce groundwater flooding which are discussed below.

### 2.2.5 Groundwater Flooding Resulting from Prolonged Rainfall

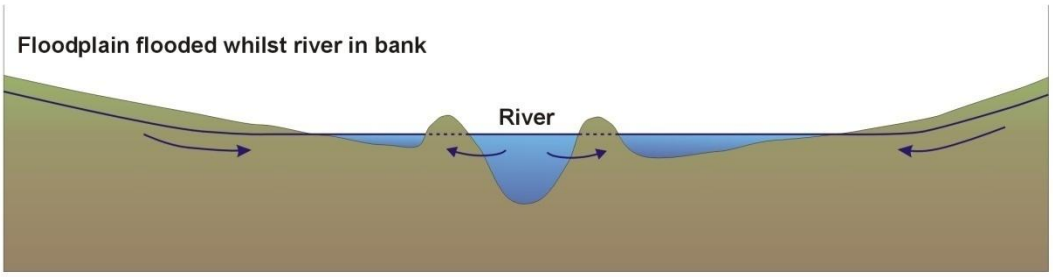
Prolonged rainfall compounded with already high groundwater levels can cause groundwater levels to rise and flood large areas for extended periods. This mechanism for groundwater flooding is associated with, but not particular to, Chalk Aquifer areas.

#### Groundwater Flooding Resulting from High in Bank River Levels

Groundwater levels may rise in superficial aquifers simultaneously with river water (e.g. floodplain gravels) in response to high in bank river levels. High in bank river levels can cause groundwater flooding if the river flood level is maintained for a sufficiently long time to allow water to flow from the river into the superficial aquifer. It is a particular problem in very large river basins with a large catchment, long flood durations and wide valleys with extensive alluvial deposits.

This type of flooding particularly affects basements and other underground structures but can also cause the groundwater level to rise above the floodplain level, flooding the surface. This occurs in situations where the in bank river water level is at a higher elevation than the surround floodplain and the potential for this is increased where the river banks have been engineered to contain higher river levels ( Figure 2-2).

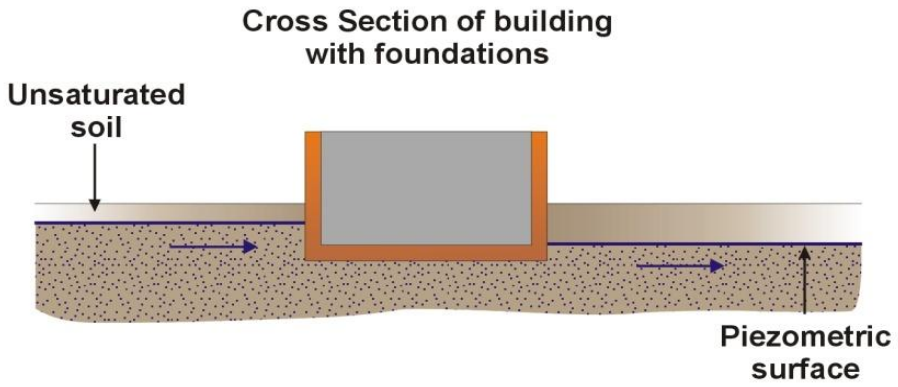
**Figure 2-2: The Mechanism of Groundwater Flooding from High in Bank River Levels[6]**




## Groundwater Flooding Resulting from Artificial Obstructions

The potential for groundwater flooding to occur within floodplains can be increased by placing artificial obstructions such as foundations into the ground: creating impermeable boundaries, damming groundwater up gradient and causing the groundwater levels to rise (Figure 2-3).

**Figure 2-3: The Damming of Groundwater by Artificial Obstructions[7]**




The second effect of placing artificial obstructions into an aquifer is that, if they are extensive enough, (e.g. a densely development floodplain area) they can cause a reduction in the storage capacity of the aquifer. A large scale reduction in storage capacity can result in raised groundwater levels and groundwater flooding.

## Groundwater Flooding Resulting From Groundwater Rebound

Groundwater levels in an area can be kept artificially depressed through groundwater abstraction; if these activities are stopped, groundwater will rise or 'rebound' to their natural level. This rise in groundwater levels may cause once dry spring lines to start discharging groundwater. In groundwater rebound areas which have been drained by the historic abstraction activities, significant groundwater flooding problems may occur if these areas have been developed in the interim.

## Groundwater Flooding Resulting From Mine Water Rebound

Mine water rebound is caused by a similar mechanism to groundwater rebound. When mine dewatering ceases, mine water levels rise as water enters the system through mine entries and permeable strata[8]. The rate of rebound is often rapid at the start of the cessation of dewatering but decreases with time as the voids in the mine fill with water and

6 Environment Agency (2007) Making Space for Water: Groundwater Flooding Records Collation, Monitoring and Risk Assessment (Reference HA5)
7 Environment Agency (2007) Making Space for Water: Groundwater Flooding Records Collation, Monitoring and Risk Assessment (Reference HA5)
8 DEFRA (2004) Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study. Final Report (LDS23)

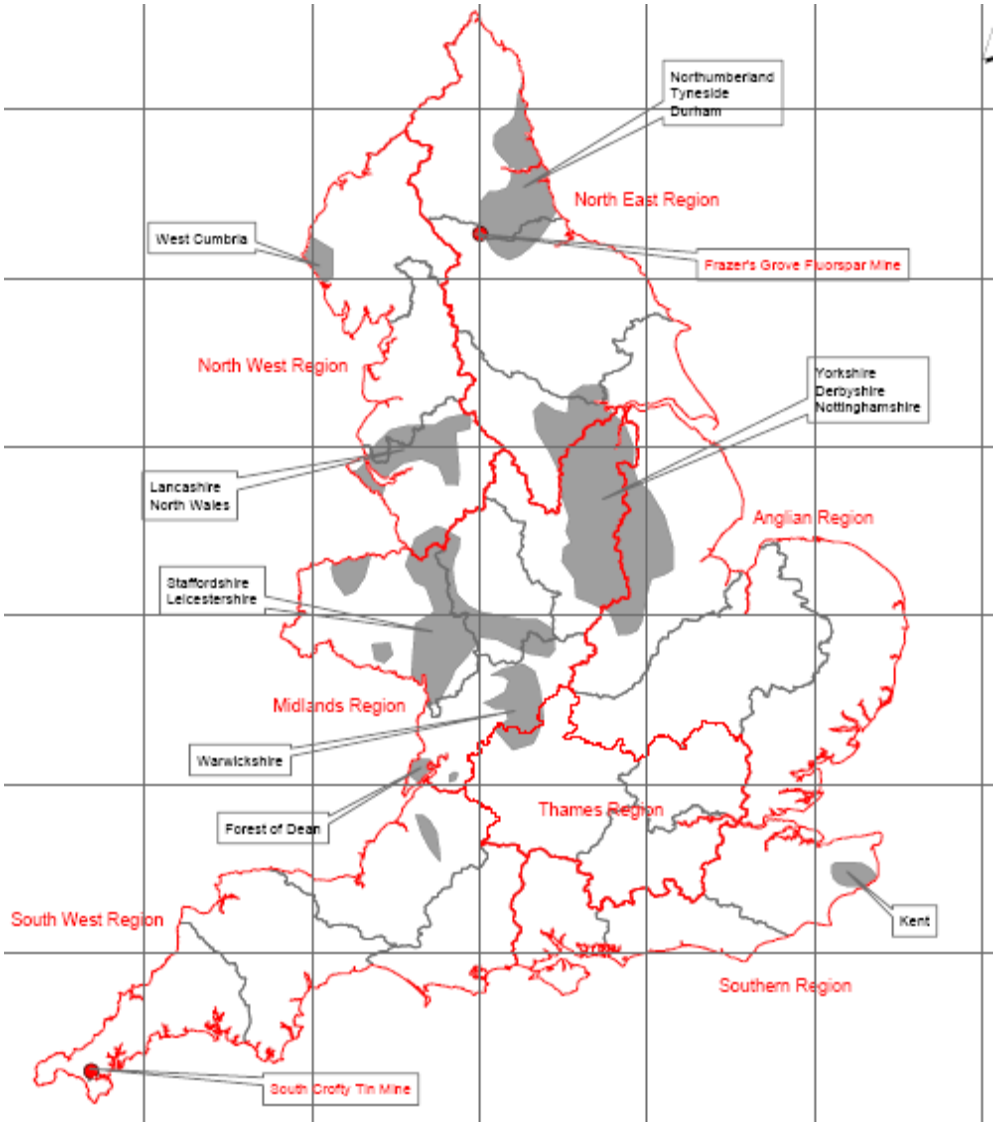
the pressure difference between the water in the surrounding aquifer and in the mine reduces. As levels rise, mine water can start to issue from previously dry adits, shafts etc., as increased water levels allow water to flow from sections and subterranean 'ponds' that were previously unconnected, forming new pathways and discharge points in the mine system.

Areas susceptible to mine water rebound (Figure 2-4) face a number of issues. These include:

- Surface water pollution – mine water rebound often exacerbates acid mine drainage issues with low pH, high metal concentration waters discharging from mine entries and other discharge points;
- Localised flooding;
- Overloading of sewers and sewage works;
- Pollution to overlying aquifers;
- Increased risks of subsidence.

A summary of coalfields susceptible to mine water rebound is provided in Figure 2-4.

**Figure 2-4: Coalfields Susceptible to Mine Water Rebound[9]**




9 Environment Agency (2007) Making Space for Water: Groundwater Flooding Records Collation, Monitoring and Risk Assessment (Reference HA5)

### 2.2.6 Flooding from Drainage Systems

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, it becomes blocked or it cannot discharge due to a high water level in the receiving watercourse;

Foul sewers and surface water drainage systems are spread extensively across the urban areas with various interconnected systems discharging to treatment works and into local watercourses.

Typically foul systems will comprise a network of drainage sewers, sometimes with linked areas of separate and combined drainage, all discharging to sewage treatment works. Combined Sewer Overflows (CSOs) provide an overflow release from the drainage system into local watercourses or surface water systems during times of high flows.

Surface water systems will typically collect surface water drainage separately from the foul sewerage and discharge directly into watercourse.

A major cause of sewer flooding is often due to the connection of surface water drains to discharge into the combined sewer systems. Sewer capacity can then become an issue in large rainfall events causing the backing up of flood waters internally within properties or discharging through manholes.

Insufficient capacity can also become an issue where urban areas develop over time, with improved sewerage infrastructure provision not always provided to accommodate the additional flows.

English and Welsh water companies are required to maintain a register of flooding incidences due to hydraulic capacity problems on the sewage network. This database identifies properties where flooding has occurred on a frequency of 1 in 5 years and 1 in 10 years. The database is known as DG5 and DG10 registers. A register for 1 in 20 years is also recorded which includes properties under investigation.

Whilst this data can give an idea of those areas with limited drainage capacity, it must be acknowledged that it is a register of properties that have flooded due to the hydraulic inadequacies of the sewer systems, not properties at risk of flooding. Therefore it has limiting usefulness in predicting future flooding.

Data generated using hydraulic network models such as InfoWorks potentially provide a very useful tool with which to predict more widespread potential for sewer flooding, and the use of such tools should be investigated during a Surface Water Management Plan.

### 2.2.7 Flooding from Reservoirs and other Artificial Sources

Reservoirs can be a major source of flood risk, as experienced during the 2007 summer floods, where 18 reservoirs were affected across England. Whilst the probability of dam failure or breaching occurring is very small, the consequences of such an event can be devastating thereby presenting a risk of flooding which has to be considered.

Flooding from reservoirs is noted within the Pitt Review Recommendations and acknowledged by Hilary Benn, the Secretary of State for Environment, Food and Rural Affairs. £1million has been pledge to improve reservoir safety specifically to produce inundation mapping for all reservoirs falling under the Reservoirs Act (i.e. those with a capacity of over 25,000 cu metres).

Reservoirs are classified on a consequence of failure basis outlined below in Table 2-1 and it is now suggested that a better risk-based approach to reservoir safety is needed, focusing on those reservoirs that pose the greatest risk to the public, even if they are not currently covered by the Act.

**Table 2-1: Reservoir Consequence Classification**

| Reservoir Category | Potential Consequence of Reservoir Failure |
|---|---|
| A | At least 10 lives at risk and extensive property damage |
| B | Fewer than 10 lives at risk or extensive property damage |
| C | Negligible risk to human life but some property damage |
| D | Negligible risk to human life and very limited property damage |

The Environment Agency is currently producing simplified inundation maps for all reservoirs under the Reservoirs Act as required by Recommendation 57 of the Pitt Review. Trial projects have been run in the North West to develop the specification for these maps and will be producing maps for all reservoirs under the Act during 2009.

Currently the Water Act 2003, which amended the Reservoirs Act 1975, requires all reservoir undertakers to prepare Flood Plans for those reservoirs where the dam failure could put people's lives at risk or lead to major damage. These plans are expected to become a legal requirement in spring 2009.

The reservoir Flood Plans will include:

- An inundation analysis to identify the extent and severity of flooding which could result from an uncontrolled release of water (i.e. breaching or failure).
- An on-site plan setting out what the undertaker would do in an emergency to try and to contain and limit the effects of the incident, and
- A communications plan with external organisations, mainly the emergency services.

Defra is currently funding a project to produce a 'Guide to Emergency Planning for UK Reservoirs', which will ultimately use the Flood Plans.

Any allocations or applications for development immediately downstream of a reservoir should be considered carefully in liaison with the Environment Agency. It should be noted that the hazard is well managed through legislation and it is unlikely that the impact zone downstream of a reservoir would be a reason to stop permitted development. It is likely that the flood risk would be mitigated through emergency planning.

### 2.2.8 Defences Failure

The condition of existing flood defences is an important consideration for local authority planners when allocating new development. PPS25 considers that defended areas (i.e. those areas that are protected to some degree against flooding by the presence of a formalised flood defence) are still at risk of flooding, and therefore sites within these areas must be assessed with respect to the adequacy of the defences.

The condition of existing defences is provided in the form of a 'rating' (1 to 5), and is a reflection of any signs of 'obvious' structural problems. The condition rating is determined on the basis of visual inspection, focussing on obvious signs of structural defect (e.g. slippage, cracking, poor maintenance), designed to inform the maintenance programme. A summary of the NFCDD condition rating allocations is shown in Table 2-2 below.

**Table 2-2: NFCDD Condition Rating for Flood Defences**

| Condition Rating | Condition | Condition Description |
|---|---|---|
| 1 | Very Good | Fully serviceable |
| 2 | Good | Minor defects |
| 3 | Fair | Some cause for concern. Requires careful monitoring |
| 4 | Poor | Structurally unsound now or in the future |
| 5 | Very Poor | Completely failed and derelict |

The condition of existing flood defences and whether they will continue to be maintained and/or improved in the future, is an issue than needs to be considered as part of the risk based sequential approach and in the light of this, whether proposed land allocations are appropriate and sustainable. In addition, detailed FRAs will need to explore the condition of defences thoroughly, especially where these defences are informal and contain a wide variation of condition grades.

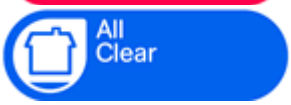
If the condition of defences are low they are open to failure or if they are not provided the required standard of protection could potentially be overtopped during lower probability events. Flood risk associated with defence infrastructure is residual; however, the risks can be significant due to their sudden onset and velocities reached by flood waters.

### 2.2.9 Flood Warning

The Environment Agency has the lead role in providing flood warnings services in England and Wales. The aim of the flood warning service is to reduce risk to like, distress to people and damage to property caused by flooding by providing accurate, timely flood warnings to residents within the floodplain of rivers, estuaries and coasts; to the media and partner organisations.

- It is crucial that people at risk receive appropriate flood warnings and take action to protect themselves and their property. Within the Environment Agency corporate plan "Creating a Better Place10" the Agency has highlight three main targets:
- To have 80% of properties at risk in the floodplain in England and Wales receiving and appropriate flood warning service,
- 75% of people who live in flood risk areas take appropriate action by 2011
- To have major incident plans in place for high flood risk areas.

Currently the Environment Agency operates a flood warning service in specific locations known as "Flood Warning Areas" where "Flood Warning Codes" are assigned based on the overall impact of flooding within an area. These include:

| | | |
|---|---|---|
| Flood Watch |  | **"flooding of low-lying land and roads is expected"** |
| Flood Warning |  | **" flooding of homes and businesses is expected"** |
| Severe Flood Warning |  | **"severe flooding is expected"** |
| All Clear |  | **"all clear or receding floodwaters"** |

The flood warnings are used to reduce the overall impact of flooding of people and property by lowering the vulnerability of the receptor. This is done by providing a warning which can then be used to remove people at risk or to relocate valuable possession to higher levels.

#### New Public Flood Warning Codes

In response to the summer 2007 floods, the Pitt Review stated that the Environment Agency flood warning service needed to be improved to stimulate a more effective response from response agencies and the general public.

10 Environment Agency (2006) Creating a Better Place: Corporate Strategy 2006-2011

In order to tackle these issue the Environment Agency set-up the Flood Warning Service Improvements Project (FWSIP) in December 2008. The project had three objectives:

- To implement new public flood warning codes, which are adaptable for all sources of flooding, and are effective at promoting action by people to reduce the impact of floods on their lives and livelihoods
- To develop an integrated service which provides professional partners with greater access to expert advisors during an event and a rationalised set of messages/alerts/warnings from the Met Office, Flood Forecasting Centre and the Environment Agency
- To make the Environment Agency river level information available to the public on the internet.

The biggest change will be the development of new public warning codes. **These new public warning codes will be put into effect from spring 2010 and include:**



### 2.2.10 Climate Change

PPS25 suggest that winters will become wetter over the whole of England, by as much as 20% by the 2050s. A shift in the seasonal pattern of rainfall is also expected, with summers and autumn becoming much drier than at present. Snowfall amounts will decrease significantly throughout the UK, but the number of rain-days and the average intensity of rainfall are expected to increase.

**Table B.1 and B.2 in PPS25** have been used as precaution sensitive ranges for flows and net sea level rises, which we derived during UKCIP02 scenarios. The sensitivity ranges have been reassessed within the UKCIP09 investigation. However they have not been fully integrated into modelling guidance as yet. It is recommended that future studies use the lasts sensitivity ranges once guidance is made available.

Table B.1 of PPS25 gives recommended contingencies for net sea level rise up to 2115. For Sunderland, the 2006 sea level is predicted to rise by 0.22m over the next 44 years (to 2050), and 0.75m within 94 years (to 2100).

**Table B.1 Recommended contingency allowances for net sea level rise**

| Administrative Region | Net Sea Level Rise (mm/yr) Relative to 1990 | | | |
|---|---|---|---|---|
| | 1990 to 2025 | 2025 to 2055 | 2055 to 2085 | 2085 to 2115 |
| East of England, East Midlands, London, SE England (south of Flamborough Head) | 4.0 | 8.5 | 12.0 | 15.0 |
| South West | 3.5 | 8.0 | 11.5 | 14.5 |
| NW England, NE England (north of Flamborough Head) | 2.5 | 7.0 | 10.0 | 13.0 |

Peak flows in fluvial floods are likely to increase by around 20% over the next 50 to 100 years. This translates into higher water levels.

**Table B.2 Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.**

| Parameter | 1990 to 2025 | 2025 to 2055 | 2055 to 2085 | 2085 to 2115 |
|---|---|---|---|---|
| Peak rainfall intensity | +5% | +10% | +20% | +30% |
| Peak river flow | +10% | +20% | | |
| Offshore wind speed | +5% | | +10% | |
| Extreme wave height | +5% | | +10% | |

### 2.2.11 Overview

Flooding in urban areas can come from a variety of sources and when flooding occurs it is often not clear where the water has come from. The Floods and Water Management Act defines local flood risk, for which local authorities will have a local leadership role, as the risk of flooding from ordinary watercourses (includes lakes, ponds and other areas of water that flow into an ordinary watercourse that are not under the jurisdiction of the Environment Agency), surface water and groundwater.

Prior to the major flood events in summer 2007, non Main River flooding was based on anecdotal evidence or described with Critical Ordinary Watercourse (COW) investigations undertaken by the Environment Agency. Little data could be abstracted from the water companies on sensitive drainage catchments where runoff impacts of new development could be significant on combined sewer systems. However, a significant proportion of recent flood insurance claims are due to flooding from other sources, such as surface water. This problem is predicted to increase with climate change.

Historically the adopted approach in many SFRAs has been not to consider other sources of flooding as a spatial or strategic issue. Through good design and attenuation of drainage inputs to sensitive watercourses, mitigation was the accepted way forward.

Summer 2007 provided a stark reminder that the significance of capacity exceedance of artificial and natural drainage systems can be severe for many communities. It was therefore considered that flooding from all sources should be scoped into any SFRAs, and that new methods of rapid screening of these risks are required. On the back of the Pitt review, the Environment Agency has prepared a national map showing areas susceptible to surface water flooding. This was developed by JBA from research for the Making Space for Water programme and has been used within this SFRA.

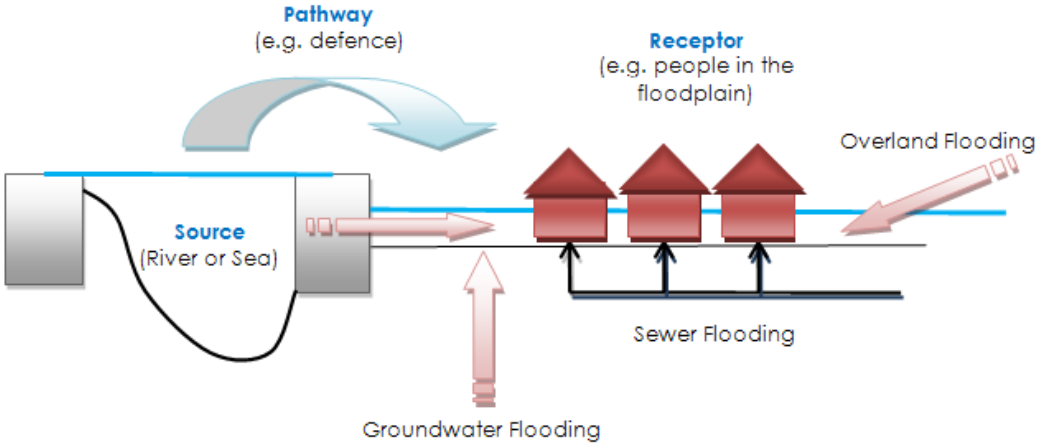
Increases in flooding impacting on people and property, due to development can be caused:

- Upstream by restricting the capacity and conveyance function of the watercourse and floodplain system;
- Downstream by decreasing the volume available for flood storage on the floodplain, altering flow routes on the floodplain or by changes to the channel which can increase the flow discharged to downstream locations; and
- By increasing run-off from reduced permeability surfaces, such as roads, roofs and car parks.

## 2.3 Flooding Likelihood and Consequences

Flood risk is generally accepted to be a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 2-5 below. This is a standard environmental risk model common to many hazards and should be starting point of any flood-risk assessment. However, it should be remembered that flood risk can occur from many different sources and pathways and not simply those shown in the simple form below.

**Figure 2-5: Source-Pathway-Receptor Model**




The principal sources are rainfall or higher than normal sea levels, the principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets and the receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk.

It is important to define the components of flood risk in order to apply this guidance in a consistent manner. Flood risk is a combination of the likelihood of flooding and the potential consequences arising.

### 2.3.1 Likelihood

Likelihood of flooding is normally expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in 100 years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every 100 years.

Considered over the lifetime of development, such an apparently low-frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 22% (1 in 5) chance of occurring at least once in a 25-year period - the period of a typical residential mortgage
- And a 53% (1 in 2) chance of occurring in a 75-year period - a typical human lifetime

### 2.3.2 Consequence

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc).

Flood risk is then normally expressed in terms of the following relationship:

**Flood risk = Probability of flooding x Consequences of flooding**

### 2.3.3 Flooding Impacts on People, Property & the Environment

Flood impacts maybe direct or indirect, immediate or long term and may affect households and communities, individuals as well as the environment, infrastructure and economy of an area.

#### Flooding Impacts on People

Flooding has a wide range of social impacts which may be difficult to delineate as they are interconnected, cumulative and often not quantifiable.

In small urban or steep upland catchments which have a very rapid response to rainfall, or with flooding due to infrastructure failure, flood waters can rise very quickly and put life at risk. Even shallow water flowing at 2m/s can knock children and many adults off their feet and vehicles can be moved by water of 300mm depth. The risks rise if the flood water is carrying debris.

The impact on people as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. This also extends to whole communities. Long-term impacts can arise due to chronic illnesses and stress. Flood water contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) is particularly likely to cause such illnesses, either directly as a result of contact with the polluted flood water or indirectly as a result of sediments left behind.

The degree to which populations are at risk from flooding is therefore not solely dependent upon proximity to the source of the threat or the physical nature of the flooding. Social factors also play a significant role in determining risk. Although people may experience the same flood, in the same area, at the same time, their levels of suffering are likely to differ greatly as a result of basic social differences. These differences will affect vulnerability in a verity of ways including and individuals or community's response to risk communication (flood warning) and physical and psychological recovery in the aftermath of a flood. How individuals and communities experience the impact will also vary depending on their awareness of the risk of flooding, preparedness for the flood event and the existence or lack of coping strategies.

#### Flooding Impacts on Property

Flooding can cause severe property damage. Flood water is likely to damage internal finishes, contents, electrical and other services and possibly cause structural damage. The physical effects can have significant long-term impacts, with re-occupation sometimes not being possible for over a year. The costs of flooding are increasing, partly due to increasing amounts of electrical and other sophisticated equipment within developments.

The damage flooding can cause to businesses and infrastructure, such as transport or utilities like electricity and water supply, can have significant detrimental impacts on local and regional economies. The long term closure of businesses, for example, can lead to job losses and other economic impacts.

The vulnerability of buildings is important to understand in terms of their occupants and their type. For example, it is much more difficult to evacuate the old and ill from hospitals and care homes than people working in offices or industrial areas. Building types that need to be operational during- and post-flood, such as ambulance stations and emergency response centres are also vulnerable as if their services they provide are disrupted by flooding it will place the immediate community at greater risk.

Transport and strategic utilities infrastructure can be particularly vulnerable to flooding because interruption of their function can have widespread effects well beyond the area of

flooding. For example, flooding of primary roads or railways can deny access to areas for the duration of the flooding, as well as causing damage to the road or railway. Flooding of water distribution infrastructure such as pumping stations or of electricity sub-stations can result in loss of water or power over large areas. This can magnify the impact of flooding beyond the immediate community and reinforces why decisions to locate development in floodplain should be taken very carefully.

Placing new development or regenerating in flood risk areas has its additional short and long term costs. The need to build resistant and resilient properties could significantly increase overall costs of development, whilst ongoing maintenance and insurance increase future expenditure.

### Flooding Impacts on the Environment

Environmental impacts can be significant and include soil erosion, bank erosion, land sliding and damage to vegetation as well as the impacts on water quality, habitats and flora and fauna caused by bacteria and other pollutants carried by floodwater.

Flooding can have a beneficial role in natural habitats. Many wetland habitats are dependent on annual flooding for their sustainability and can contribute to the storing of flood waters to reduce flood risk elsewhere. It is important to recognise the value of maintenance or restoration of natural riparian zones such as grasslands which protect the soils from erosion and 'natural' meadows which can tolerate flood inundation. The use of Green Infrastructure throughout the river corridor can also play a vital role in enhancing the river environment as well as safeguarding land from future development, protecting people and buildings from flooding and reducing flood risk downstream.

A natural floodplain can help accommodate climate change and improve the quality of rivers and associated wetlands to help achieve 'good status' by 2015 under the Water Framework Directive. Meeting WFD objectives involves not only ecosystems, water quality, drought and flood impact considerations but also the physical characteristics and morphology of the river channel, floodplain and associated structures.

# 3 The Planning Framework

## 3.1 Introduction

The purpose of this section of the report is to identify and outline those high level documents which have been taken into account in preparing this SFRA, from a national to local level.

The land use planning process is driven by a whole host of policy guidance on a national, regional and local level. Whilst the majority of these policies are not aimed at mitigating flood risk, there are key links at strategic, tactical and operational levels between land use and spatial planning (Regional and Local Government), and Flood Risk Management (FRM) planning (Environment Agency), which should be considered as part of a planned and integrated approach to delivering sustainable development.

The sustainability appraisal will help draw together these links and balance the application of wider social, economic and environmental planning policy and guidance. Flood risk assessment is required at all levels of the planning process and for all major developments in flood risk areas; these play and increasingly important role in assisting effective delivery of key planning objectives.

## 3.2 Key Flood Risk Management Drivers

The principal FRM policy drivers are brought together in central government's recently released Flood and Water Management Act and it is an important part of central government's response to Sir Michael Pitt's Report on the summer 2007 floods. It also gives effect to a number of commitments in the Government's "Future Water" strategy document. In addition, the Act responds to a number of climate change challenges including, more frequent extreme weather events causing a greater risk of flooding and drought, increased population, increased water demand and more water quality problems. It provides the Environment Agency with a strategic overview role for flood risk in England and Wales and gives local authorities in England a clear leadership role in local flood risk management encompassing all sources of flooding. An improved integrated and risk based approach is proposed to the future management of flood risks, and this requires other concerns such as sustainability, biodiversity and the whole water cycle to be taken into account by local authorities and other relevant organisations.

A core policy thread running through all current flood risk management drivers is the fundamental shift in emphasis from building defences to prevent flooding, to one of managing flood risk by using a suite of proactive measures of avoiding placing further receptors at flood risk. All operating authorities are required to invest in the provision of sustainable flood risk management and this includes LPAs adopting a flood risk management hierarchy of assessing, avoiding, substituting, controlling and mitigating flood risk through the land use planning system. They should have regard to flooding from all sources (particularly surface water and not just from rivers and the sea). Central government does however; recognise that in some circumstances, appropriate mitigation measures may still involve new, or improving and maintaining existing flood defences where justified, to protect increasingly vulnerable communities.

Current key policy related documents provide LPAs with important and valuable knowledge on the strategic direction of flood risk management and assist their strategic land use planning decision making for re-generation, inward investment and growth etc.

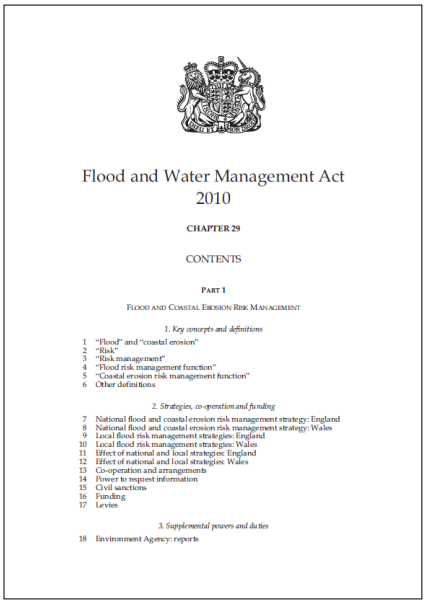
Key documents currently influencing FRM policy include:

- Floods and Water Management Act (2010)
- EU Floods Directive (2007) & Flood Risk Regulations (2009)
- Future Water (2008)
- Improving Surface Water Drainage (2008)

- Making Space for Water (2005)
- Planning Policy 25: Development & Flood Risk (2010)
- Planning Policy 25: Development & Flood Risk Practice Guide (2009)
- Planning Policy 25 Supplement: Development & Coastal Change (2010)
- Planning Policy 25 Supplement: Development & Coastal Change Practice Guide (2010)
- Learning Lessons from the 2007 Floods – Sir Michael Pitt (2008)
- Catchment Flood Management Plans
- Shoreline Management Plans

### 3.2.1 Floods & Water Management Act

The need to address flood risk and water management effectively is becoming ever more important and urgent. On 8 April 2010 the Flood and Water Management Act 2010 ("the Act") became law. This now places new roles and responsibilities on all local authorities.



Flood and Water Management Act 2010

CHAPTER 29

CONTENTS

PART 1

FLOOD AND COASTAL EROSION RISK MANAGEMENT

*1. Key concepts and definitions*

1 "Flood" and "coastal erosion"
2 "Risk"
3 "Risk management"
4 "Flood risk management function"
5 "Coastal erosion risk management function"
6 Other definitions

*2. Strategies, co-operation and funding*

7 National flood and coastal erosion risk management strategy: England
8 National flood and coastal erosion risk management strategy: Wales
9 Local flood risk management strategies: England
10 Local flood risk management strategies: Wales
11 Effect of national and local strategies: England
12 Effect of national and local strategies: Wales
13 Co-operation and arrangements
14 Power to request information
15 Civil sanctions
16 Funding
17 Levies

*3. Supplemental powers and duties*

18 Environment Agency: reports

The Environment Agency will have a key role under the Act's provisions in developing a national strategy for the management of all sources of flood risk, and the local strategy will have to be consistent with this. Water companies will also be risk management authorities, and will be a key partner with whom the lead local flood authority will need to work.

The role and duty of the "lead local flood authority (LLFA)" to prepare and implement a flood risk management strategy are the most obvious examples of increased duties on local authorities i.e. to identify the risk of flooding from all sources; and then to manage this risk through all mechanisms/solutions available. The lead flood authority will assume overall responsibility and should therefore be able to take an integrated approach, linking their work with that of other stakeholders, and providing pro-active leadership.

There are a number of tasks and clauses within the Act which have particular implications for local authorities, land use planning and related flood risk. These include:

- The Environment Agency will be given a strategic overview role covering all forms of flooding and will coordinate maps and plans in relation to the sea, main rivers and reservoirs; it will also be given the same powers as Councils to carryout coastal erosion works and may be a statutory consultee in respect of future coastal erosion planning applications
- The Act provides a new role of the lead local flood authority, defined as LLFA for an area as the unitary authority or the county council. The Act enables LLFA to delegate flood or coastal erosion functions to another risk management authority by agreement.
- Each LLFA must produce a Local Flood Risk Management Strategy that specifies:
    - Risk Management Authorities (FMA)
    - Flood and coastal erosion risk management (FCERM) functions that RMAs may exercise
    - Objectives for managing flood risk inc Flood Directive FRMP objectives
    - Measures proposed to meet the objectives
    - How and when measures will be implemented

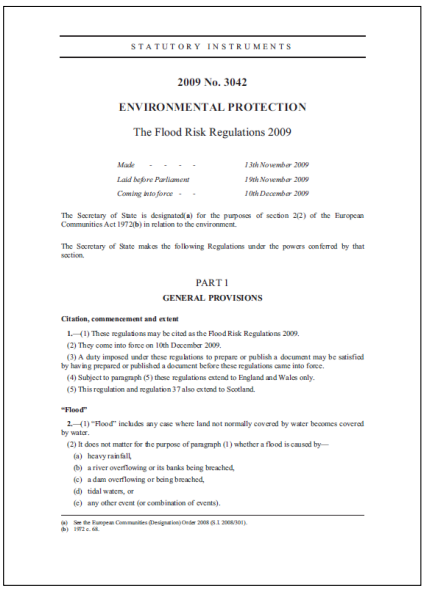
- Costs, benefits and funding of measures
- Assessment of local flood risk for the purpose of the strategy
- Review process

- How the strategy contributes to wider environmental objectives e.g. WFD
- The LLFA will be required to investigate flooding incidents in its area, to identify which authorities have relevant functions to deal with the flood and whether each of them intends to respond and maintain a register of structures or features which they consider have a significant effect on flood risk in their area (including third party assets).
- The EA, local authorities and internal drainage boards will be able to manage water levels to provide leisure, habitat and other environmental benefits. This may include increasing flooding and coastal erosion where this would be beneficial.
- The Land Drainage Act has been altered so that culverts can no longer be built on ordinary watercourses without permission.
- Right to Connect (Water Industry Act, 1991) S106 of the act has been amended by the FWM Act so that for new developments the approved sustainable drainage system must be constructed to connect to the public sewer network.
- Surface water connection to public sewers will be conditional on meeting new national standards on SUDS and drainage, and the adoption of a SUDS approving body will be needed, and a certificate issued, before development can begin;
- The approving body (LLFA) must adopt the drainage system if has been constructed to meet the sustainable drainage approval with exceptions for single properties and roads and then becomes responsible for maintaining the system.
- All relevant authorities will be required to cooperate and share information.

The content and implications of the Act provide considerable opportunities for improved and integrated land use planning and flood risk management by local authorities and other key partners. The integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable re-generation and growth.

### 3.2.2 EU Floods Directive

The EU Floods Directive (2007) aims to reduce and manage the risk floods pose to human health, the environment, cultural heritage and economic activity. Member States had two years in which to transpose its provisions into domestic legislation with the first requirements of the Directive begin at the end of 2011.



STATUTORY INSTRUMENTS

2009 No. 3042

ENVIRONMENTAL PROTECTION

The Flood Risk Regulations 2009

*Made* - - - - *13th November 2009*
*Laid before Parliament* *19th November 2009*
*Coming into force* - - *10th December 2009*

The Secretary of State is designated(**a**) for the purposes of section 2(2) of the European Communities Act 1972(**b**) in relation to the environment.

The Secretary of State makes the following Regulations under the powers conferred by that section.

PART 1
GENERAL PROVISIONS

**Citation, commencement and extent**

1.—(1) These regulations may be cited as the Flood Risk Regulations 2009.
(2) They come into force on 10th December 2009.
(3) A duty imposed under these regulations to prepare or publish a document may be satisfied by having prepared or published a document before these regulations came into force.
(4) Subject to paragraph (5) these regulations extend to England and Wales only.
(5) This regulation and regulation 37 also extend to Scotland.

**"Flood"**

2.—(1) "Flood" includes any case where land not normally covered by water becomes covered by water.
(2) It does not matter for the purpose of paragraph (1) whether a flood is caused by—
(a) heavy rainfall,
(b) a river overflowing or its banks being breached,
(c) a dam overflowing or being breached,
(d) tidal waters, or
(e) any other event (or combination of events).

(a) See the European Communities (Designation) Order 2008 (S.I. 2008/301).
(b) 1972 c. 68.

England and Wales have recently implemented the Flood Risk Regulations (2009) which came into force on the 10th December 2009, transposing the Directive into law. These regulations outline the requirement for the Environment Agency and Lead Local Flood Authorities (LLFA) to create Preliminary Flood Risk Assessments (PFRAs), with the aim of identify significant flood risk (SFR) areas.

- PFRAs must be completed by the Environment Agency for flooding from main rivers, the sea, and reservoirs.
- LLFR must complete PFRAs for local flood risk - i.e. other sources apart from rivers, the sea and reservoirs (therefore focusing on ordinary watercourses, surface water and groundwater flooding).

For these SFR areas flood hazard and flood risk maps must be created by the Environment Agency or LLFA (dependent on the source of risk as above). Flood Risk Management Plans (FRMP) will also need to be created for each flood risk area identified. These FRMP must include:

- Objectives for the purpose of managing ; flood risk:
  - With the aim of reducing the adverse consequences of flooding to human health, economic activity and the environment, and
  - Reducing the likelihood of flooding.
- The proposed measures for achieving those objectives

The timetable for which these assessments or plans should be carried out is outlined below:

**Table 3-1: Flood Risk Regulations 2009 Timetable**

| Assessment or Plan | Organisation to carry out study | Deadline | 1st Review |
|---|---|---|---|
| River Basin PFRA | Environment Agency | 22nd Dec 2011 | 22nd Dec 2017 |
| Local Authority PFRA | Lead Local Flood Authorities | 22nd Dec 2011 | 22nd June 2017 |
| River Basin Flood Hazard and Risk Maps | Environment Agency | 22nd Dec 2013 | 22nd Dec 2019 |
| Local Authority Flood Hazard and Risk Maps | Lead Local Flood Authorities | 22nd Dec 2013 | 22nd June 2019 |
| River Basin FRMP | Environment Agency | 22nd Dec 2015 | 22nd Dec 2021 |
| Local Authority FRMP | Lead Local Flood Authorities | 22nd Dec 2015 | 22nd June 2021 |

**The Environment Agency and Defra are currently preparing guidance for Lead Local Flood Authorities in England and Wales, to help undertake PFRAs. Government will soon be drafting a cover letter to every Local Authority Chief Executive informing them of the guidance release, with the draft guidance expected in May 2010.**

Guidance has been drafted on the content of the Preliminary Assessment Reports on past and future flood risk, whilst outline methodologies have been developed using national datasets to determine significant flood risk and identify Flood Risk Areas. Preliminary Assessment Maps for the river basin districts have also been prepared.

It is expected however, recommendations will be made for the use of existing flood risk planning outputs of RFRAs and SFRAs to deliver the requirements of PFRAs along with SWMPs becoming FRMPs under the directive, and will also be a tool more generally for local flood risk management. This integrated approach will underpin the planning system and guide the location of future development to avoid and minimise flood risk, whilst also meeting the requirements of the Floods Directive. Local authorities, through their land use planning activities, have a key role to play.

### 3.2.3 Improving Surface Water Drainage

The “Improving Surface Water Drainage” consultation document was produced in support of the Government’s water strategy and in line with Sir Michael Pitt’s initial conclusions. Many of the proposals identified have been carried forward into the new Flood and Water Management Act. The consultation considers policy measures to improve the way surface water runoff is managed. In particular, it proposes:

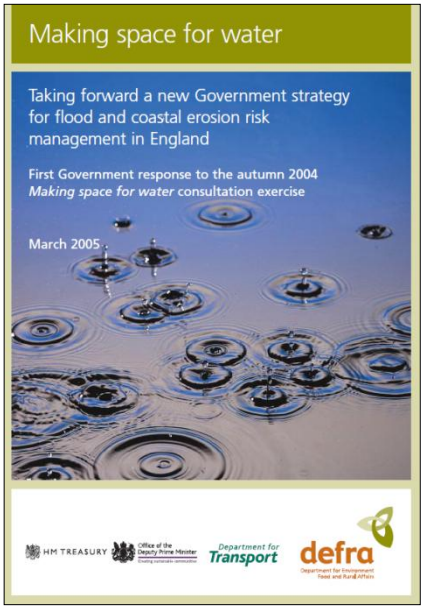
1. Issuing SWMPs as a tool to improve co-ordination between stakeholders involved in drainage and local management of flood risk;
2. Increasing uptake of SUDS by clarifying responsibilities for adoption and management; and

3. Reviewing the ability for premises to connect surface water drainage automatically into the public sewer system.

Current roles and responsibilities were considered along with various options for improving the current surface water drainage situation. In particular the document recognises that SFRAs and SWMPs already form part of the PPS25 planning framework and there is an aim to enhance their role and make stronger links between surface water drainage and strategic planning.

### 3.2.4 Making Space for Water Strategy

The "Making Space for Water Strategy" is a milestone document that confirms the Government's strategic direction for Flood and Coastal Erosion Risk Management (FCERM). Over the 20-year lifetime of the new strategy, Government will implement a more holistic approach to managing flood and coastal erosion risks in England. The approach will involve taking account of all sources of flooding, embedding flood and coastal risk management across a range of Government policies, and reflecting other relevant Government policies in the policies and operations of operating authorities for flood and coastal erosion risk management.




The 2004 document "Making Space for Water" sets out the following vision:

*"…we want to make space for water so that we can manage the adverse human and economic consequences of flooding and coastal erosion while achieving environmental and social benefits in line with wider government objectives."*

In other words, the aim of the strategy is to balance the three pillars of sustainability, managing flood risk and ensuring that the social and economic benefits which accrue from growth and development are attained. This balanced approach, integrating sustainable development with responsible risk management, has underpinned this SFRA.

Section 7 of the consultation document deals with measures to reduce flood risk through land-use planning, which emphasises the Government's commitment to ensuring that the planning system aims to reduce flood risk wherever possible and, in any event, should not add to it. However, it is acknowledged that 10% of England is already within mapped areas of flood risk and that contained within these areas are some of the Brownfield sites which other areas of Government policy has identified as a priority for future housing provision. The document asserts that over the past five years, 11% of new houses were built in flood-risk areas. The document identifies three sets of measures which may be undertaken to manage flood risk when development is sited in such areas:

- Protection measures to provide, at minimum, the standards of protection specified in PPS25;
- Provision of features such as sacrificial areas and compartmentalisation to reduce the consequences of a flood event should one occur (such as functional floodplain); and
- Use of construction techniques that increase the flood resistance and resilience of buildings.

The document proposes that RSSs and LDFs should take full account of flood risk and incorporate the sequential approach in PPS25. Moreover, the document encourages integration with other planning systems, in particular Catchment Flood Management Plans. Use of European Union (EU) funding streams, such as Intgerreg IIIB is

recommended where applicable, to enable Local Authorities to undertake trans-national projects aimed at advancing knowledge and good practice in flood risk management.

### 3.2.5 Making Space for Water: Programme of Work

The "Making Space for Water: Programme of Work" was developed following consultation and takes account of any relevant recommendations that emerged from the Pitt Review into the 2007 floods that affected many parts of England.

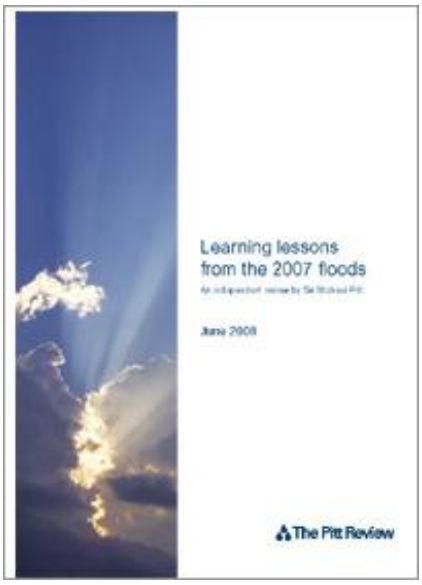
One of Defra's and CLG's early outputs from the Making Space for Water Programme was the publication, of PPS25 in December 2006. This work, together with the Practice Guide forms the Governments required approach to managing and reducing flood risk through the land use planning system.

A valuable piece of work looking at "Developing a Broader Portfolio of Options to Deliver Flooding and Coastal Solutions" has been carried out as part of this programme and is very useful to local authorities and other operating authorities, in their strategic planning of flood risk management. Outputs from this work are available from Defra. Quarterly update reports are released providing details of progress made and key achievements. These reports can be accessed via the Making Space for Water website at

**www.defra.gov.uk/environment/flooding/policy/strategy/index.htm** [14/12/2009]

### 3.2.6 The Pitt Review

The "Pitt Review" has been carried out following the severe floods of summer 2007 and is a key document for local authorities in their consideration of flood risk management. Sir Michael Pitt was asked by Ministers to conduct an independent review of events and report on the lessons that should be learned. In December 2007 an Interim Report was published by the Review team. The Review collected evidence by visiting affected areas and examining over 600 written statements submitted by victims of the floods. The report presents a schedule of interim conclusions, many of which relate to local authorities. These interim conclusions shaped the National approach to flood management and can be accessed via the Defra website.




Pitt's final report was released in June 2008 and contains detailed findings, conclusions and 92 recommendations for action, covering all aspects of strategic and local flood risk management. These interim conclusions are intended to shape the National approach to flood management and can be accessed via the Defra website. Some of the recommendations which are relevant to this SFRA and the role of local authorities' in future local flood risk management include;

- **Recommendation 11** – Building Regulations should be revised to ensure that all new or refurbished development in high flood risk areas are flood resistant or resilient.
- **Recommendation 14** – Local Authorities should lead on the management of local flood risk, with support of the relevant organisations.
- **Recommendation 15** – Local Authorities should positively tackle local problems of flooding working with all relevant parties, establishing ownership and legal responsibility.
- **Recommendation 16** – Local Authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.

- **Recommendation 17** – All relevant organisations should have a duty to share information and cooperate with local authorities and the Environment Agency to facilitate the management of flood risk.
- **Recommendation 18** – Local Surface Water Management Plans, as set out under PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk.
- **Recommendation 19** – Local Authorities should assess and, if appropriate, enhance their technical capabilities to deliver a wide range of responsibilities in relation to local flood risk management.
- **Recommendation 20** – The Government should resolve the issue of which organisations should be responsible for the ownership and maintenance of sustainable drainage systems.
- **Recommendation 52** – In the short term, the Government and infrastructure operators should work together to build a level of resilience in critical infrastructure assets that ensures continuity during worst case flood event.
- **Recommendation 57** – The Government should provide Local Resilience Forums with the inundation maps for both large and small reservoirs to enable them to assess risks and plan for contingency, warning and evacuation.

Pitt's findings, conclusions and recommendations for action are challenging but will be extremely important in guiding local authorities and other operating authorities in their consideration of future flood risk management activities, including land use planning. They have also been a key driver in shaping the content of the draft Flood and Water Management Bill, which has now become and Act.

## 3.3 National Planning Policy

This SFRA has been prepared in a period during which planning authorities have been implementing the provisions of the Planning and Compulsory Purchase Act 2004 and accompanying planning guidance, including PPS1 Delivering Sustainable Development and PPS12 Local Development Frameworks. This affected all tiers of the planning system and has necessitated major changes at both the regional and local level which will impact on the way in which planned development is approached in the regional strategy and delivered locally.

### 3.3.1 PPS25: Development and Flood Risk

In 2006 the Government published PPS25: Development and Flood Risk.


The aim of PPS25 is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. The key planning objectives are that:

Regional Planning Bodies (RPBs) and Local Planning Authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

- Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;
- Preparing Regional or Strategic Flood Risk Assessments (RFRAs / SFRAs) as appropriate, as a freestanding assessment that contributes to the Sustainability Appraisal of their plans;

- Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;
- Only permitting development in areas of flood risk when there are no suitable alternative sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding;
- Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water, and flood defences;
- Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS);
- Using opportunities offered by new development to reduce the cause and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; re-creating functional floodplain; and setting back defences;
- Working effectively with the Environment Agency, other operating authorities and other stakeholders to ensure that best use is made of their expertise and information so that plans are effective and decisions on planning applications can be delivered expeditiously; and
- Ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning.

In addition to setting out the roles and responsibilities for LPAs and RPBs, PPS25 identifies that landowners also have a primary responsibility for safeguarding their land and other property against natural hazards such as flooding. Those promoting sites for development are also responsible for:

- Demonstrating that is consistent with PPS25 and Local Development Documents (LDDs);
- Providing a Flood Risk Assessment (FRA) demonstrating whether the proposed development: is likely to be affected by current or future flooding; satisfies the LPA that the development is safe; and identifies management and mitigation measures.

In 2006, PPS25 introduced an amendment to Article 10 of The Town and Country Planning (General Development Order) 1995 which makes the Environment Agency a Statutory Consultee on all applications for development in flood risk areas, and those within 20m of a Main River.

The Direction also introduces the requirement for LPAs to notify the Secretary of State where they are minded to approve a planning application contrary to a sustained objection by the Environment Agency.

The introduction of PPS25 enables local authorities to make a direction under Article 4 of the Town and County Planning (General Permitted Development) Order 1995. This will enable Local Authorities to remove permitted development rights where those rights threaten to have a direct, significant and adverse effect on a flood risk area, or its flood defences and their access, or the permeability and management of surface water, or flood risk to occupants.

### PPS25 March 2010 Update

In March 2010, CLG published a revised version to PPS25, which clarifys some aspects of the existing national spatial planning policy on development and flood risk, to help ensure the policy is applied effectively. This version of PPS25 should now be used.

The updated PPS25 mirrors the 2006 version, however includes amendments to the ‘definition’ of Flood Zone 3b (the Functional Floodplain) in Table D.1 in Annex D, and to some of the Flood Risk Vulnerability Classifications in Table D.2, Annex D.

The definition of the functional floodplain has been updated to:

*"..The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain"*

The reasoning behind this was that by simply stating it should be based on probability rather than local circumstance, leads to areas of land that are not intended to allow for floodwater to flow or be stored being inappropriately identified as functional floodplain, and potentially also for areas that are designed to flood being wrongly excluded from identified functional floodplain.

There are four amendments in Table D.2 including:

- Moving water treatment and sewage treatment works from 'less vulnerable' to 'essential infrastructure'. This means they will now need to pass the Exceptions Test if planned in Flood Zone 3a rather than just Flood Zone 3b. As usual, they will have to be designed to the appropriate uses and policy aims within Table D.1
- Allowing police, ambulance and fire stations to be defined as 'less vulnerable' only if they are not required to be operational during flooding. This will stop the exclusion of new emergency services facilities from communities they service in high flood risk areas.
- To allow facilities requiring hazardous substances consent, which are required to be located in flood risk areas, due to their need to be co-located with other facilities (i.e. the need to be located near ports, or processed or manufactured facilities) to be defined as 'essential infrastructure' rather than 'highly vulnerable'
- Adding wind turbines to the 'essential infrastructure' category. However, in keeping with PPS22, the Sequential Test is not required but Parts A) and C) of the Exceptions Test would need to be passed if located in Flood Zone 3a and 3b.

### PPS25: Development and Flood Risk Practice Guide

The Practice Guide to PPS25 was published by the Department for Communities and Local Government (CLG) in June 2008 following on from the original PPS25 in 2006. It provides advice on the practical implementation of PPS25 policy and reflects extensive discussion with local authorities, the Environment Agency and other key stakeholders and practitioners. The guide provides further guidance on the preparation of SFRA's and FRA's, the Sequential and Exception Test, outlines potential mitigation measures e.g. SUDS and risk management techniques.

Local Authority planners and developers are advised to refer to and use PPS25 and its Practice Guide in conjunction with the further advice and guidance contained within this report.

In December 2009, CLG published an update to the PPS25 Practice Guide which replaces the version published in June 2008. It reflects the intention announced at the time of publication to keep the guide fresh and relevant through periodic updates. The majority of the updates are relatively minor acknowledging material such as the Pitt Review and new flood risk information such as the Environment Agency national Areas Susceptible to Surface Water Flooding map.

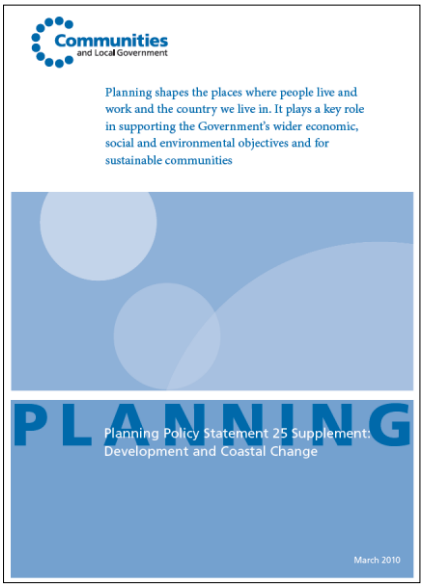
Page v of the Practice Guide draws out some of the more substantial changes from the June 2008 version of the guide. Some of the most important ones relevant to this SFRA are highlighted below.

- *"Additional advice on applying the sequential approach at the regional level over a longer time frame*
- *Further advice on the issues relating to guidance provided within SFRAs, including on the role of surface water management plans*
- *Updated guidance on climate change impacts*

- *Updated guidance on applying the sequential approach to other sources of flooding*
- *Further advice on the application of the Sequential Test, including the availability of alternative sites*
- *Further clarification on defining functional floodplains*[11]"

### 3.3.2 PPS25: Development and Coastal Change

A supplement to PPS25 (Development and Coastal Change) and its Practice Guide was released in March 2010, replacing the policy on managing the impacts of coastal erosion to development set out in PPG20 (1992).




Both the RPB and LPA should take account of the policies within this supplement whilst preparing regional spatial strategies and local development documents respectively to support and deliver appropriate sustainable development in the right places. However, the preparation of these development plans should not be delayed unnecessarily to take these policies into account.

Development and Costal Changed has been added as a supplement to PPS25 Development and Flood Risk because it follows many of the same principles and risk management hierarchy (appraise, identify, avoid, manage and mitigate) and also in recognition of the impact costal erosion can play to future flood risk.

It is the Governments objective to ensure that costal communities continue to prosper and adapt to coastal change. As outlined in the supplement, this means planning should:

- *"ensure that policies and decisions in coastal areas are based on an understanding of coastal change over time*
- *prevent new development from being put at risk from coastal change by:*
  - *avoiding inappropriate development in areas that are vulnerable to coastal change or any development that adds to the impacts of physical changes to the coast, and*
  - *directing development away from areas vulnerable to coastal change*
- *ensure that the risk to development which is, exceptionally, necessary in coastal change areas because it requires a coastal location and provides substantial economic and social benefits to communities, is managed over its planned lifetime, and*
- *ensure that plans are in place to secure the long term sustainability of coastal areas.*[12]"

The identification of areas at risk of coastal change should become an important evidence base to inform plan making. This is likely to be best placed within or as a supplement to RFRAs or Level 1 SFRAs.

The majority of this evidence base should be available from current Shoreline Management Plans (SMP) and associated maps and data developed by the Environment Agency and local authorities, together with other strategic plans that apply to coastal areas. The Environment Agency is currently preparing a new coastal erosion risk mapping tool which will be a valuable resource for these strategic high-level assessments of coastal risk. This mapping tool will be available during 2010-11 and will present:

11 Communities and Local Government (2009) PPS25: Practice Guide
12 Communities and Local Government (2010) PPS25 Supplement: Development and Coastal Change

- The predicted erosion rate for 0-20 years, 20-50 years and 50-100 years into the future, taking climate change into account
- The range of predicted erosion rates for each of these timescales, reflecting the full range of confidence bands (from 5 to 95 per cent)
- Erosion information in an interactive web-based format – using Ordnance Survey maps to provide context

With regards to tasks relevant to LPAs identified in the supplement to PSP25 (policy DCC3), LPAs should identify areas likely to be affected by physical changes to the coast and refer to these areas as the Coastal Change Management Areas (CCMAs). CCMAs should be identified using relevant information discussed above, regional strategies and wider policy objectives and in partnership with other LPAs and relevant agencies and bodies with an interest in the coast.

Where CCMAs have then been identified the LPA should then set out, zone and allocate appropriate development and identify the circumstances in which certain types of development may be permissible. For example, where the rate of coastal erosion is high over the short term development must be avoided and a managed retreat of current infrastructure identified. However, where erosion is progressing at a lower rate appropriate development (safe over its planned lifetime) can occur to sustain the immediate community but longer term development must be avoided and policies to relocate existing infrastructure should be sought. Where development and infrastructure need to be relocated from CCMAs, LPAs need to make provision for sufficient, suitable land outside the CCMAs.

LPAs will also have responsibility within development management during the assessment and approval of planning applications in CCMAs. Where CCMAs have not yet been identified, development management should take a precautionary approach requesting all coastal development proposals include an assessment of coastal change and planning conditions are applied where necessary.

### 3.3.3 Other Planning Policy Statements

PPS1 Delivering Sustainable Development published in February 2005 sets out the overarching planning policies for the delivery of sustainable development across the planning system and sets the tone for other planning policy statements. PPS1 explicitly states that development plan policies should take account of flooding, including flood risk. It proposes that new development in areas at risk from flooding should be avoided. Planning authorities are also advised to ensure that developments are "sustainable, durable and adaptable" including taking into account natural hazards such as flooding.

PPS1 also places an emphasis on 'spatial planning' in contrast to the more rigid 'land use planning' approach which it supersedes. Planning authorities will still produce site specific allocations and a proposals map as LDDs, but their Core Strategy will be more strategic and visionary in content and will take into account the desirability of achieving integrated and mixed use development and will consider a broader range of community needs than in the past. With regard to flood risk, it will be important for the Core Strategies and accompanying Supplementary Planning Documents to recognise the contribution that non-structural measures can make to flood management.

Planning Policy Statement: Planning and Climate Change, a supplement to PPS1, published in December 2007, sets out how the Government expects the planning system to address climate change. It explains that there is a compelling scientific consensus that human activity is changing the world's climate. The evidence that climate change is happening, and that man-made emissions are its main cause, is strong. The Intergovernmental Panel on Climate Change highlights that we are already experiencing the effects of climate change and if these changes deepen and intensify, as they are predicted to do without the right responses locally and globally, we will see even more extreme impacts.

One of the predicted impacts of climate change is more intense periods of rainfall and consequent flooding. The PPS1 supplement requires Regional Spatial Strategies and

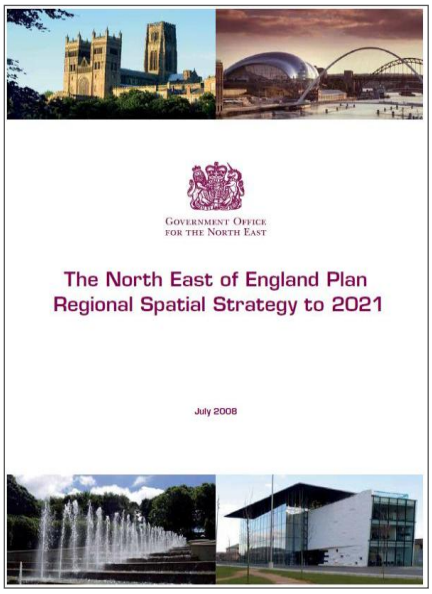
Local Development Frameworks to shape sustainable communities that are resilient to such effects. A key objective of the planning system being to secure new development and shape places that minimise vulnerability and provide resilience to climate change in ways that are consistent with social cohesion and inclusion. Accordingly new development should be planned to minimise future vulnerability in a changing climate. Carrying out the Sequential and Exception Test is essential in meeting the objectives of the PPS1 supplement Planning and Climate Change.

Whilst not directly relevant to the development of an SFRA, it is important to recognise that the exercise takes place within the context of other planning policy guidance and statements, some of which also require sequential testing of site allocations and development proposals. PPS3 (Housing), emerging PPS4 (Planning for Sustainable Economic Development) and PPS6 (Planning for Town Centres) are intrinsic within the planning process and, therefore, an understanding of the constraints faced as a result of this additional policy guidance is required.

## 3.4 Regional Policy Drivers

### 3.4.1 Regional Spatial Strategy

The Regional Planning Guidance for the North East (RPG1) was published in November 2002. In September 2004, following the implementation of the Planning and Compulsory Purchase Act 2004, the Regional Planning Guidance was converted to the Regional Spatial Strategy (RSS) in line with Governmental reforms. The converted RSS was prepared as a draft revision called VIEW: Shaping the North East, which was issued for consultation in December 2004 and published in August 2006.




After two rounds of consultation periods the North East RSS was updated and published in July 2008. It now outlines the current adopted planning strategy for the period to 2021.

The published RSS, when compared to the previous, demonstrates an increased emphasis and heightened awareness of flood risk under Policy 35. It states that:

*"Strategies, plans and programmes should adopt a strategic, integrated, sustainable and proactive approach to catchment management to reduce flood risk within the Region, managing the risk from:*

- *Tidal effects around estuaries and along the coast including the implications of the latest Government predictions for sea level rise;*
- *Fluvial flooding along river corridors and other significant watercourses resulting from catchments within and beyond the Region and other sources of flooding; and*
- *Flooding resulting from surface water runoff and capacity constraints in surface water drainage systems.*

*In developing Local Development Frameworks and considering planning proposals, a sequential risk-based approach to development and flooding should be adopted as set out in PPS25. This approach must be informed by Strategic Flood Risk Assessments prepared by planning authorities in liaison with the Environment Agency to inform the application of the Sequential Test and, if necessary, the Exception Test, in development allocations in their LDDs and consideration of planning proposals."*[13]

13 Communities and Local Governments (2008) The North East England Plan Regional Spatial Strategy to 2021

### 3.4.2 Northumbria River Basin Management Plan

In accordance with the Water Framework Directive (WFD), implemented in December 2000, a River Basin Management Plan (RBMP) must be produced for each of the 11 River Basin Districts by 2009. The Environment Agency state that:

*"RBMPs will have a number of functions, but are primarily intended:*

- *To establish a strategic plan for the long term management of the River Basin District.*
- *To set out objectives for waterbodies and in broad terms what measures are planned to meet these objectives*
- *Act as the main reporting mechanism to the European Commission"*

The Northumbria River Basin District is one of only two that cross the England-Scotland border. The Environment Agency recognise that cross-board RBDs can,

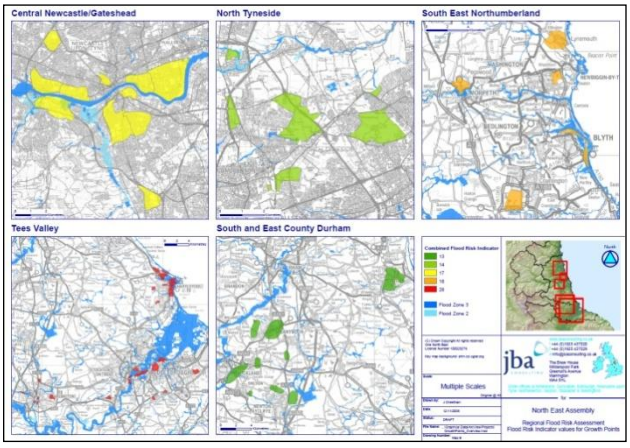
*"Raise issues for the relationship between those responsible for the delivery of the WFD's objectives, the devolved governments, local authorities and government agencies."*[14]

The North East RSS observes that,

*"To ensure the planning system can positively facilitate the delivery of the Directive's objectives and the River Basin Management Plan can take account of local priorities, frequent dialogue between the Environment Agency and local planning authorities at all stages in the planning cycle is essential."*[15]

### 3.4.3 North East Regional Flood Risk Appraisal

JBA Consulting was commissioned by the North East Assembly (NEA) in conjunction with One Northeast to undertake a scoping study for the Regional Flood Risk Appraisal (RFRA). The scoping study examines the Strategic Flood Risk Assessments undertaken across the North East region, and considers how these could form the basis for a more strategic flood risk appraisal. By using the sub-areas defined in the RSS, the study provides a more holistic view of flood risk, and therefore planning implications at a sub-area level.




The appraisal is displayed through maps which have been structured:

- Regionally through economic indicators,
- At city regions via a range of flood risk indicators presented at Growth Point Level; and
- At Growth Areas using a broad range of combined flood risk indicators.

The scoping report and associated maps can be found on the Association of North East Council (ANEC) website.

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.

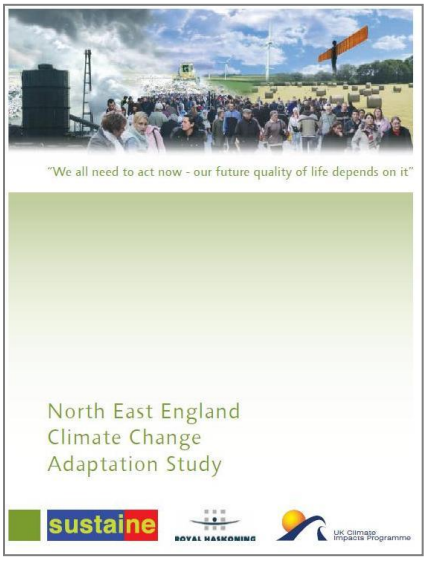
14 The Environment Agency (2005) Briefing Note: Cross-border River Basin Districts and the Water Framework Directive www.environment-agency.gov.uk/commondata/acrobat/bn_cb_2005_1184314.pdf
15 Communities and Local Governments (2008) The North East England Plan Regional Spatial Strategy to 2021

The RFRA assists decisions on key land use factors such as need for employment, inward investment, re-generation, provision of housing and open/green space, major road and other infrastructure development provision to deliver sustainable growth whilst taking full account of flood risks, now and in the future. The appraisal also drives and informs policy development and setting in the Regional Spatial Strategy (RSS) for the strategic management of flood risk, and in turn assists local authority planners in their consideration and implementation of land use policies in Local Development Frameworks (LDFs) and Local Development Documents (LDDs). In addition, it provides important strategic flood risk input to the Regional Sustainability Appraisal (RSA) and the Strategic Environmental Assessment (SEA).

The outputs of the RFRA help to identify where there may be a need for further flood risk assessment work to be undertaken, particularly in respect of SFRAs and where strategically significant developments are proposed in areas currently at risk of flooding. Even where SFRAs already exist, the RFRA helps to place specific local authority flood risks into a regional context, showing the variation of risk and the interdependency between neighbouring authorities and river sub-catchments. Flooding does not respect local authority administrative boundaries and the RFRA provides a mechanism to help local authorities work better together, and with key stakeholders, to consider, communicate and share common or similar flood risk management policy objectives, opportunities and constraints.

### 3.4.4 Climate Change Action Plan for the North East

'And the Weather Today is...Climate Change in the North East' was published in 2002 based on the UKCIP 2002 scenarios. This was followed by the North East Climate Change Adaption Study in 2008.




The Climate Change Action Plan for North East England identifies what is needed to be done to tackle climate change in North East England. It shows how all sectors have the opportunity to actively engage with this work, take direct action and influence how the plan is developed.

Climate change action plans already exist or are being developed at a sub-regional and local level. The action plan for North East England provides a regional framework that coordinates and facilitates action at a regional level, incorporating both adaptation and mitigation measures, ensuring that a regional evidence base is developed to inform those local action plans.

Climate change impacts continue to provide an increasing challenge to sustainable flood risk management for government and operating authorities. The severe flooding experienced across the country in recent years and in particular during the summer 2007 were, in the words of Sir Michael Pitt, "a wake up call".

Flood risk related climate change issues are extremely important to the future management of flood risk in the UK and beyond. These issues need to be taken seriously and mitigation and adaptation measures planned and adopted by Regional and Local Authorities.

Principle adverse flood risk effects of climate change threatening people and property include:

- More frequent and intense rainfall events causing flash flooding to low lying areas;
- More and faster surface water runoff and overland flows causing sewers, drains, rivers and streams to overflow;

- Increased sea level rise, storminess and frequency of storm surges threatening low lying coastal communities; and
- Rising groundwater levels causing increased spring source activity and higher spring flows increasing the risk of flooding.

If not addressed, these effects are likely to have a significant impact on many communities and in particular new developments in areas at high risk of flooding. Recent climate change trends are contained within a UK Climate Impacts Programme document: The Climate of the United Kingdom and Recent Trends published in December 2007 and is available on their website.

**The UKCIP09 report was launched in late 2009. However, they have not been fully integrated into modelling guidance as yet. It is recommended that future studies use the lasts sensitivity ranges once guidance is made available.**

In recognition of the Governments increasing concerns about the effects of climate change on flood risk management, Defra produced a "Supplementary Note to Operating Authorities – Climate Change Impacts" in October 2006 in which they updated the climate change policy for flood and coastal management. This document is available on the Defra website. In conjunction with Defra, CLG then provided the recommended climate change contingency allowances for sea level rise and precautionary sensitivity ranges for peak rainfall intensities and peak river flows etc. in Annex B of PPS25. These figures should be used in all aspects of flood risk management including the consideration of new developments and changes of land use in flood risk areas.

## 3.5 Local Planning Policy

Following the introduction of the Planning and Compulsory Purchase Act 2004, the way in which development plans are prepared is changing. With the aim of speeding up and simplifying plan preparation and improving community involvement, development plans in their current form are to be abolished and replaced with a new development plan system, the LDF.

### 3.5.1 Sunderland City Council Unitary Development Plan

The Sunderland City Council's UDP was adopted in 1998 and sets out the Council's requirements for development including transport until 2006. Insofar as the consideration of flood risk is concerned applications for development would be subject to saved UDP policies **EN11** (development in areas subject to flooding), **EN12** (impact of development on flooding and water quality) and **EN13** (the 'coastal zone').

The UDP policies are based on the provisions of DoE Circular 30/92 "Development and Flood Risk" and PPG20 "Coastal Planning (1992)" (referred to in UDP paragraph 9.39). The UDP policies are 'saved' under the Local Development Scheme and will eventually be replaced by the LDF Core Strategy and other Development Plan Documents (DPDs).

Sunderland City Council began a review of the UDP in 2000, producing an amended document through Alteration No. 2 (2007), which concentrates on the proposed policies of Central Sunderland and should therefore be read in conjunction with the 1998 UDP.

Several riverside development sites were identified at risk of flooding from the River Wear. However, redefined Environment Agency Flood Zones in 2008 removed this risk.

Housing sites in Alteration No 2 have been considered in the context of preparation of the Council's Interim Strategy for Housing Land (ISHL – February 2006). The ISHL provides a non-statutory housing land allocations policy and identifies sites throughout the City to meet new housing needs up to 2021. It has been approved as a material consideration in determining planning applications and as input to the Local Development Framework (LDF). The sites have been included in this SFRA study.

Sunderland City Council has started work on preparing the LDF for the city, which sets out information on the council's programme of work on the replacement of the current UDP policies.

### 3.5.2 Sunderland City Council Emerging Local Development Framework

The UDP is currently in the process of being replaced by the Local Development Framework (LDF). The LDF will take the form of a portfolio of plans and documents made up of several Local Development Documents (LDDs). Some of them will have statutory status (Development Plan Documents) and others will be adopted as local guidance documents. LDDs can either deal with different issues or different geographical areas, but when taken together they will set out the Council's policies for how it will assess development proposals and direct future growth.

These documents will include but are not limited to:

**Table 3-2: Sunderland City Council LDF Documents**[16]

| Document | Subject Matter |
|---|---|
| Local Development Scheme | The LDS sets out the timetable for the documents that the council will be producing as part of the LDF. It provides a starting point to see what documentation will be produced and at what stage people can become involved in the LDF process, and illustrates when documents would be submitted to the Secretary of State and the timescale for adoption. |
| Statement of Community Involvement | The SCI sets out how the Council proposes to engage communities and stakeholders in not only the preparation of local development documents but also the consideration of planning applications. |
| Core Strategy | The Core Strategy will provide the overall spatial vision and strategy for the City of Sunderland. It will address important city-wide spatial matters including housing, economy, retail, sustainability, community safety, tourism, transport, and areas of regeneration. It will aim to conform to the Regional Spatial Strategy and take forward the aims of planning related issues related to sustainable development and sustainability. It will also take into account other city-wide plans and strategies, including those produced by other agencies. |
| Allocations DPD | Provides site-specific allocations for housing, employment, retail, community, open space, waste management and transport proposals. |
| Hetton Downs Area Action Plan | Sets out the planning framework and land use proposals for major sites in Hetton Downs. |
| Annual Monitoring Report | The AMR provides a review of how the Council is performing in terms of the LDF, the LDS timetable and monitors DPD policies. |
| Supplementary Planning Documents | SPDs and Supplementary Planning Guidance (SPG) are not statutory documents, but supplement DPDs by giving more detailed advice on how to comply with the policies contained within the relevant DPD. |

### 3.5.3 LDF Evidence Base

The LDF Evidence Base is a collection of studies, reports and surveys undertaken by Sunderland City Council to gather information for the LDF. The LDF evidence base currently includes the:

- Strategic Housing Land Availability Assessment
- Strategic Housing Market Assessment
- Retail Needs Assessment
- Employment Land Assessment
- Green Space Audit
- Strategic Flood Risk Assessment

16Information found at http://www.sunderland.gov.uk/public/editable/themes/environment/PlanningandEnvironment/PlanningPolicy/LDF/ldf-folder/ldf.asp [14/07/2009]

As highlighted above, the Strategic Flood Risk Assessment (SFRA) forms a key part of the LDF evidence base by assisting Sunderland City Council in making spatial planning decisions and determining planning applications. The SFRA will be used as a planning tool to enable the City Council to select sustainable development allocations away from areas of potential flood risk. The assessment has focused on the existing development sites within the city but also sets out procedures to be followed when assessing additional sites for development in the future. The first SFRA was produced in accordance with PPS25. Since its publication there have been a number of key policy changes and availability of key flood risk information, triggering this review which should form part of the new evidence base including the PPS25 Practice Guide.

Additional work is also being undertaken to provide key evidence to underpin the Core Strategy and Allocations DPD, including:

- Infrastructure Delivery Plan
- Identification of Strategic Sites
- Green Infrastructure Strategy

## 3.6 Environment Agency Policy

### 3.6.1 Catchment Flood Management Plan

Sunderland is covered by two CFMP areas; the Tyne CFMP and the Wear CFMP. Both CFMPs were published in December 2008.

The CFMPs are a high level policy document covering the whole of the River Tyne and Wear catchments. The CFMP investigates what factors influence flood risk at the catchment scale and assess the impacts that climate change, land use change and urbanisation may have on flood risk over the next 50 to 100 years.

Each CFMP has established policy frameworks for flood risk management across the catchments through which future flood defence management strategies and programmes will be formulated. Recognition of these strategic plans is very important to local authority planners when planning for the future and considering long term land use options for re-generation, inward investment and growth.

The CFMPs help to prioritise activities, focus resources where there is greatest need, and determine what flood risk management responses need to be considered further (and which responses will not be effective). The responses to flood risk will be broader than those traditionally used for flood defence to reflect the full range of management options available. CFMPs support an integrated approach to spatial planning and river basin management, in line with the Water Framework Directive and the EU Directive on the assessment and management of flood risk; they cover all geographical areas in England and Wales and are crucial in the planning of sustainable flood risk management.

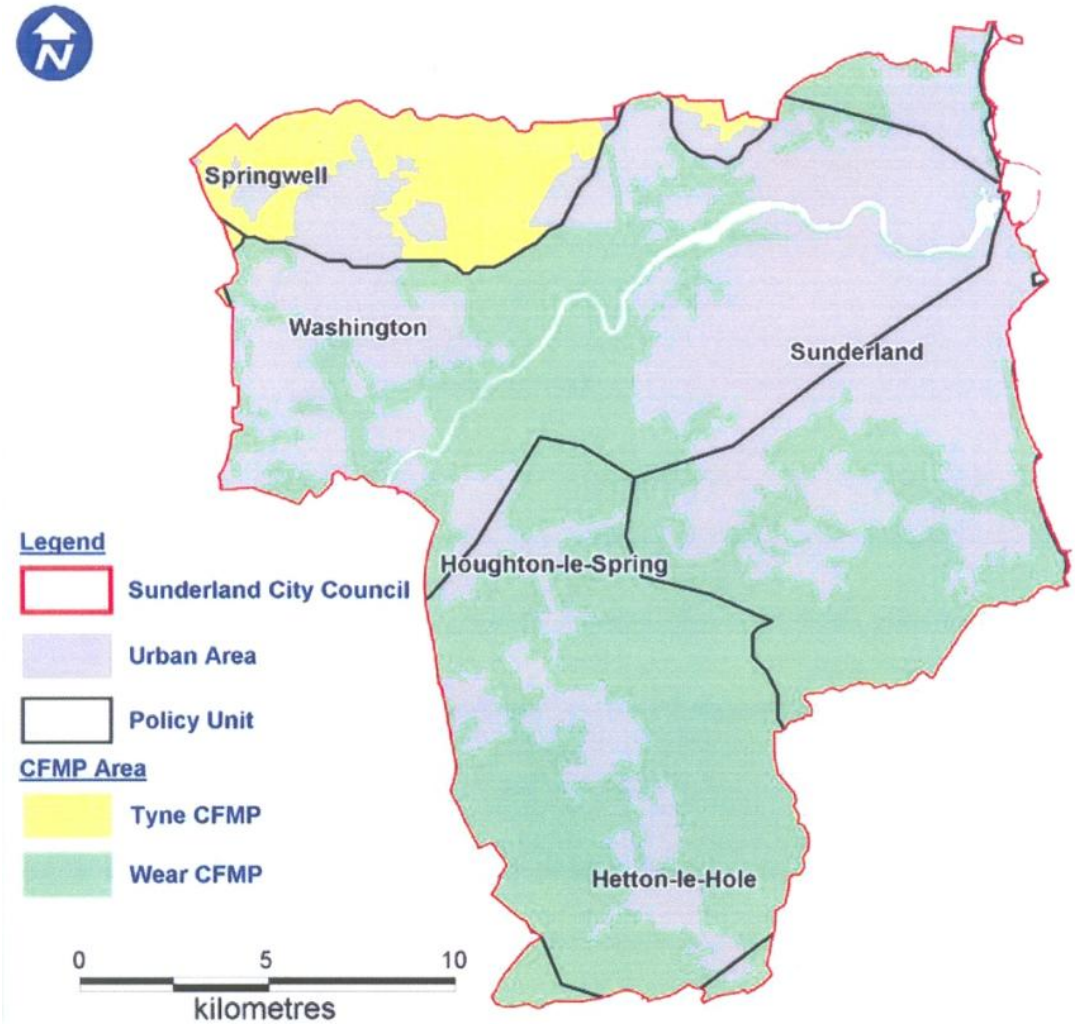
Sunderland is covered by 6 CFMP Policy Units. These are summarised in Table 3-3 and illustrate in Figure 3-1.

**Table 3-3: Tyne and Wear CFMP Policy Units Covering Sunderland**

| CFMP | Policy Unit | Policy | Actions for SCC |
|---|---|---|---|
| Tyne | Don | Continue with existing or alternative actions to manage flood risk at the current level | No |
| Tyne | Derwent and Rural River Team | Reduce existing flood risk management options | No |
| Wear | Tursdale, Croxdale & Oldham Durham Becks | Reduce existing flood risk management options | No |
| Wear | Lumley Park Burn | Continue with existing or alternative actions to manage flood risk at the current level | Yes |

| CFMP | Policy Unit | Policy | Actions for SCC |
|---|---|---|---|
| Wear | Tidal River Wear | Take further action to reduce flood risk | Yes |
| Wear | Coastal Streams | No Active Intervention | Yes |

**Figure 3-1: Tyne and Wear CFMP Policy Units covering Sunderland**[17]




### 3.6.2 Shoreline Management Plan

Shoreline Management Plans (SMPs) provide coastal operating authorities with opportunities to consider the longer term implications of protecting the coast and coastal communities. They provide a large scale assessment of the risks associated with coastal processes and help in determining policies and procedures to reduce flood risks to people and the built and natural environment. Many SMP1s are in the process of being updated following new guidance issued by Defra.

The River Tyne to Flamborough Head Shoreline Management Plan 2 (SMP2) was published in February 2007 on behalf of the Northumbria Coastal Authorities Group (NCAG). The SMP2 collates information from the three original SMPs (SMP1) produced for the sub-cells 1b, 1c and 1d, completed in 1998, 1999 and 1997 respectively.

17 Environment Agency (2009) Sunderland City Council Local Area Agreement: NI189 - Flood risk and coastal erosion

A SMP provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner up to 2105. Its objectives are to:

- Provide an understanding of the coast, its behaviour and its values.
- Define, in general terms, the risks to people and the developed, natural and historic environment within the SMP2 area over the next century.
- Appraise different policy approaches and identify the preferred policies for managing those risks or creating opportunity for sustainable management.
- Examine the consequences of implementing the preferred policies in terms of the objectives for management.
- Set out procedures for monitoring the effectiveness of the SMP policies.
- Inform others so that future land use and development of the shoreline can take due account of the risks and preferred SMP2 policies.
- Comply with international and national nature conservation legislation and biodiversity obligations.

The generic SMP policies considered in the SMP2 are those defined by Defra, and they are represented by the statements:

- **Hold the Line (HTL)** – Maintain or upgrade the level of protection provided by defences
- **Advance the Line (ATL)** – Build new defences seaward of the existing defence line
- **Managed Realignment (MR)** – Allowing realignment of the shoreline, with management to control or limit movement
- **No Active Intervention (NAI)** – A decision not to invest in providing or maintaining defences

SSC is covered by three Management Units (MA06, MA07 and MA08) in which individual SMP policies are set. Chosen policies along the coast are highlighted in Table 3-4.

**Table 3-4: SMP2 Policy Plan for Sunderland**

| MA | Policy Unit | Policy Plan | | | |
|---|---|---|---|---|---|
| | | 2025 | 2055 | 2105 | Comment |
| 6.1 | Whitburn Cliffs | NAI | NAI | NAI | No change |
| 6.2 | The Bents | MR | MR | HR* | Provide additional near shore protection |
| 6.3 | South Bent/Seaburn | HTL | HTL | HTL | Maintain defences and improve beach control |
| 6.4 | Parson's Rocks | HTL | HTL | R | Eventually remove defences |
| 6.5 | Marine Walk | HTL | HTL | HTL | Maintain defences and improve beach control |
| 7.1 | Main Harbour Piers | HTL | HTL | HTL | Principal benefits to Port operation |
| 7.2 | North Harbour | HTL | HTL | HTL | Improve condition of North Pier |
| 7.3 | South Harbour | HTL | HTL | HTL | Examine opportunity for local retreat |
| 8.1 | Harbour East Bay | HTL | HTL | HTL | Integrate with land use planning |
| 8.2 | Harbour South face | HTL | HTL | HTL | - |
| 8.3 | Hendon Seawall | HTL | HTL | HTL | Linked benefits with area to south |
| 8.4 | Hendon to Pincushion | R | MR | MR | Hard point control |

| MA | Policy Unit | Policy Plan | | | |
|---|---|---|---|---|---|
| | | 2025 | 2055 | 2105 | Comment |
| 9.1 | Pincushion to Seaham | NAI | NAI | NAI | - |
| MA - Management Area, HTL - Old the Line, A - Advance the line, R - Retreat of Realignment, NAI - No active intervention, MR - Managed realignment | | | | | |

The SMP2 provided an Action Plan to be carried out by Sunderland City Council in order to implement the chosen polices highlighted above. It will be in general, the Operating Authority who, even if not actually managing specific actions, will be promoting or ensuring actions are undertaken in a timely manner. The SMP confirms the strategy set out in the Whitburn Bay to Ryhope Coast Protection Strategy (May 2001). The key elements of this are maintenance and major refurbishment of the linear defences and the actions recommended are summarised in Table 3-5.

Along the port area, the defence actions need to be integrated with the proposed regeneration plan. This will tend to determine the timescale for action. Over the southern extent of the Council's area both major refurbishment work and reconstruction is to be undertaken. Further south, an investigation into the Halliwell Banks quarry (former landfill site) is on-going. The outcome of this investigation together with the development of detailed appraisal of actions along the Hendon area need to take account of the longer term policies of the SMP2.

**Table 3-5: SMP2 Sunderland Action Plan**

| Time-scale | Action | MA | Responsibility | Cost (£k) |
|---|---|---|---|---|
| 2007 | Complete investigation of Halliwell Banks. Management of potential contamination | 08 | SCC | 80 |
| 2007 | Longitudinal access study to Hendon Beach | 08 | SCC | 5 |
| 2008 | Review strategy prioritisation against outcome measures | 06-08 | SCC | 15 |
| 2008 | Scheme development for Harbour East Bay. Review and develop defence requirements to port regeneration area | 08 | SCC | 50 |
| 2010 | Scheme development. Review strategy and develop appraisal for maintenance and refurbishment plan | 06 | SCC/co-ordinated with STC | 40 |
| 2012 | Review strategy along Hendon frontage/Ryhope | 08 | SCC | 25 |
| 2017 | Review strategy of port area | 07 | SCC | 30 |
| MA - Management Area, SCC - Sunderland City Council | | | | |

### 3.6.3 Local Area Agreements NI189: Flood and Coastal Erosion Risk Management

The Wear CFMP, Tyne CFMP and the River Tyne to Flamborough Head SMP2 discussed above will help steer future investment, policies and overall risk management activities for the catchment through the development of action plans.

As the timescale associated with the actions may not match the long term action plans, resources and funding of other organisations, the Environment Agency see National Indicator 189 (Flood and coastal erosion risk management) as the basis for working with Local Authorities by developing further detail and identifying the financial requirements for the successful implementation of CFMP and SMP actions.

Using NI189 will also allow the Environment Agency and other organisation to target joint efforts and resources in the most beneficial way.

All Local Authorities have to implement NI189. However, some authorities have adopted NI189 as part of their designated or local targets (up to 35 designated targets are developed by LA from the list of 198), reflecting local priorities.

In order to successfully manage flood and coastal erosion throughout the region the Environment Agency has developed an approach which allows the long term requirements for implementation to be taken into account. This three year approach to the long term implementation is outlined below and uses the NI189 Self Assessment Sheet provided at the end of the document. It is based on a percentage of agreed annual targets for CFMP and SMP actions.

- **Year 1 -** Ensuring effective relationships
- **Year 2** - Ensuring commitment to progressing priority actions for flood and coastal erosion risk management
- **Year 3** - Delivering action for change

NI189 for Sunderland City Council highlights five 'catchment approach' actions. These actions require implementation by Sunderland City Council as the responsible party when either leading on implementation or as the supporting authority. These actions include:

1. Ensure that the principles of PPS25 are implemented - *lead authority*
2. Develop further detail for each local authority on the appropriate was in implementing CFMP actions - *supporting authority*
3. Significantly improve public awareness - *supporting authority*
4. Provide information and advice to individual property owners and businesses on improving flood resilience and flood proofing of properties - *supporting authority*
5. Increase the number of properties registered to receive the Environment Agency flood warning service - *supporting authority*

The development of this Level 1 SFRA will help Sunderland City Council meet some of these 'catchment approach' actions, including the implementation of PPS25. The SFRA will help Sunderland City Council prove this action has been carried out in a successful and transparent format.

Along with the 'catchment approach' actions, Sunderland City Council has been given a number of location specific actions which require some element of implementation by Sunderland City Council as the lead or supporting organisation. These include:

**Table 3-6: Sunderland City Council NI189 Actions**

| Action | Lead Organisation | Timescale |
|---|---|---|
| Finalise the detailed flood risk mapping study of the flood risk from all sources at Houghton-le-Spring | Environment Agency | 1-6 years |
| Through use of the planning process, ensure that the tidal floodplain does not see an increase in development. When the opportunity arises, use redevelopment plans to set back developments from the tidal floodplain. | Sunderland City Council | 1-20 years |
| Develop a Project Appraisal Report into the development of a flood defence scheme at Fatfield. | Environment Agency | 1-20 years |
| Expand the flood warning coverage in along the tidal reach to cover all properties at risk. | Environment Agency | 1-20 years |
| Undertake a flood risk mapping study of the urban surface water flood risks, and the effects of tidal locking of drainage systems in Sunderland, including urban watercourses. | Sunderland City Council/Northumbrian Water | 1-20 years |

| Action | Lead Organisation | Timescale |
|---|---|---|
| Undertake a detailed flood risk mapping study to cover current and future flood risks from all sources of flooding through Sunderland and Dalton-le-Dale. | Sunderland City Council | 1-20 years |

The Level 1 SFRA will go someway in providing the evidence base to meet these actions, however a Level 2 SFRA maybe seen as an ideal vehicle as discussed in Volume II to meet some of the specific flood risk mapping studies in consultation with the Environment Agency.

### 3.6.4 Adapting to Climate Change

Locally, Councils are now required by the Audit Commission to demonstrate how they are managing impacts from weather and climate, which is measured through a new national indicator (NI188). Performance is measured on a process-based indicator, where Council's are required to work through the following levels:

- Level 0 - Baseline understanding of climate impacts
- Level 1 - Assessed risks from weather and climate change
- Level 2 - Taken action in priority areas
- Level 3 - Developed a comprehensive adaptation strategy, with partners
- Level 4 - Are implementing, assessing and monitoring actions.

To manage the overall risks and impacts from climate change, Sunderland has in place a "Weather and Climate Risk Management Strategy" (April 2009). This strategy considers all risks arising from climate change, which includes consideration of flood risk. Sunderland is currently assessed to be at Level 1 of NI188, with the aim of moving to Level 2 by March 2010, Level 3 by March 2011 and Level 4 by 2012.

The SFRA will contribute to Sunderland's increasing understanding of risks arising from climate change. Information on improved flood risk knowledge and potential mitigating measures will be incorporated into this wider climate risk management strategy.

## 3.7 Summary

In accommodating future development in Sunderland, there is a range of planning policies to consider and balance on a national, regional and local level. Future development needs have been broadly specified in regional plans and are being refined on a local level in the emerging LDF.

PPS25 and its Practice Guide provides the overarching national guidance with respect to development and flood risk, emphasising the need to effectively manage flood risk within the planning system, rather than relying on reactive solutions to flooding. This includes a responsibility for LPAs to reduce flood risk to people and property as a result of new development. It also identifies the preparation of SFRAs as a key process in the understanding and management of flood risk for planning purposes.

It is widely recognised that flood risk is one of a whole raft of policy constraints placed upon the local planning system. Development must facilitate the socio-economic needs of a community, and spatially must sit within an existing framework of landscape and infrastructure. For this reason, a balance must be sought between development need and the risk it may pose upon existing and future residents of the area as a result of flooding.

The aim of this SFRA is to provide a better understanding of flood risk in Sunderland that can feed into the emerging LDF and the Sustainability Appraisal to enable an informed and balanced planning decision to be made.

Information provided in this Level 1 SFRA can also help support other studies and plans currently being developed or proposed by Sunderland City Council and can be incorporated into meeting national indicators such as NI188 Adapting the Climate Change and NI189 Flood and Coastal Erosion Risk Management.

# 4 The Sequential Approach

## 4.1 Introduction

PPS25 provides the basis for the sequential approach, in which its policies require that the LPA consider flood risk, its mechanisms, spatial distributions and development vulnerability in all stages of the development planning process.

PPS25 promotes positive planning to deliver strategic opportunities to reduce flood risk to communities and apply the Government's policy on flood risk management. The Practice Guide also provides further advice on how flood risk should be taken into account in the LDF (See **Section 2.20-2.24 of PPS25 PG**).

Throughout the risk based sequential approach, management actions to avoid, substitute, control and mitigate flood risk should always be kept in mind and opportunities taken to minimise flood risk at every stage of the planning process. The principal aim of these actions is to ensure that flood risk to people, their property and the environment is reduced to acceptable levels.

The hierarchy of management decisions and actions include:

- **Avoidance** by locating new development outside areas at risk of flooding,
- **Substitution** by changing from a more to a less vulnerable land use, and
- **Control and Mitigation** of the risks by implementing flood risk management measures through a variety of techniques to reduce the impact and mitigate residual risks.

The sequential approach is achieved through the **successive** application of the Sequential Test and Exception Test. The SFRA provides the flood risk evidence base for this decision making process and should form part of the baseline information for the Sustainability Appraisal of LDDs during the scoping and evaluation stages.

Both Level 1 and Level 2 SFRAs provide the relevant information on flood risk to allow the LPA to:

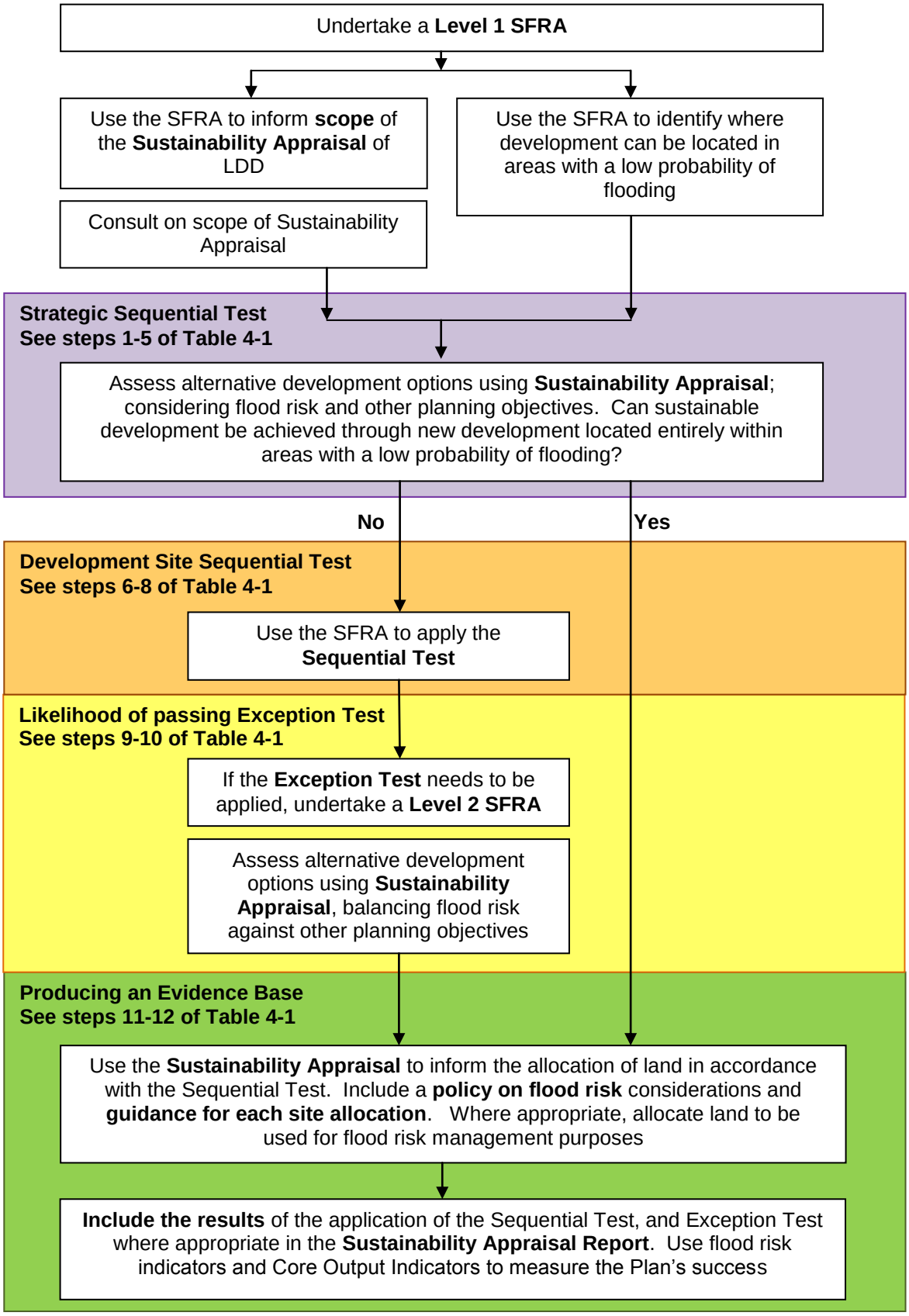
- Produce appropriate policies for the allocation of sites and Development Management which avoids flood risk to people and property,
- Produce appropriate flood risk indicators to inform the Sustainability Appraisal,
- Undertake the Sequential Test and Exception Test, and
- Allocate appropriate land use through the Sustainability Appraisal.

Figure 4-1 illustrates the accountability of flood risk within LDDs and the use of SFRA information. The flow diagram has been adapted from PPS25 Practice Guide (Figure 2.4 p.18) to link in with guidance provided within the below Sections.

***Each colour represents a key stage in the sequential approach process. Identical colours are used throughout the next Chapters to make it easier to identify what guidance relates to individual steps within the sequential approach sequence.***

It must be acknowledged that Figure 4-1 is a generic flow diagram, with each LPA likely to be at different stages of its LDD process. It is more likely that the LPA may have produced a Core Strategy prior to undertaking the Sequential Test with the benefit of the data in this SFRA or are preparing their LDDs and allocating development. PPS25 Practice Guide assumes a strong link with the Sustainability Appraisal, and the SFRA influences all stages of the Sustainability Appraisal. Therefore the generic flow diagram in both PPS25 Practice Guide and this User Guide should be amended to take account of steps which may have previously been taken within the first pass of the Sustainability Appraisal stage.

**Figure 4-1: Taking Flood Risk into account in LDDs**



## 4.2 The Sequential Test

When allocating or approving land for development in flood risk areas, those responsible for making development decisions are expected to demonstrate that there are no suitable alternative development sites (of the type and nature proposed by the Core Strategy) located in lower flood risk areas.

PPS25 introduces a Sequential Test that is core to the SFRA process. The Sequential Test is the key driver for the Level 1 SFRA.

The Environment Agency Flood Zone Map provides the foundation of the Sequential Test, on the basis of the Flood Zones provided in Table D.1 of PPS25. According to PPS25,

*"The overall aim of decision-makers should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying broad locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zone 1 or 2 should decision-makers consider the suitability of suites in Flood Zone 3, talking into account the flood risk vulnerability of land uses and applying the Exception Test if required."*

In order to carry out the Sequential Test the LPA need to know:

- Spatial extent of flood risk within the whole LPA area
- Flood Zones extents
- Flooding from other sources
- Location of proposed development sites and the proposed vulnerability of that development in flood risk terms

There are a number of key challenges faced by the LPA in applying the Sequential Test in accordance with PPS25 and its Practice Guide.

The Sequential Test is purely based on the Flood Zones as defined by Table D1 of PPS25, but these zones only take account of fluvial and tidal flooding, which ignore the presence of flood risk management measures such as defences. Other sources of flooding must also be considered in the spatial distribution of development. However, it can be problematic to map the spatial extent of flooding from other sources as well as matching the level of risk associated with other sources with those presented within the three Flood Zones. For instance, Flood Zone 3 cannot be directly related to a high susceptible area at risk of surface water flooding as the probability and consequences are significantly different.

**Whilst it may not be appropriate to avoid development at risk from other sources of flooding, risk should be considered when taking a sequential approach to land use or the substitution of lower development vulnerability in higher risk areas within a development site.**

## 4.3 Exception Test

If the Sequential Test has been successfully applied, following the steps in Figure 4-2, and the LPA cannot allocate development in lower flood risk areas, **Table D.2 of PPS25** and the vulnerability of development should be referred to. A copy of this Table can be found in Appendix B

**Only once the vulnerability of the development is defined using Table D.3 of PPS25 should an assessment be made of whether or not that development is appropriate within that Flood Zone and whether the Exception Test needs to be applied.**

Table 4-1 below has been produced from Table D.3 of PPS25.

**Table 4-1: Where the Exception Test Applies**

| Flood Risk Vulnerability classification (see Table D2) | | Essential Infrastructure | Water compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone (see Table D.1) | Zone 1 | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Zone 2 | ✔ | ✔ | Exception Test required | ✔ | ✔ |
| | Zone 3a | Exception Test required | ✔ | ✗ | Exception Test required | ✔ |
| | Zone 3b 'Functional Floodplain' | Exception Test required | ✔ | ✗ | ✗ | ✗ |

Key:

✔ Development is appropriate

✗ Development should not be permitted

**Once the requirement of the Exception Test has been identified, three stringent conditions must all be passed in order to pass the Test. If all conditions of the Exception Test cannot be met, planning permission cannot be granted.**

These conditions (see **Paragraph D9 of PPS25**) are as follows:

a. *It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the LDD has reached the 'submission' stage (see Figure 4.1 of PPS12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal (SA);*

b. *The development must be on developable previously-developed land or, if it is not on previously-developed land, that there are no reasonable alternative sites on developable previously-developed land; and*

c. *A site-specific Flood Risk Assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

**It will be the requirement of Development Management officers to make sure all parts of the Exception Test have been passed in granting planning permission (see Section 4.5). At a Spatial Planning stage, only the likelihood of passing the Exception Test can be assessed, as actually passing the Test will require the completion of a site-specific FRA to determine if the site and its occupiers will be safe during times of flood.**

What should be done at this early stage of the planning process is to identify those sites in which the Exception Test is required and to avoid those sites in which flood risk is too great or there is no overriding planning objectives for that development. This should be aided using the information contained in Level 2 SFRAs.

## 4.4 Guidance for Spatial Planners

This section provides the following guidance on how Spatial Planners are to apply the Sequential and Exception Test within the Sustainability Appraisal of LDDs.

Figure 4-1, discussed earlier on, identifies how flood risk is taken into account in LDDs and introduces the use of the Sustainability Appraisal in applying the Sequential and Exception Tests. What PPS25 does not provide, is step-by-step guidance on how to apply each Test rather the concept in which they are applied.

What the guidance below will do, if followed appropriately, is produce clear and transparent evidence that both the Sequential and Exception Test have been applied, which can then feed into the Sustainability Appraisal process of LDDs. This can either be reported within the Sustainability Appraisal itself or a supporting stand alone document which then feeds into the Sustainability Appraisal.

The guidance provided in this SFRA should not supersede PPS25 or other plans and policies, but should be seen as a practicable approach in how the LPA should apply the Sequential and Exception Tests within the preparation of the LDF.

### 4.4.1 Carrying out the Sequential Test and identifying the likelihood of sites passing the Exception Test

The following flow diagrams and tables provide a recommended approach for Spatial Planners in applying the two tests, keeping in mind the flood risk management hierarchy of avoid, substitute, control and mitigate, whilst identifying and allocating sustainable development sites.

***Colours have again been used to represent key stages in the sequential approach process as identified in Figure 4-1 previously. The same colours are used in the flow diagrams and tables below, the aim of which is to make it easier to identify what guidance relates to individual steps within the sequential approach sequence.***

Figure 4-2 below, illustrates the Sequential and Exception Tests as an input, process and output flow diagram. The main inputs being the evidence provided in both the Level 1 and Level 2 SFRA and the LPA Core Strategy and Sustainability Appraisal. The flow diagram begins by the LPA assessing alternative development options at a strategic scale using the Sustainability Appraisal. This then works down using evidence provided in the Level 1 and Level 2 SFRA to avoid inappropriate development sites, substitution within the site boundary and identifying those sites requiring the Exception Test. The flow diagram ends by revisiting and updating the Sustainability Appraisal with the allocation of development sites. Figure 4-2 can be linked to Table 4-2, which provides a more detailed descriptive step by step guidance of the flow process illustrated.

During this process there is a need to identify which sites should be avoided, substituted, those which can go forward, or once the Sequential Test has been applied how to assess if the site will remain safe during the Exception Test. This is a step wise process and must be documented, but a challenging one as a number of the criteria used are qualitative and based on experienced judgement.

Figure 4-3 provides more guidance on using the Sequential Test Spreadsheet produced in the SFRA during Steps 1 to 8. Figure 4-4 provides guidance on how to assess the likelihood of sites passing the Exception Test using key questions and evidence provided in the SFRA in assessing whether a site will remain safe or not during Steps 9 to 10.

**Figure 4-2: Sequential Approach Sieving Process**

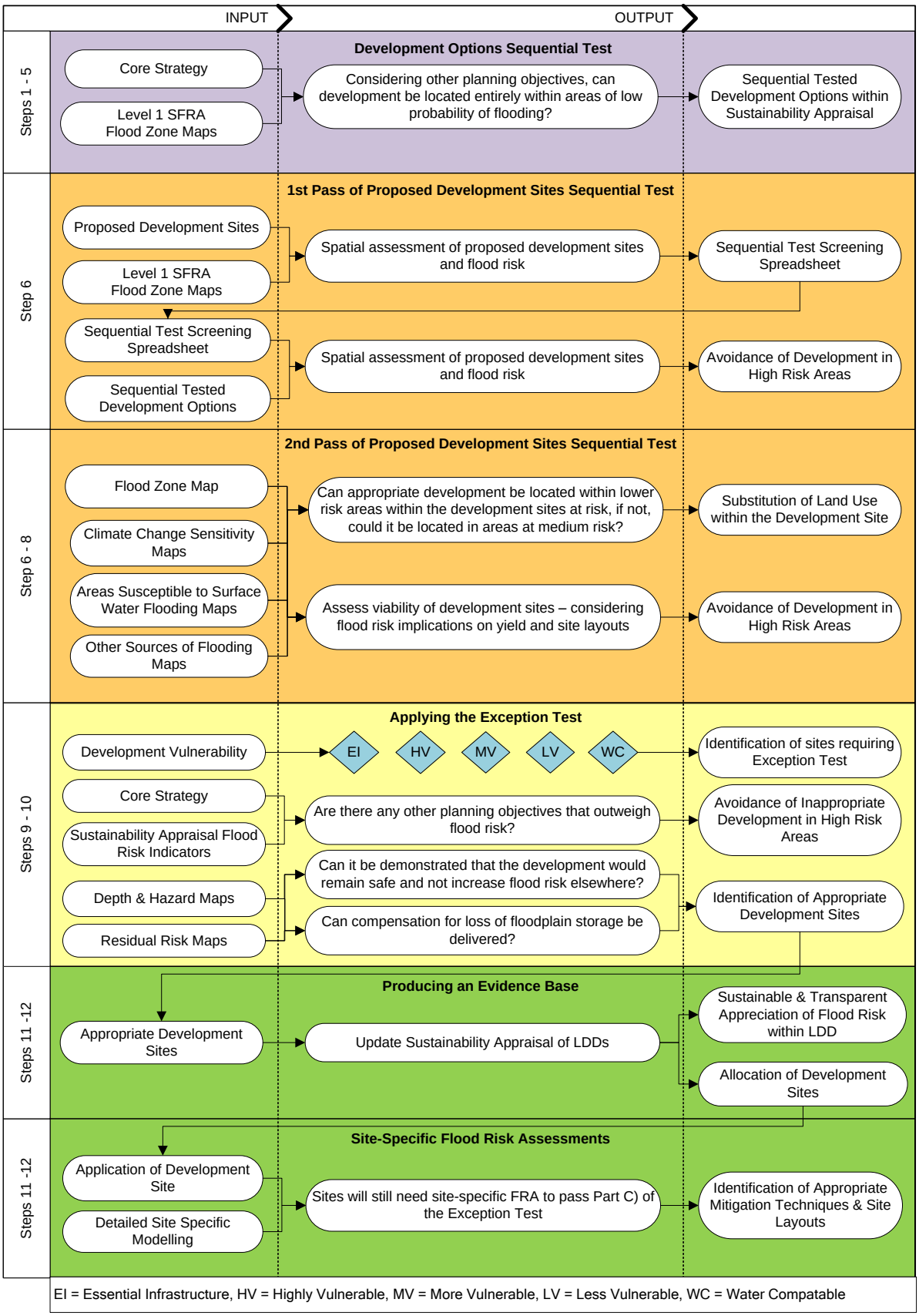
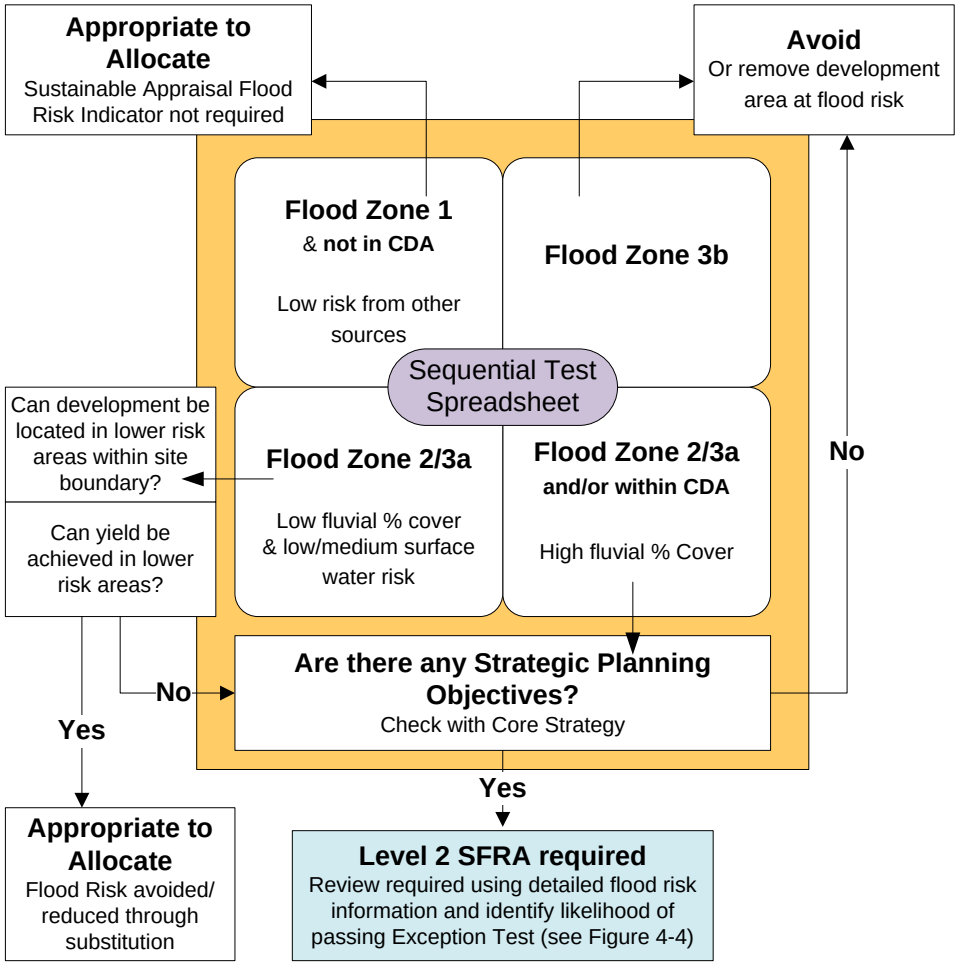


**Table 4-2: Sequential and Exception Tests Key Steps**

| | |
|---|---|
| **Applying the Sequential Test during the SA of Development Options** | |
| STEP 1 | State the **geographical area** over which the Sequential Test is to be applied. This can be over the entire LPA area but will usually be reduced to communities to fit with functional requirements of development or objectives within RSS or Core Strategy |
| STEP 2 | Identify reasonably available areas of strategic growth |
| STEP 3 | Identify the presence of **all sources of risk** using the evidence provided in this SFRA |
| STEP 4 | **Screen available land** for development in ascending order from Flood Risk Zone 1 to 3, including the subdivisions of Flood Risk Zone 3<br><br>*This can be achieved using the information provided in the* **Sequential Test Spreadsheet** *(See Volume II Section 5). The screening spreadsheet provides a spatial assessment of each proposed development site provided by the LPA against Flood Zones and Environment Agency surface water susceptibility zones* |
| STEP 5 | Could all development be located in lower risk areas? If not, move onto the next Steps |
| **1st and 2nd Pass of the Proposed Development Sites Sequential Test** | |
| | *Follow Figure 4-3 using the Sequential Test Spreadsheet to:* |
| STEP 6 | Identify those sites which should be **avoided** where risk is considered too great and there is no strategic planning objectives identified in Core Strategy |
| STEP 7 | Identify those sites in which the consequence of flooding can be reduced through **substitution** within the site boundary |
| STEP 8 | Assess yield and layout issues for remaining high risk sites to check whether development is viable |
| **Identify the Likelihood of passing the Exception Test** | |
| | *Follow Key Questions imbedded within Figure 4-3 and Level 2 SFRA evidence (if produced) to identify the likelihood of those sites remaining at risk passing the Exception Test.* |
| STEP 9 | Assess the compatibility of the **development vulnerability** using Table D.2 of PPS25 and identify the requirement of passing the **Exception Test using** Table D.3 of PPS25 |
| STEP 10 | Use the SA to assess alternative development options by balancing flood risk against other planning constraints. **Proposed sites should be avoided and removed if it is unlikely to pass the Exception Test** i.e. if:<br>*- Key Questions in Figure 4-3 attributes a significant negative response*<br>*- Where development will require significant mitigation measures to make the site safe and to reduce impacts downstream*<br>*- Where the requirement of loss of floodplain compensation cannot be delivered* |
| **Producing an Evidence Base** | |
| | *The following steps should be used within the SA to produce the evidence that all Tests have been applied:* |
| STEP 11 | **Produce a supporting stand alone document** recording all decisions made during Steps 1 to 10. Each proposed development site should be referenced and the decisions made to avoid, substitute, or allocate the site and the evidence used. This can be incorporated within the appendix of the SA |
| STEP 12 | **Allocated development allocations within the SA**, including appropriate flood risk policies and development guidance on each allocated site. Guidance should include the need for appropriate site-specific FRAs.<br>*The Environment Agency and other relevant stakeholders (such as Northumbrian Water) should be consulted on any policies drafted that inform the application of the Exception Test and the production of FRAs within the LPA area* |

**Figure 4-3: 1st and 2nd Pass of Proposed Development Sites Sequential Test**




Once the requirement for a Level 2 SFRA has been identified, Spatial Planners will need to assess the likelihood of sites passing the Exception Test. **This is seen as a critical part of the spatial planning process by avoiding inappropriate development being allocated**. The Environment Agency and/or Development Management are likely to object to inappropriate development.

During Steps 9 and 10, Spatial Planners are asked to assess whether or not a site highlighted at flood risk has the potential to pass the Exception Test. This requirement can be linked to Figure 4-4 illustrated below.

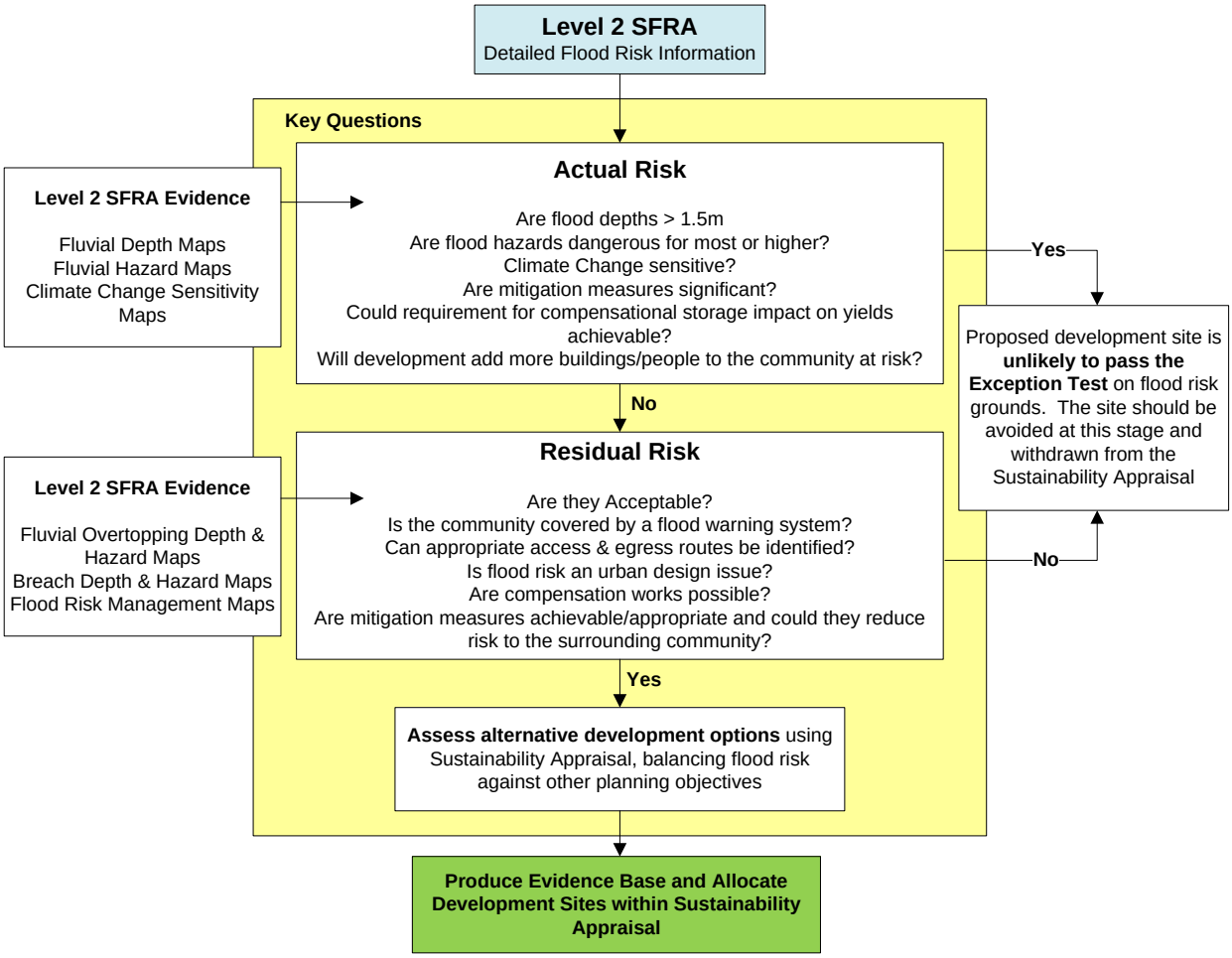
By following Figure 4-4 with information provided in a Level 2 SFRA, Spatial Planners should be able to obtain a greater understanding on the level of flood risk present at each key development site that remains following the application of the Sequential Test.

***A detailed review of the flood risk associated with key development sites should be carried out during a Level 2 SFRA to support the decision on the likelihood of sites passing the Exception Test in these areas. A review of the Sequential Test process should again be carried out; avoiding those sites where the detailed flood risk information illustrates that the risk is too high.***

During Steps 9 and 10, following Figure 4-2, Spatial Planners should use the Sustainability Appraisal process to assess alternative sites against flood risk indicators and other planning considerations. **Whilst a balance is require, the Exception Test can be a show stopper in that planning permission cannot be granted if all criteria of the**

**Exception Test cannot be met.** Once this has been completed, Steps 11 and 12 can be carried out, producing the evidence base for the Sustainability Appraisal, allocating appropriate development sites, producing flood risk policies and development guidance.

**Figure 4-4: Identifying the Likelihood of Passing the Exception Test**




## 4.5 Guidance for Development Management and Developers

The LPA are the principal decision-makers on applications for new development. This is carried out through Development Management. Whilst it is the overall responsibility of the developer to carefully consider flood risk issues regarding their proposed development site, the LPA should be involved at the earliest possible stage during pre-application discussions.

**Following on from recommendations made in the Pitt Review, Development Management must take some of the roles and responsibilities from the Environment Agency as the first point of call in Flood Risk Management and planning applications.**

If an individual site has been identified for development, Development Management must check that the development is sound regarding flood risk i.e. it has passed the Sequential Test and is likely to pass the Exception Test where applicable and that it is supported by a coherent FRA which meets the requirements of PPS25.

**Development Management officers must always consider development from a strategic view point and the cumulative effect of all proposed development taking place, even though applications for developments are submitted at a site level. It**

**should not be presumed that flood risk has been understood at a strategic high level and that one application may need to fit within a flood risk management strategy for an area.**

### 4.5.1 Carrying out the Sequential Test and Exception Test

If the proposed site is already identified in a Sequentially Tested LDD, which is supported by the findings of the SFRA, the site will already have been though the Sequential Test. The developer must still apply the sequential approach to site layout when matching land use vulnerability within flood risk areas as described in PPS25, pass the Exception Test, if appropriate, and prepare a site-specific Flood Risk assessment.

However, where a site has not been identified within a Sequentially Tested LDD, the Sequential Test will need to be applied i.e. the developer will need to provide evidence to the LPA that there are no other reasonable available sites where the development could be located. The LPA will then use this information to apply the Sequential Test. This particularly applies to Windfall Sites that have not been allocated in the LDF.

Table 4-3 identifies when the Sequential and Exception Tests are required for certain types of development and who is responsible for providing the evidence and those who need to apply the tests.

**Table 4-3: Development Types and Application of Sequential and Exception Tests**

| Development/ PPS25 PG Reference | Sequential Test | | Exception Test | |
|---|---|---|---|---|
| | Required? | Who Applies the Test? | Required? | Who Applies the Test? |
| **Allocated Sites**<br><br>Sect. 4.23–4.31 | No | LPA should have already carried out the test during the allocation of development sites within their LDD | Dependent on land use vulnerability | LPA to advise on the likelihood of passing test. But the developer must provide evidence that the Test can be passed by providing planning justification and producing a detailed FRA |
| **Windfall Sites**<br><br>Sect. 4.33–4.35 | Yes | Developer provides evidence that the test can be passed to the LPA. An area of search to be agreed, but should be within local community boundary. | Dependent on land use vulnerability | Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA |
| **Regeneration Sites Identified Within LDD**<br><br>Sect. 4.36–4.38 | No | - | Dependent on land use vulnerability | LPA to advise on the likelihood of passing test. But the developer must provide evidence that the Test can be passed by providing planning justification and producing a detailed FRA |
| **Renewable Energy Projects**<br><br>Sect. 4.39 | No | PPS22 Renewable Energy advises the LPA not to use a sequential approach in the consideration of such proposals | Dependent on land use vulnerability. | LPA to advise on the likelihood of passing test. But the developer must provide evidence that the Test can be passed by providing planning justification and producing a |

| Development/ | Sequential Test | | Exception Test | |
|---|---|---|---|---|
| | | | | detailed FRA. Part B of the Exception Test may not apply in accordance with PPS22. |
| **Redevelopment of Existing Single Properties**<br><br>Sect. 4.40-4.41 | No | - | Dependent on land use vulnerability | Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA |
| **Changes of Use**<br><br>Sect. 4.42-4.45 | No | - | Dependent on land use vulnerability | Developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA |

Development Management and developers should refer to Section 4.2 and 4.3 of this report for guidance on applying the Sequential and Exception Tests. This includes identifying a zone of search to apply the Sequential Test as recommended.

A site-specific FRA will also be necessary for those sites identified as required to pass the Exception Test (Part C).

For all sites being proposed in flood risk areas, a site-specific FRA must accompany the development proposal. Development Management should be involved at the earliest stage of consultation in the scope and development of a FRA with the Environment Agency and other revenant stakeholders.

The Environment Agency Standing Advice should be used at this stage. This can be accessed online at:

**http://www.environment-agency.gov.uk/research/planning/82584.aspx**.

Development Management will then need to review the evidence provided and decide whether a site passes the Exception Test. The Section below provides further guidance on the preparation of site-specific FRAs.

# 5 Flood Risk Assessments

## 5.1 Introduction

There are principally three levels of flood risk assessment namely, Regional Flood Risk Appraisals (RFRAs), Strategic Flood Risk Assessments (SFRAs) and Site-specific (known as Detailed) Flood Risk Assessments (FRAs).

Once the site has been through the Sequential Test and has been identified as being likely to pass the Exception Test a site-specific FRA should be undertaken. The LPA and Environment Agency should be consulted in order to scope the content and level of the FRA.

The FRAs are site or project specific and are the responsibility of those proposing development to prepare. The principle aims of a FRA are to determine the acceptable management of flood risk to the development proposal itself and any impacts elsewhere, and to ensure that the development and its users/occupants remain safe in times of flood.

The FRA will determine any effective flood mitigation measures necessary and include these in the development proposal. The FRA needs to demonstrate that the proposed development will not increase flood risk either upstream or downstream of the site and all sources of flood risk, including fluvial, surface water runoff and drainage need to be considered. The FRA will then be submitted to the LPA in support of the developers outline and/or detailed planning application.

There are principally three levels of FRA:

- **Level 1** - Screening study, to identify whether there are any flooding or surface water management issues that need to be considered further;
- **Level 2** - Scoping study, to be undertaken if the Level 1 FRA indicates that there are flood risk issues needing further consideration and these risk can be readily quantified; and
- **Level 3** - Detailed study, where further quantitative analysis is required to appropriately assess flood related issues and determine any effective mitigation measures needed to be put in place.

The detail required for each level of FRA is highlighted in Figure 5-1 below. The production of a site-specific FRA can be seen as an iterative process with those carrying out a Level 1 FRA before moving on to a Level 2 and finally a Level 3. It is appropriate to review the level of risk present to assess whether development is appropriate and achievable before moving onto the next stage.

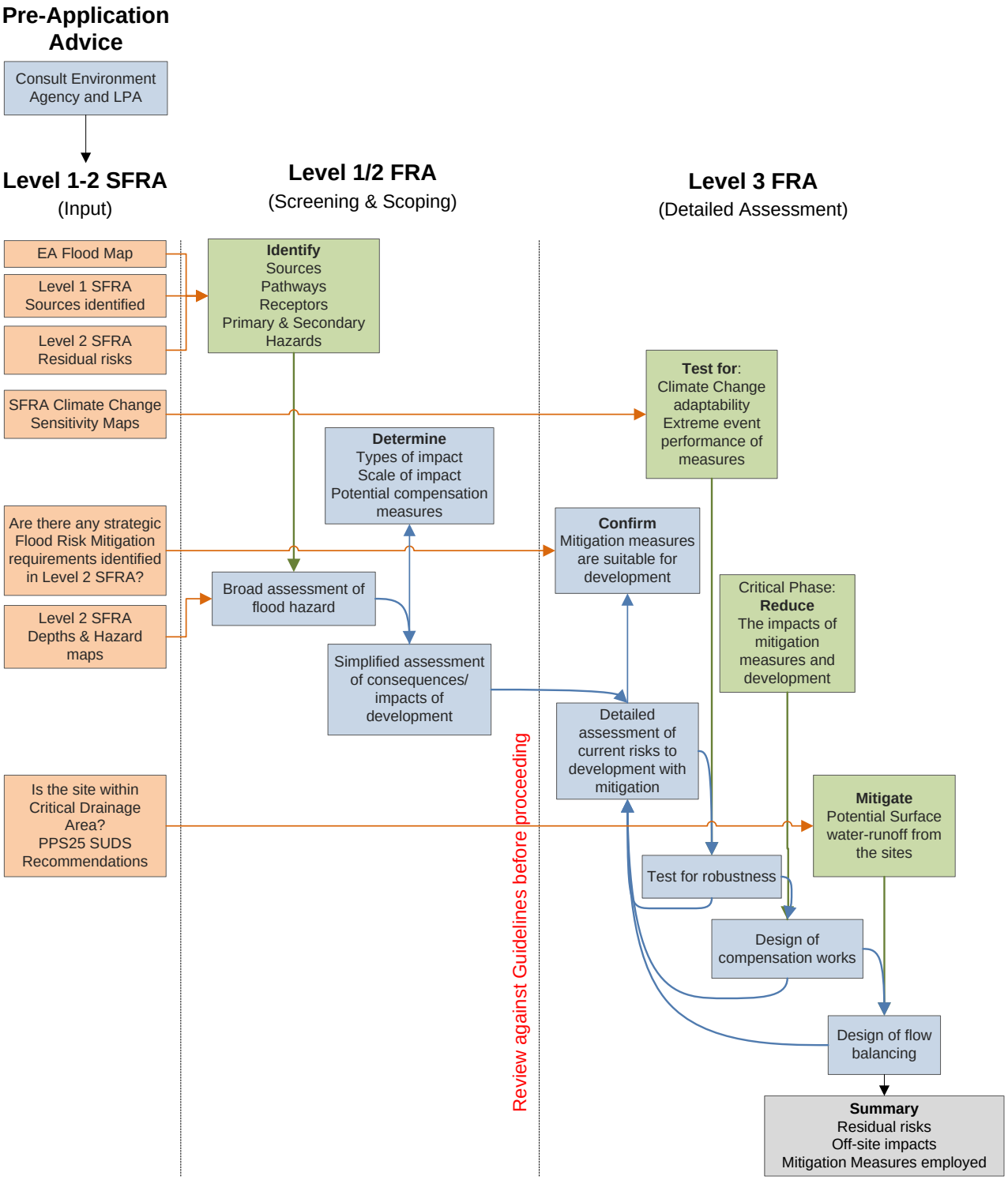
A larger number of iterations and/or consultations on the FRA maybe needed if significant mitigation measures are proposed and compensational storage is required to assure the LPA and Environment Agency that the development can remain safe and meets all requirements.

**The list below outlines a number of considerations which should trigger the requirement for a detailed FRA.**

1. The development other than minor development is situated in Flood Zone 2 and 3
2. The development exceeds 1ha in Flood Zone 1
3. The development is exceeds 0.5ha in Flood Zone 1 and within a Critical Drainage Area (CDA)
4. The development is at risk of flooding from other sources of flooding
5. The development is situated behind flood defences (possibility of overtopping during extreme flood event or breach)
6. The development is within 20m of the bank top of a Main River – the Environment Agency will have to consent to any work within 5m of a Main River and are likely to object in principal to any development within these areas

7. Any culverting operation or development which controls the flow of any river or stream

**Figure 5-1: FRA Preparation**



## 5.2 Available FRA Guidance

Flood Risk Assessments for proposed development should follow the approach recommended by:

- **Environment Agency Standing Advice** – this can be found at the website below (http://www.environment-agency.gov.uk/research/planning/82584.aspx)
- **PPS25 and its Practice Guide**.
- **CIRIA Report C624 Development and Flood Risk** – Guidance for the Construction Industry (2004)

These documents describe when a FRA is required, what it should contain and are extremely helpful in guiding developers to produce a "fit for purpose" FRA and are commensurate with the advice given in this SFRA. For all levels of FRA developers are advised to make early contact with the Environment Agency and the LPA to discuss their proposals in outline and consider the site in respect of the risk based sequential approach contained within the SFRA.

The key requirements of a FRA are provided in **Section 3** of the PPS25 Practice Guide. The FRA should answer the following questions:

1. **Development Description and Locations**
    a. What is the type of development and where will it be located?
    b. What is the vulnerability classification of the current and future use of the development site (using **Table D.2 of PPS25**)?
    c. Has the development site been assessed during the Level 1 and Level 2 SFRA and is in line with LDDs?
2. **Definition of Flood Hazard**
    a. What sources of flooding could affect the site?
    b. For each source, how would flooding occur, referencing any historical records where these are available?
    c. What existing surface water drainage requirements are present on the site?
3. **Probability**
    a. Which Flood Zones are present within the site?
    b. What actual and residual risks are associated with the site?
    c. What are the existing rates and run-off volume generated by the site?
4. **Climate Change**
    a. How is flood risk at the site likely to be affected by climate change?
5. **Flood Risk Management Measures**
    a. How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime?
6. **Off Site Impacts**
    a. How will the proposed development and measures be implemented to protect the site from flooding and prevent run-off be designed to not increase flood risk elsewhere and where achievable reduce flood risk to the surrounding community?
7. **Residual Risks**
    a. What flood-related risks will remain after mitigation measures has been implemented to protect the site from flooding?
    b. How, and by whom, will these risks be managed over the lifetime of the development?

## 5.3 Assessment of Fluvial Risk

The mitigation design criterion for development within floodplain areas are generally set to protect against the flood event coinciding with a 1 in 100 year fluvial flood event, including the impact of climate change. Detailed consideration will need to be given to the impact these mitigation measures may have and it is a requirement to ensure that flood risk is not increased elsewhere as a result of development. Compensation measures may take the form of compensatory flood storage as mitigation for loss of floodplain, enhanced flood defences and flood compatible master planning.

Compensation measures will be needed in both defended and undefended floodplains. This concept is included in PPS25 and ensures that residual risk is appropriately managed in new and existing development. The need for compensation storage should be considered as a major constraint within the individual site assessments as this requirement may have implication for the yields achievable for individual sites given the associated land take this may require. For example where sites are of a small size, within large flood zone coverage may cause difficulties in achieving compensatory storage and may therefore call into questions the developments design and viability

Before embarking on detailed modelling, and in light of this SFRA, proposals for development should be discussed in detail with the Environment Agency at an early stage.

Detailed FRAs may need to be carried out using hydraulic models. However, before any modelling is undertaken a review of available information should be conducted to assess if modelling is necessary. For fluvial floodplains an assessment of the hydrological regime is required. This should be undertaken using available gauged records and Flood Estimation Handbook (FEH) techniques. Where hydraulic modelling is necessary, it will need to include structures, such as bridges and weirs that influence flood levels. This modelling should also include floodplains to accurately determine the depth and extent of flooding.

Whenever possible models should be verified using historical records of flooding. Its sensitivity to modelling assumptions and climate change should also be investigated. Mapping the extent of flooding in a specific location will assist the risk of flooding to a specific development to be assessed.

Where allocations remain in high risk flood zone areas for other material considerations, it needs to be demonstrated that technically feasible flood mitigation options are available. A fuller appreciation of the sustainability of the site and its mitigation measures will be addressed via the Sustainability Appraisal. These measures must be designed to provide an appropriate level of flood mitigation to a site for the lifetime of the development. At most sites it is technically feasible to mitigate or manage flood risk (if potential off-site impacts are ignored), however the measures required may result in some practical constraints on development and/or require significant financial cost where flood risk is high. The detailed FRA should build on initial potential mitigation measures considered when determining the likelihood of the Exception Test being met as indicated earlier in Section 4.3.

## 5.4 Considering Other Sources of Flooding

Flood Risk Assessments must take account of flood risk from all sources, rather than concentrating on fluvial, tidal or surface water flood risk. Volume II has gone some way in identified the presence of these sources, whilst any Level 2 SFRA produced after this study will provide a more detailed analysis of the actual and residual risk associated with them where practicable.

### 5.4.1 Reservoirs

As part of a FRA, developers should liaise with Local Authority Emergency Planners to identify potential evacuation measures that should be taken to protect against the unlikely event of a major reservoir breach.

Developers should undertake a zone of search in the vicinity of their site to identify smaller reservoirs such as fishing lodges or mill supply ponds. The FRA should determine the ownership and maintenance regime of the reservoir and undertake a more detailed investigation into the effects of the reservoir overtopping or failing. The developer should then liaise with the LPA and reservoir owner to determine applicable emergency planning requirements or mitigation needs. Where there is significant flood hazard identified to the site from such failure and especially from unmaintained reservoirs, the developer should liaise closely with the LPA about the suitability of the site for development.

### 5.4.2 Groundwater

There is not a significant risk of groundwater flooding in Sunderland but it should not be dismissed as a possibility and the FRA should consider the potential mechanisms that could affect the development site, as outlined in Volume II. If a risk of groundwater flooding is found, developers should consult with the LPA and Environment Agency at an early stage as to the next steps.

The risk of groundwater flooding should be considered when assessing suitable SUDS techniques at a strategic level. Groundwater flooding is expected to be a design issue. For example, basements should not be considered in areas at risk of flooding from groundwater rebound or in the floodplain of watercourses where there might be alluvial groundwater flooding.

### 5.4.3 Surface Water

This is discussed in Section 5.5.

### 5.4.4 Sewers

Where Volume II has identified risk from sewer flooding, any water that surcharges the sewer system would be expected to follow similar flow paths and pond in similar low spots. However, the volume of water that emerges from the system will be entirely dependent on the reason for the network surcharging (which could be due to rainfall beyond the design level of the sewer system, sewer capacity issues or blockage or failure).

Developers should take account of the guidance in Section 4 where appropriate and liaise closely with Northumbrian Water over any localised sewer flooding problems that could affect the site. Any known sewer flooding locations are prioritised for investment by Northumbrian Water and may be the subject of future investment by the water company. Future development should be designed so that it does not contribute to existing sewer flooding problems.

## 5.5 Drainage for New Developments

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure.

**Managing surface water discharges from new development is crucial in managing and reducing flood risk to new and existing development downstream.** Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding. The Planning System has a key role to play in settings standards for sustainable drainage from new developments and ensuring that developments are designed to take account of the risk from surface water flooding. Sustainable drainage plays an important part in reducing flows in the sewer network and in meeting environmental targets, alongside investment in maintenance and new capacity by NWL. NWL plan their investment on a five year rolling cycle, in consultation with key partners, including the Environment Agency.

Sustainable drainage and the use of Sustainable Drainage Systems (SUDS) is supported by the policy direction in Future Water[18], Making Space for Water[19], the Pitt Review[20] and

18 Defra (2008) Future Water

the Flood and Water Management Act[21] that provides for more sustainable management of the water cycle, working in partnership across different agencies and new responsibilities for local flood risk management. In particular, the Draft Flood and Water Management Bill requires developers where practical, to include sustainable drainage in new developments to reduce flood risk and improve water quality. It includes

*'a requirement on developers to demonstrate that they have met national standards for the application of SUDS techniques before they can connect any residual surface water drainage to a public sewer (amending section 106 of the Water Industry Act 1991).'*

As part of their new responsibility for local flood risk management, local authorities will be responsible for approving SuDS for new developments and adopting and maintaining them.

**Recognising the above, drainage from new developments should incorporate storage, with residual discharge of surface water to the following networks in order of preference:**

- Infiltration drainage (e.g. soakaways)
- Discharge to a watercourse
- Discharge to a public sewer

The choice of system will be determined by local ground conditions (including groundwater levels). The guidance below should be used in addition to the Environment Agency Standing Advice[22].

### 5.5.1 Development Sites in the Wider Local Authority Districts

Developers should use the following guidance regarding surface water runoff from new developments:

#### Allowable Discharge Rates in the Wider District

- Development should deliver Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, considering climate change
- Development should aim for a reduction in surface water runoff rates for Brownfield sites up to a 1 in 100 year storm event, considering climate change
- Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event
- There may be local variations on this where outfalls are directly to larger watercourses and hence surface water discharges from development sites can pass downstream before the main peak on the watercourse

Wherever possible, this should be achieved through the implementation of SUDS. Source control should be considered firstly. There may be opportunities to deliver SUDS though integrated solutions for collections of strategic sites. The future ownership and maintenance of SUDS systems should be discussed at the planning application stage with the relevant sections of the LPA (including Highways and Drainage), NWL and the Environment Agency. More detail on SUDS is available in Section 7.

The developer should liaise closely with the local authority drainage engineer, the Environment Agency and NWL to determine appropriate discharge rates. The developer should prove that surface water discharges from the site will not have an adverse impact

19 Defra, Department for Transport, HM Treasury and Office of the Deputy Prime Minister (2005) Making Space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England; First Government response to the autumn 2004 Making space for water consultation exercise
20 The Pitt Review (2008) Learning lessons from the 2007 floods
21 Defra (2010) Flood and Water Management Act
22 Environment Agency. Flood Risk Standing Advice for England - PPS25 National Version 2.0. Can be accessed online at http://www.environment-agency.gov.uk/research/planning/82584.aspx

on flood risk elsewhere, with reference to investment planning by NWL that may increase the capacity of the sewer network in the area.

#### Overland Flow Paths in the Wider District

Underground drainage systems have a finite capacity and regard should always be given to larger events when the capacity of the network will be exceeded. Hence there is a need to design for exceedance. This should be considered alongside any surface water flows likely to enter a development site from the surrounding area.

Master planning should ensure that existing overland flow paths are retained within the development. As a minimum the developer should investigate, as part of a FRA, the likely depths and extents of surface water flooding on a development site when the national Areas Susceptible to Surface Water Flooding map indicate that there is a risk of surface water flooding. This is a precautionary, but an appropriate approach to reduce the risk of flooding to new developments. Green infrastructure should be used wherever possible to accommodate such flow paths. Floor levels should always be set a minimum of 300mm above adjacent roads to reduce the consequences of any localised flooding.

The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography, geology (soil permeability), development density, existing drainage networks within the site and surrounding area, adoption issues and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined at an early stage and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential.

### 5.5.2 Critical Drainage Areas

**Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. These areas have been defined as Critical Drainage Areas (CDAs) in the SFRA and have been identified in Volume II. Specific drainage requirements are required in these areas to help reduce local flood risk. The SFRA has designated CDAs as high flood risk areas.**

These are areas with complex surface water flooding problems that would benefit from a drainage strategy, which is most effectively done in a Surface Water Management Plan. The CDAs identified in the SFRA should be refined over time as more detailed information on flood risk and local flood management assets, including detailed sewered records, becomes available.

**In these areas, this SFRA proposes a detailed FRA is required regardless of which Flood Zone that applies for all developments over 0.5 hectares**. This is more stringent than what is generally requested in PPS25 (over 1ha) but using a smaller development size highlights the possibility of multiple smaller developments in key flood risk areas have an accumulative effect downstream. The FRA should demonstrate that new development is not at risk from flooding from existing drainage systems or potential overland flow routes. It should also demonstrate that the development will not adversely affect existing flooding conditions by the use of appropriate mitigation measures. The FRA should define and address the constraints that will govern the design of the drainage system and layout of the development site.

The Environment Agency Standing Advice allows developers to screen online for the level of flood risk assessment that is appropriate for a development with regard to the PPS25 Flood Zones. This highlights the need for a FRA in Flood Zones 2 and 3 and in Flood Zone 1 where there are critical drainage problems. The Standing Advice notes that for developments in Flood Zone 1 FRA Guidance Note 1[23] should be followed:

23 Environment Agency. Flood Risk Assessment (FRA) Guidance Note 1, development greater than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha) can be accessed online at http://www.environment-agency.gov.uk/static/documents/Research/FRAGuidanceNote1.pdf

*'In areas where the Local Planning Authority has identified drainage problems through a Strategic Flood Risk Assessment or Surface Water Management Plan and they have indicated that a formal flood risk assessment is required'. FRA Guidance Note 1 requires FRAs to provide 'Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the development (in accordance with sustainable drainage principles, and the Local Planning Authority's published SFRA).'*

Proposals for development in Critical Drainage Areas as defined by this SFRA should follow the guidance and standards as set out below for developments that are within any flood zone.

#### Allowable Discharge Rates in CDAs

Over time, it is envisaged that local authorities will commission drainage strategies (see below) to determine in more detail and establish the evidence base for set reductions in surface water runoff from development sites. With regard to this, the developer should liaise closely with the Environment Agency, NWL and the LPA as soon as possible to determine an appropriate reduction in runoff rate and volume with reference to discharge limits as laid down by any completed SWMP or drainage strategy for that area.

Wherever possible, this should be achieved through the implementation of SUDS. Source control should be considered firstly. There may be opportunities to deliver SUDS though integrated solutions for collections of strategic sites. The future ownership and maintenance of SUDS systems should be discussed at the planning application stage with the relevant sections of the LPA (including Highways and Drainage), NWL and the Environment Agency. This approach should be taken unless the developer can demonstrate that this is not feasible and that there will be no adverse impact caused by the development elsewhere.

This is supported by Category 4 of the Code for Sustainable Homes, which requires developers to ensure that peak run-off rates and run-off volumes will be no greater than the pre-development conditions as a minimum. However, the code recommends that attenuation of the additional flows caused by development should be related to the degree of flood risk in an area. In 'high flooding risk areas,' 100% of the additional volume should be attenuated[24]. PPS1[25] allows local planning authorities to stipulate high levels of the code where there are local circumstances that allow and warrant it. **The SFRA has designated CDAs as high flood risk areas.**

#### Overland Flow Paths in CDAs

Developers should follow the advice on managing exceedance and overland surface water flow paths as set out in Section 5.5.1.

### 5.5.3 Integrated Drainage

There is the potential for groups or strategic development sites coming forward to share a central and integrated solution for managing surface water runoff. This is best investigated further through a SWMP or a Drainage Strategy, which may or may not be undertaken at the same time as a SWMP. Such solutions can provide great benefits besides water management, including providing recreational facilities, improving biodiversity and making communities a better place to live.

Where there are several sites that would share a communal facility, such sites may be funded through developer Section 106 or Community Infrastructure Levy payments. Drainage Strategies can be particularly useful for considering, recommending the implementation of and long term management arrangements for SUDS and setting appropriate runoff rates from new development.

24 DCLG (2006) Code for Sustainable Homes
25 DCLG (2007) Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1

# 6 Flood Risk Management

## 6.1 Introduction

Throughout the risk based sequential approach, the need to take a sequential approach when allocating land for development should always be kept in mind and opportunities taken to minimise flood risk at every stage of the planning process.

**Mitigation measures should be seen as a last resort to address flood risk issues to new development.**

Mitigation measures must be designed to provide an appropriate level of protection to a site for the lifetime of the development. At many sites it may be technically feasible to mitigate or manage flood risk. However, the potential impacts of mitigation measures on flood risk to the surrounding community must always be considered and where the depth of flooding is substantial, these mitigation measures may result in practical constraints to development with significant financial implications. There will always be a residual risk remaining that should be accounted for through effective emergency planning.

The minimum acceptable standard of protection against flooding for new property within flood risk areas is the 1 in 100 and 1 in 200 year flood event for fluvial and tidal sources respectively, with an allowance for climate change over the lifetime of the development.

### 6.1.1 Strategic Approach

Mitigation measures should be considered on a strategic basis that avoids a piecemeal approach and advocates partnership between the LPA and the Environment Agency and integration with wider Environment Agency flood risk management works and strategies (e.g. Wear CFMP).

Taking a strategic approach requires all that are involved in flood risk management to consider:

- Avoidance of development in flood risk areas
- The sequential approach to site layout, substituting higher vulnerability development in lower flood risk areas and considering flooding from all sources
- Wherever possible, using open land or green infrastructure to reduce risk, provide compensatory flood storage or serve a sustainable drainage function
- **Adopting mitigation solutions that fit with the wider vision of the community in managing flood risk. In significant flood risk areas, developers should aim to reduce risk to the wider community as provided for in the policy aims of PPS25**
- Adopting SUDS
- Preparing emergency flood plans

## 6.2 Potential Mitigation Measures

Normally, suitable mitigation measures for a proposed development will be determined through assessment of flood depths via hydrological and hydraulic modelling (or use of existing models) carried out as part of a site-specific FRA.

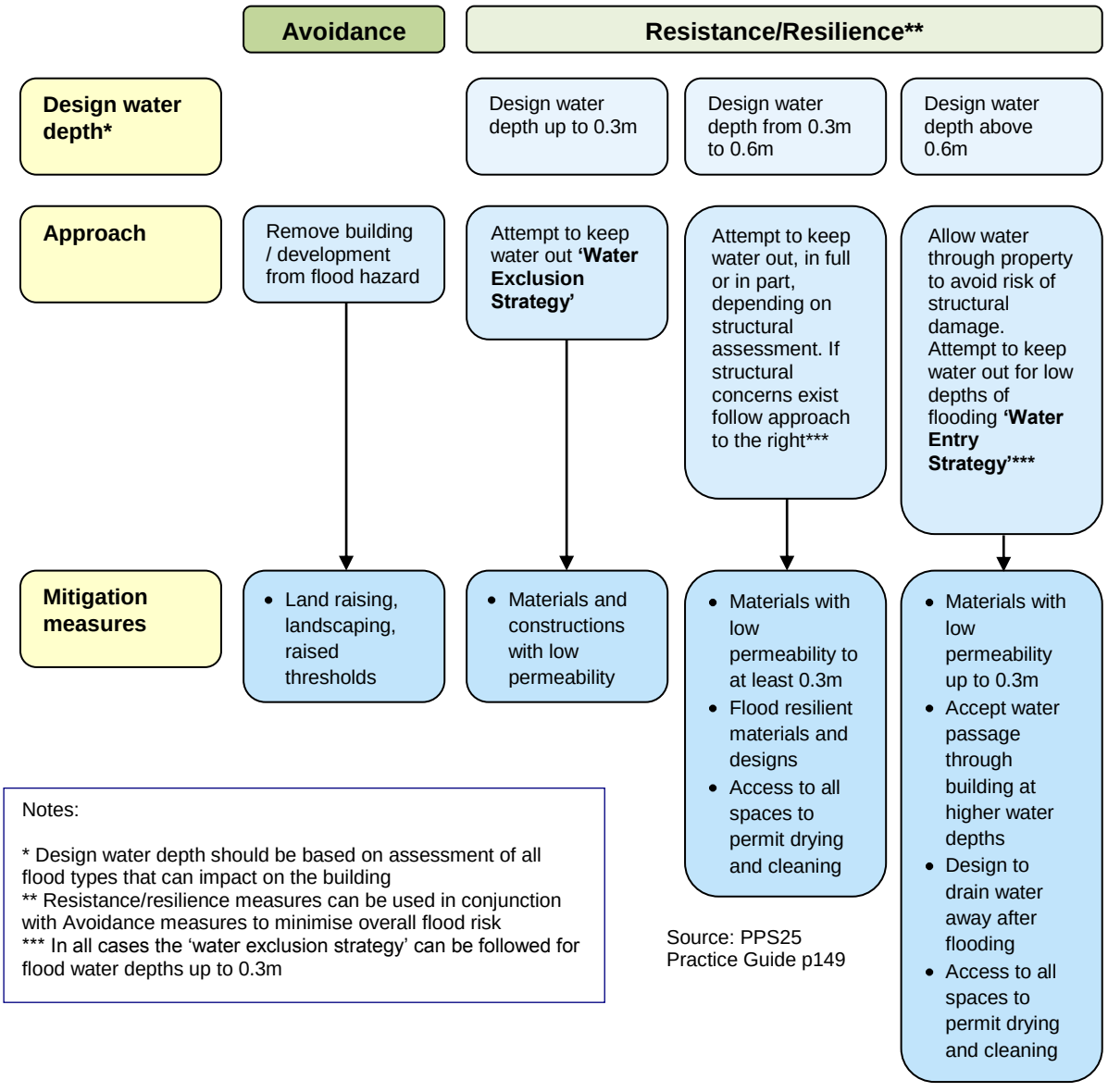
Often the determining factor in deciding whether a particular development can or cannot proceed is the financial feasibility of flood risk mitigation rather than technical limitations. Detailed technical assessments are required in the FRA to assess this feasibility, together with a commercial review by the developer of the cost of the mitigation works. At the SFRA stage, broad assumptions are therefore required regarding the feasibility of flood risk mitigation to ensure that only sites with realistic development potential are put forward.

Some mitigation measures as outlined in PPS25 are presented in Figure 6-1. It is not assumed that floor level raising will continue to be the traditional mitigation measure. It should be noted that the Environment Agency see actual land raising as a last option.

Thought will also be required to ensure safe access and egress is available for flood events including climate change.

Whilst flooding mitigation measures can be implemented in most sites, it is worth noting that in some instances the findings of individual FRAs may determine that the risk of flooding to a proposed development is too great and mitigation measures are not feasible. In these instances, the development will be subject to an objection by the Environment Agency.

**Figure 6-1: Rationale for Flood Resilient and/or Resistant Design Strategies[26]**




Notes:

* Design water depth should be based on assessment of all flood types that can impact on the building
** Resistance/resilience measures can be used in conjunction with Avoidance measures to minimise overall flood risk
*** In all cases the 'water exclusion strategy' can be followed for flood water depths up to 0.3m

Source: PPS25 Practice Guide p149

### 6.2.1 Reducing Flood Risk through Site Layout and Design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

26 Adaption from Communities and Local Government (2007) Improving the Flood Performance of New Buildings

The PPS25 Practice Guide states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use to higher ground, while more flood-compatible development (e.g. vehicular parking and recreational space) can be located in higher risk areas.

Waterside areas, or areas along known flow routes, can be used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas, and avoid the creation of isolated islands as water levels rise.

The Environment Agency will have to consent to any works within 5 metres of a main river. It is likely that they will object in principle to any development within these areas.

**The Royal Institute of British Architects (RIBA) have produced a guidance document 'Designing for Flood Risk' which can aid this process. The guidance document can be found at:**

http://www.architecture.com/FindOutAbout/Sustainabilityandclimatechange/Flooding/DesignGuide.aspx

### 6.2.2 Modification of Ground Levels

Modifying ground levels to raise the land above the required flood level is a very effective way of reducing flood risk to the site in question, especially in tidal flood risk areas.

However, in most areas of fluvial flood risk, conveyance or flood storage would be reduced by raising land above the floodplain, adversely impacting on flood risk downstream. **Compensatory flood storage must be provided, and should be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain)**. It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated).

Where the site is entirely within the floodplain it is not possible to provide compensatory storage at the maximum flood level and this will not be a viable mitigation option. Compensation schemes must be environmentally sound.

The need for compensatory storage must been discussed at the earliest stage of planning as this will be a major constraint as this requirement may have significant implications for the yields achieved for individual sites due to the associated land take this may require.

### 6.2.3 Raised Defences

Construction of raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Temporary or demountable defences are not acceptable flood protection for a new development unless flood risk is residual only.

In some cases, it may be necessary for the developer to make a contribution to the improvement of flood defence provision that would benefit both the development in question and the local community.

### 6.2.4 Building Design

The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood. If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable, they should be raised to 600mm above the maximum water level during a 1 in 100 year flood event plus climate change. This additional height that the floor level is raised is referred to as the 'freeboard'.

Depth information produced in a Level 2 SFRA could provide an indication of the height of land raising required to lift the development out of the 1 in 100 year event plus climate

change. Whilst this will provide an early indication, detailed modelling will still be required during a site-specific FRA to define these levels further.

Making the ground floor use of a building water compatible (e.g. a garage), is an effective way of raising living space above flood levels.

Putting a building on stilts is not considered an acceptable means of flood mitigation for new development. However it may be allowed in special circumstances if it replaces an existing solid building, as it can improve flood flow routes. In these cases attention should always be paid to safe access and egress and legal protection should be given to ensure the ground floor use is not changed.

### 6.2.5 Resistance and Resilience

There may be instances where flood risk remains to a development. For example, where the use is water compatible, where an existing building is being changed, where residual risk remains behind defences, or where floor levels have been raised but there is still a risk in a 1 in 1000 year event. In these cases (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery. These measures should not be relied on as the only mitigation method.

The 2007 document 'Improving the Flood Performance of New Buildings' provides further details on possible resistance and resilience measures[27].

#### Temporary Barriers

Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale temporary snap-on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

#### Permanent barriers

Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

#### Wet-proofing

This involves designing interiors to reduce damage caused by flooding, for example:

- Electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level
- Water-resistant materials for floors, walls and fixtures

Resilience measures will be specific to the nature of flood risk, and as such will be informed and determined by the FRA.

## 6.3 Making Development Safe

### 6.3.1 Safe Access and Egress

The developer must ensure that safe access and egress is provided to an appropriate level for the type of development. This may involve raising access routes to a suitable level.

As part of the FRA, the developer should review the acceptability of the proposed access in consultation with the Environment Agency.

27 Communities and Local Government (2007) Improving the Flood Performance of New Buildings – Flood Resilient Construction

For the purpose of the SFRA it is considered appropriate to provide a low hazard environment in access and egress routes associated with new housing developments. Environment Agency guidance suggests that all development should have a dry access and egress in the 1 in 100 year event.

Greater depth and velocity may be permitted where elevated and safe access/egress to safe ground is provided.

It should be noted that the emergency services are unlikely to regard developments that increase the scale of any rescue that might be required as being safe.

### 6.3.2 Flood Warning and Evacuation

Emergency/evacuation plans should be in place for all properties, large and small, at residual risk of flooding; those developments which house vulnerable people (i.e. care homes and schools) will require more detailed plans.

**More information on flood plans for development is provided in Section 8.**

## 6.4 Making Space for Water

### 6.4.1 Opportunities for River Restoration and Enhancement

All new development close to rivers should consider the opportunity presented to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

### 6.4.2 Opportunities for Floodplain Restoration

It is an objective of PPS25 to safeguard land from development that may be required for current or future flood management. In areas of very high flood risk there may be a strong case for allowing previously developed sites to return to Functional Floodplain in urban areas where they can act to convey and store flood water and reduce risk to current development.

### 6.4.3 Buffer Strips

The Environment Agency should be consulted on all proposed development within 20m of bank top and are likely to object in principle to any developments being put forward within 5m of bank top. Developers should set back development from the landward toe of fluvial defences (or top of bank where defences do not exist). An 8m easement gap is suggested. However, any distance should be agreed with the Environment Agency on a case by case basis. This easement will provide a buffer strip to ‘make space for water’, allow additional capacity to accommodate climate change and ensure access to defences is maintained for maintenance purposes.

These buffer strips should be linked to the wider green infrastructure strategy and the re-establishment of the functional floodplain.

# 7 Sustainable Drainage Systems

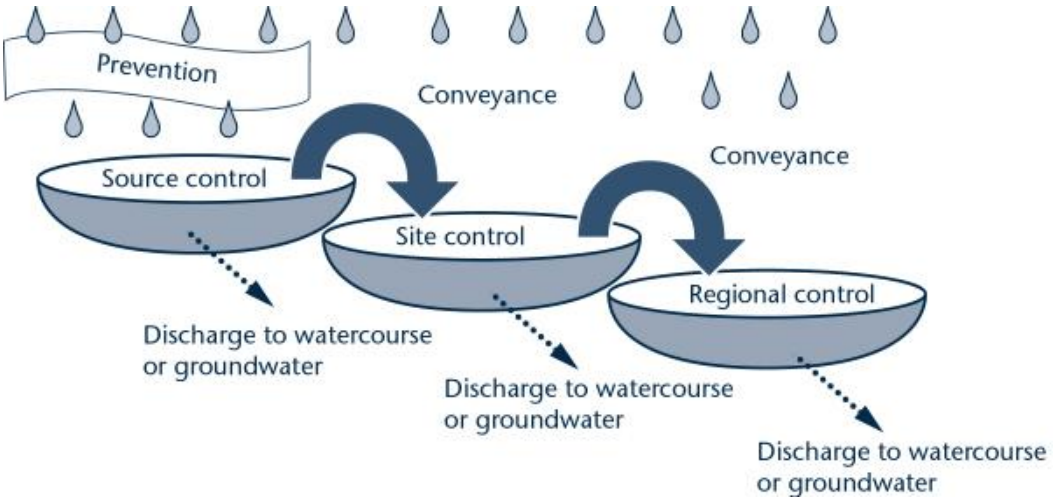
## 7.1 Introduction

Sustainable Urban Drainage Systems (SUDS) are management practices which enable surface water to be drained in a more sustainable manner.

For Greenfield developments, the aim is to not increase runoff from the undeveloped situation; for Brownfield re-developments, the aim is to reduce existing runoff rates. Wherever possible, this should be achieved through the implementation of a sustainable drainage or flow retention system, constructed within the boundaries of the development site.

There are many different SUDS techniques which can be implemented. As a result, there is no one correct drainage solution for a site. In most cases, a combination of techniques, using the Management Train principle, will be required. Figure 7-1 shows the SUDS Management Train principle, where source control is the primary aim.

**Figure 7-1: SUDS Management Train Principle**[28]




A good first assessment of the suitability of different SUDS components can be achieved be reviewing the techniques set out in Table 1.7 of the CIRIA SUDS Manual[29], which shows the capability of different SUDS techniques.

The CIRIA SUDS Manual provides a detailed series of matrices that can be used as a screening process to select the best groups of SUDS for a development site. These are based around five selection criteria:

- Land use characteristics
- Site characteristics
- Catchment characteristics
- Quantity and quality performance characteristics
- Amenity and environmental requirements

The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography, geology (soil permeability), and available area. In addition to potential ground contamination associated with urban and formerly industrial sites with concern being placed on the depth of the local water table and potential contamination risks. The design, construction and ongoing

28 CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative
29 CIRIA (2007) The SUDS manual

maintenance regime of such a scheme must be carefully defined, and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential. Additionally, for infiltration SUDS it is imperative that the water table is low enough and a site specific infiltration test is undertaken.

At a catchment level characteristics determine whether there are any regulatory criteria that may restrict or preclude the use of a particular SUDS technique, or that may impose additional requirements on the performance of a particular system. The design of the SUDS may for example be influenced by the characteristics of the downstream water body that will receive the storm water discharge. In some cases, high pollutant removal or environmental performance will be needed to fully protect aquatic resources and/or human health.

Catchment characteristics are generally related to the number of components in the treatment train that will lower the risk of poor water quality treatment performance rather than appropriateness of technique.

Regarding flood risk, those SUDS with a high/primary process for dealing with water quantity should first be investigated, before other benefits such as water quality and environmental befits are included. SUDS can reduce the amount and rate of runoff by a combination of:

- Infiltration - infiltration of rainwater into the ground
- Storage - holding water in storage areas
- Conveyance - slowing down the movement of water

There are a number of SUDS techniques which could be used individually or as part of a management train, however their suitability relies on the site and catchment descriptors discussed above but also their intended purpose (as shown in Table 7-1).

**Table 7-1: Suitability of SUDS Techniques**

| SUDS Technique | Infiltration | Storage | Conveyance |
|---|---|---|---|
| Green Roofs | × | ✓ | ✓ |
| Permeable Paving | ✓ | × | ✓ |
| Rainwater Harvesting | × | ✓ | × |
| Swales | ✓ | ✓ | ✓ |
| Detention Basins | ✓ | ✓ | ✓ |
| Ponds | × | ✓ | ✓ |
| Wetlands | × | ✓ | ✓ |
| Source: PPS25 Practice Guide | | | |

PPS25 stresses that Regional Planning Bodies and Local Planning Authorities (LPAs) should:

- Promote the use of SUDS for the management of run-off.
- Ensure their policies and decisions on applications support and complement the Building Regulations on sustainable rainwater drainage, giving priority to infiltration over first watercourses then sewers.
- Incorporate favourable policies within Regional Spatial Strategies.
- adopt policies for incorporating SUDS requirements in Local Development Documents
- Encourage developers to utilise SUDS wherever practicable, if necessary through the use of appropriate planning conditions

- Develop joint strategies with sewerage undertakers and the Environment Agency to further encourage the use of SUDS.

Adoption and future maintenance of above ground SUDS facilities by Sunderland City Council as public open space requires early discussion between the developer, the Council and Northumbrian Water. Above ground attenuation can be adopted by Sunderland City Council as public open space, with the provision of a payment to Sunderland City Council via a strategic infrastructure levy. This must, however, be agreed at an early stage and ideally discussed in advance of the planning application to allow the contribution to be ring fenced specifically for the facility.

If future maintenance arrangements are to be assigned to a Management Company, this should be discussed at an early stage with Northumbrian Water. This can have implications on the adoption of the remaining site drainage and consequently adoption of any highways on the development.

Allowance should be made by whomever is to take future responsibility for the SUDS facilities, for checking the SUDS designs and for inspection during construction, if necessary employing competent individuals to perform this task.

Information should be provided to make the end-users of the development aware of SUDS and in particular their responsibilities to maintain and not to remove any privately owned SUDS facilities. If deemed necessary the removal of permitted development rights or the inclusion of covenants in the deeds of properties could be considered.

## 7.2 Types of SUDS

### 7.2.1 Permeable Surfaces[30]

Pervious pavements such as permeable concrete blocks, reinforced grass, crushed stone or gravel and permeable asphalt will allow water to infiltrate directly into the subsoil before soaking into the ground.

It is also possible to incorporate attenuation into the sub base of porous paving construction if the infiltration potential of the ground is not ideal.

On Brownfield sites where contaminated ground is an issue, a lined attenuation system can be built into the sub-base. The porous paving provides a filtering action and improves water quality. Additional products are available that provide a specific filtering function within the attenuation system.

The shallow excavation required to install such facilities in comparison to traditional over-sized pipes can have the added benefit of reducing surplus material and costly off-site disposal.

30 Photos Courtesy of Charcon / Aggregate Industries

### 7.2.2 Living (Green) Roofs and Walls[31]

Living Roofs and walls can vary in type from Roof Gardens, Roof Terraces, Green Roofs and Green Walls.

This approach utilises plants and their substrate to provide temporary storage of rainfall. The water retained by the substrate and lost through evaporation and evapotranspiration minimises runoff from the roof. Even when saturated, the run-off rate is slowed by the roughness of the vegetation and so mimics more closely the run-off prior to development.

Commonly perceived problems are largely unwarranted. These include a lack of British Standards associated with green roofs. However, the German FLL, the Landscape Research, Development & Construction Society, covers all aspects of green roofs from waterproofing, soils, vegetation, installation methods and maintenance and members include major UK suppliers.

There is also a perception that dry vegetation during the summer months could lead to fires being started on green roofs, however, the FLL have strict guidelines on this issue.

Maintenance requirements will depend on the type of roof system. An amenity space will require similar maintenance to a garden; otherwise a one to two year inspection is likely to suffice, to weed out unwanted plants.

### 7.2.3 Basins, ponds and wetlands[32]

Dry basins, ponds and wetlands can be designed to provide temporary storage for storm water through the regarding of site ground levels to form a contained storage area, in conjunction with a flow control to force water into the storage facility and allow it to drain down slowly at a controlled rate. They can often be a key part of landscape strategies, providing amenity space and opportunities for the creation of wildlife habitats.

The permanent pool volume and pond planting can be designed to provide a cleaning function, diluting and removing pollutants from the storm water. Basins, ponds and wetlands can be fed by swales, filter drains or piped systems.

Safety should be carefully considered when designing the side slope gradients and water depths and, if required, fencing and barrier planting should be incorporated.

The future adoption and maintenance arrangements need to be agreed with Sunderland City Council and Northumbrian Water prior to designing the attenuation basin or pond, as this can potentially affect the adoption of site sewers and highways.

In areas susceptible to fluvial flooding, surface water attenuation facilities should be designed not to conflict with floodplains or flood mitigation measures. The basin or pond base level should be set above the peak 1 in 100 year fluvial flood level with climate change.

31 Photos courtesy of livingroofs.org/greenroofconsultancy.com
32 Photos courtesy of Greenbelt Group


### 7.2.4 Filter strips, swales and infiltration devices[33]

Swales provide temporary storage for storm water to help reduce peak flow runoff. While providing an alternative to traditional piped conveyance systems, the flow across vegetation provides a filtering function at low velocities. Check dams and flow controls can be introduced to further reduce flows and utilise the storage potential.

Filter Strips are vegetated areas that are intended to treat sheet flow from adjacent impervious areas. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice. Infiltration devices drain water directly into the ground. They may be used at source or the runoff can be conveyed in a pipe or swale to the infiltration area. They include soakaways, infiltration trenches and infiltration basins as well as swales, filter drains and ponds. Infiltration devices can be integrated into and form part of the landscaped areas. Filter Drains are gravel filled trenches which trap sediments from run-off and provide attenuation. Flow is directed to a perforated pipe which conveys run-off back into the sewerage network or into a water body. Filter drains are used mainly to drain road and car park surfaces.


### 7.2.5 Rainwater Harvesting

Rainwater harvesting techniques can aid in increasing the attenuation of rainfall and contribute to the onsite recycling of water. Water butts are a common rainwater harvesting technique; however they are easily bypassed or full when a rainfall event occurs. If used on a strategic basis and it can be demonstrated that their use will make available volume for storage, the Environment Agency may consider whether they can count towards surface water attenuation.

33 Photos courtesy of Greenbelt Group

# 8 Emergency Planning

## 8.1 Introduction

This section provides guidance on how Local Authority Emergency Planners can use the outputs of the SFRA to update Multi-agency Flood Plans and provide advice on Flood Plans written by developers for new development.

## 8.2 Emergency Planning Overview

Under the Civil Contingencies Act, Category 1 responders to emergencies are required to produce risk assessments and contingency plans in dealing with emergencies and to provide advice and information to the public. Under the Act, risk assessments and planning is arranged through Local and Regional Resilience Forums (L/RRF). Sunderland falls within the Northumbria LRF (NLRF). The purpose of the forums is to ensure all agencies, which are exposed to risk or to be required to respond to events can effectively deliver their duties under the Act.

NLRF overall purpose is to ensure that there is an appropriate level of preparedness to enable an effective multi-agency response to emergency incidents that may have a significant impact on the communities in the North East. Strategic decision-making and resource allocation are determined by reference to the Northumbria Community Risk Register (CRR), which considers the likelihood and consequences of the most significant risks facing Northumbria over the next 5 years.

NLRF has a multi-agency work programme in which the Council is actively engaged. This is designed to develop integrated and co-ordinated multi-agency planning arrangements including the risk assessment of the hazards and threats that face Northumbria; the development of plans; the training of personnel and development of appropriate levels of response capability; and the exercising and validation of plans.

At a local level, it is the local authorities that play a critical role in civil protection. They have a wide range of functions which are likely to be called upon in support of the emergency services during an emergency, including key statutory responsibilities such as environmental health, housing, social services and highways, and crucially, exercise a community leadership role.

The role of local authorities in relation to the initial response phase is to provide support for the people in their area. Resources of local authority departments will be utilised to mitigate the effects on people, property, and the environment and to co-ordinate the response from the voluntary sector.

Local authorities will provide, in liaison with the Police, Rest Centres for people who have been evacuated, arrangements for friends and relatives of people bereaved and seriously injured, and Survivor Reception Centres. In addition, the local authority will have responsibility for establishing, in liaison with H.M. Coroner and the Police, emergency mortuary capacity in emergencies that exceed existing mortuary provision.

Emergency planning is essential for individual developments at flood risk and therefore considered within a FRA.

Flooding is a natural process and cannot wholly be avoided. As was seen in the summer 2007 floods, flooding can cause massive disruption to communities, damage to property and possessions and even loss of life. The aim of the SFRA so far has been to try an avoid development in flood risk areas in the first instance. However, it has also been accepted that there is current development in flood risk areas and there will need to be a level of continued regeneration. Minimising flood risk to people, property and the environment should be considered.

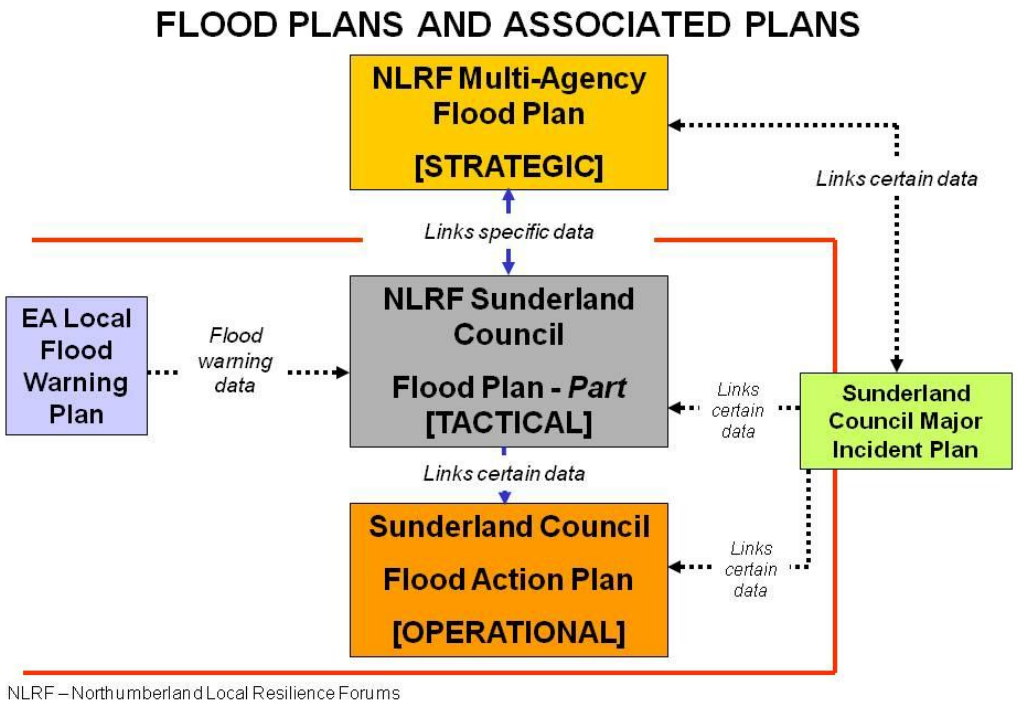
Flood defences go some way in reducing the current flood risk by providing a standard of protection, however there is still a residual risk associate with them as they can be

overtopped or breached. Flood Warnings are an integral part of flood defences, in which the Environment Agency are the lead authority responsible for warning the public, local authorities and emergency services.

Along with the Environment Agency Flood Warning systems, there are a range of Flood Plans at a regional and local level, outlining the major risk of flooding and the tactical and operation plan for key responders. These plans are incorporated in Local Authority Major Incident Plans.

Figure 8-1 identifies the links between Environment Agency Flood Warning data and regional and local Flood Plans

**Figure 8-1: Local & Regional Flood Plans**




### 8.2.1 Environment Agency Local Flood Warning Plans

A Local Flood Warning Plan for Sunderland has been produced by the Environment Agency. The plan outlines the Environment Agency procedures for issuing flood warnings to Sunderland and the locations and properties covered. The information provided by the Environment Agency and the nature of its flood warnings in Sunderland were discussed in Volume II of the SFRA. The locations of the flood warning areas are also provided on a map discussed in the SFRA Flood Risk Mapping Section.

Flood warning data held in this report should be used to inform the Sunderland Flood Plans.

### 8.2.2 NRFL Multi-Agency Flood Plan

The Northumbria Local Resilience Forum (NLRF) is developing a NLRF Multi-Agency Flood Plan based on Defra Guidance. This is being developed in partnership with the Tyne & Wear and Northumbria Local authorities. The NFLR Multi-Agency Flood Plan looks at a strategic level response to major flooding incidents in the Tyne and Wear area. This plan is currently being developed and further planning meetings will be undertaken in the coming months to finalise the content of the plan. A draft plan should be available by the end of 2009, however the public release of this document will have to be discussed and agreed with the NLRF.

Once complete it will provide a general overview of actions, roles and responsibilities and sits alongside the relevant emergency plans of all Category 1 and 2 responders and other organisations concerned with supporting the response of the community to a flood, and is dependent upon the existence and maintenance of those plans.

The plan has been developed to collate information regarding the roles and responsibilities of organisations that respond to flooding within the Northumberland area to improve multi agency response and co-ordination to a major flood (a major flood can be defined as Level 5 or Level 4 if declared a major incident by a Category 1 Responder).

The key objectives of the plan are to:

- Ensure a co-ordinated response to a flood
- Protect life and well-being
- Mitigate damage to property and the environment
- Protecting the health and safety of personnel
- Define command structure
- Define trigger alerts
- Ensure a co-ordinated response to recovery

The information contained within this plan includes:

- Details of areas where flooding can occur from watercourses.
- Details of areas that receive the full Environment Agency Flood Warning service.
- Forms detailing organisational information relating to role, responsibility, response and resources for flooding.

The NLRF Flood Plan is also supplemented with an additional Sunderland Flood Plan section which details the tactical level response to flooding. This Plan is also still under development and further meetings are planned in the coming months to discuss its further alignment with the DEFRA Guidance. A draft should be available by the end of 2009, again the public release of this document will have to be discussed and agreed with both the NLRF and at a local level.

### 8.2.3 Sunderland City Council Flood Plan

Sunderland City Council is currently developing a Flood Action Plan, which will detail their emergency response to localised flooding events.

## 8.3 SFRA Emergency Planning Recommendations

All sources of flood risk have been assessed within this Level 1 SFRA and the hazard associated with that risk has been mapped where information has been available. This flood risk data should be used to update these Flood Plans and the Local Authority Emergency Planners is advised to:

- Consider and understand the possibility, likelihood and spatial distribution of all sources of flooding, including fluvial, tidal, surface water and sewer, man-made bodies of water including canals and reservoirs and groundwater flooding, as discussed in the Level 1 SFRA and associated mapping for report.
- Consider and understand the residual risk associated with flood risk management infrastructure and the management of manmade bodies of water
- Update the Northumbria LRF Community Risk Register is updated using information contained within the SFRA. The latest version of the CRR was produced in December 2008 and is available on the Government Office of the North East website:

  http://www.go-ne.gov.uk/gone/prepforemergencies/northumbria/ [29/06/2009]

  The CRR is down to be reviewed in June 2009. Updating the register with information within the SFRA will enable a more effective and direct response to those people/communities at greatest risk.

- Incorporate the findings of this SFRA within the upcoming Sunderland and NLRF Multi-Agency Flood Plans to ensure that safe evacuation and access for emergency services is possible during times of flood for both existing developments and those future development sites.
- The findings of this SFRA should also be integrated within the development of emergency plans within site-specific FRAs. Large development should consult with Sunderland City Council Emergency Planning Officer, when producing the evacuation plan as part of an FRA. Flood Plans should also be updated with Environment Agency reservoir inundation maps once available.

## 8.4 Planning Approval – Flood Plans including flood warning

As a condition of planning approval flood evacuation plans should be provided by the developer which aim to safely evacuate people out of flood risk areas, using as few emergency service resources as possible. These plans should detail any prearranged emergency arrangements including dry evacuation routes, flood warning, location of rest centres and safe havens. It is recommended that any flood evacuation plan written is forwarded onto Sunderland City Council as appropriate and the Environment Agency for review. The plan owner must put in place the plan if the development goes ahead, and maintain and update the plan.

According to the PPS25 Practice Guide, flood warning and evacuation plans should include the following information:

1. **How flood warning is to be provided**
    a. Availability of existing flood warning system
    b. How flood warning is provided
    c. Rate of on set of flooding
2. **What will be done to protect the development and contents**
    a. How easily will damaged items be relocated
    b. The availability of staff/occupants/users to respond to flood warning
    c. The time taken to respond to flood warning
3. **Ensuring safe occupancy and access to and from the development**
    a. Occupants awareness of the likely frequency and duration of flood events
    b. Designing and location of safe access routes
    c. Preparing evacuation routes
    d. Identify safe locations for evacuees
    e. Vulnerability of occupants
4. **Expected time taken to re-establish normal use following an event**

## 8.5 Flood Awareness

Emergency Planners should also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of measures that people can take to make their homes more resilient to flooding from all sources and encouraging all those at fluvial flood risk to sign up to the Environment Agency's Floodline Warnings Direct service.

# Appendices

# A . Flood Risk Zones

**PPS25 Table D.1.**

| Flood Zone 1 - Low Probability |
|---|
| **Definition**<br><br>This zone comprises land assessed as having a less than 1 in 1000 annual probability of river and sea flooding in any year (<0.1%).<br><br>**Appropriate uses**<br><br>All uses of land are appropriate in this zone<br><br>**FRA requirements**<br><br>For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in an FRA [Flood Risk Assessment]. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E (of PPS25) for minimum requirements<br><br>**Policy aims**<br><br>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage techniques. |
| **Flood Zone 2 - Medium Probability** |
| **Definition**<br><br>This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) and between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.<br><br>**Appropriate uses**<br><br>The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure listed in… [The Flood Risk Vulnerability Classification, see Table A-2] are appropriate in this zone.<br>Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 (of PPS25 and Table B-2 of this report) are only appropriate in this zone if the Exception Test is passed<br><br>**FRA requirements**<br><br>All development proposals in this zone should be accompanied by a FRA, See Annex E (of PPS25) for minimum requirements<br><br>**Policy Aims**<br><br>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques. |

## Flood Zone 3a - High Probability

**Definition**

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) and a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

**Appropriate uses**

The water-compatible and less vulnerable uses of land listed in Table D.2 (of PPS25 and Table A-2 of this report) are appropriate in this zone. The highly vulnerable uses listed in Table D.2 (of PPS25 and Table A-2 of this report) should not be permitted in this zone.

The more vulnerable and essential infrastructure listed in the Table D.2 (of PPS25 and Table B-2 of this report) should only be permitted in this zone if the Exception Test is passed. Essential Infrastructure permitted in this zone should be designed and constructed to remain operational and safe for user in times of flood.

**FRA requirements**

All development proposals in this zone should be accompanied by a FRA, See Annex E (of PPS25) for minimum requirements.

**Policy Aims**

In this zone, developers and local authorities should seek opportunities to:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
- Relocate existing development to land in lower Flood Zones; and
- Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocation and safeguarding open space for flood storage.

## Flood Zone 3b - The Functional Floodplain

**Definition**

**This zone comprises land where water has to flow or be stored in times of flood.** Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

**Appropriate uses**

Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

**FRA requirements**

All development proposed in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

**Policy Aims**

In this zone, developers and local authorities should seek opportunities to:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- Relocate existing development to land with a lower probability of flooding.

# B . Flood Risk Vulnerability Classification

**PPS25 Table D.2**

| Classification | Description |
|---|---|
| Essential Infrastructure | • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.<br>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.<br>• Wind turbines. |
| Highly Vulnerable | • Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding.<br>• Emergency dispersal points.<br>• Basement dwellings.<br>• Caravans, mobile homes and park homes intended for permanent residential use.<br>• Installations requiring hazardous substances consent[34]. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'[35]). |
| More Vulnerable | • Hospitals.<br>• Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.<br>• Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.<br>• Non–residential uses for health services, nurseries and educational establishments.<br>• Landfill and sites used for waste management facilities for hazardous waste.[36]<br>• Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan. |
| Less Vulnerable | • Police, ambulance and fire stations which are not required to be operational during flooding.<br>• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works which do not need to remain operational during times of flood.<br>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). |

34 See Circular 04/00: Planning controls for hazardous substances (paragraph 18) at: www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols

35 In considering any development proposal for such an installation, local planning authorities should have regard to Planning Policy Statement 23, 'Planning and Pollution Control'.

36 See Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10 for definition. www.communities.gov.uk/index.asp?id=1500757

| Classification | Description |
|---|---|
| Water-compatible Development | • Flood control infrastructure.<br>• Water transmission infrastructure and pumping stations.<br>• Sewage transmission infrastructure and pumping stations.<br>• Sand and gravel workings.<br>• Docks, marinas and wharves.<br>• Navigation facilities.<br>• MOD defence installations.<br>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.<br>• Water-based recreation (excluding sleeping accommodation).<br>• Lifeguard and coastguard stations.<br>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.<br>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan. |

**Notes**

1. This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)[37] and also on the need of some uses to keep functioning during flooding.
2. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
3. The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

[37] See website for further details.
www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf

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