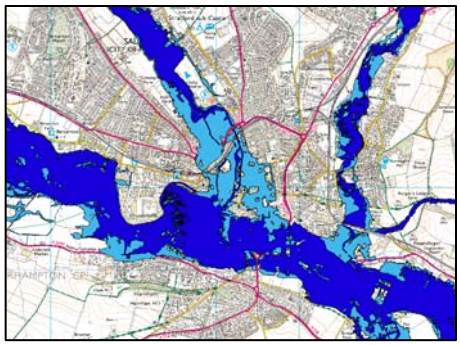
Bournemouth, Christchurch, East Dorset, North Dorset and Salisbury SFRA

Level 1 Strategic Flood Risk Assessment
Volume I (Final Report)
February 2008

Halcrow Group Limited

East Dorset District Council
So much to offer

SALISBURY District Council

Christchurch
...where time is pleasant

Bournemouth Borough Council

North Dorset DISTRICT COUNCIL

Bournemouth, Christchurch, East Dorset, North Dorset and Salisbury SFRA

Level 1 Strategic Flood Risk Assessment

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Halcrow Group Limited

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Strategic Flood Risk Assessment

Final Report

February 2008

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	Final report	23 Oct 07	D Wilson B Venturini R Prescott
2	1	Final report	04 Dec 07	D Wilson B Venturini R Prescott
3	1	Final Report	1 Feb 08	D Wilson B Venturini R Prescott

Contents

1 Introduction

1.1 ***Overview***

1.1.1 In July 2007 a consortium of the following councils: Bournemouth BC, Christchurch BC, East Dorset DC, North Dorset DC and Salisbury DC (termed herein as the five Councils) commissioned Halcrow to produce a Strategic Flood Risk Assessment in accordance with national Planning Guidance and the Environment Agency's guidance, which includes Planning Policy Statement 25: Development and Flood Risk (2006) and Development and Flood Risk, a Practice Guide Companion to PPS25 (2007).

1.1.2 For this study, a Level 1 SFRA approach has been agreed with the five Councils and the Environment Agency. A Level 1 SFRA is defined in the Practice Guide Companion to PPS25, as a desk-based study using existing information (refer to ***Appendix A*** for audit trail database) to allow application of the Sequential Test on the basis of Table D1 of PPS25 and to identify whether application of the Exception Test is likely to be necessary.

1.1.3 It is important to recognise that the SFRA is a 'living' document in that as new information becomes available (such as improved river models) updates will be made to the Flood Maps and SFRA report, to ensure that the best information is used to guide the site selection process for future developments.

2 The SFRA Study Area

2.1 ***Study area***

The study area comprises Bournemouth, Christchurch, East Dorset, North Dorset and Salisbury Local Planning Authority areas. There are a number of catchments within the study area, of which the main ones are the River Stour and the River Avon (see ***Figure 2.1***).

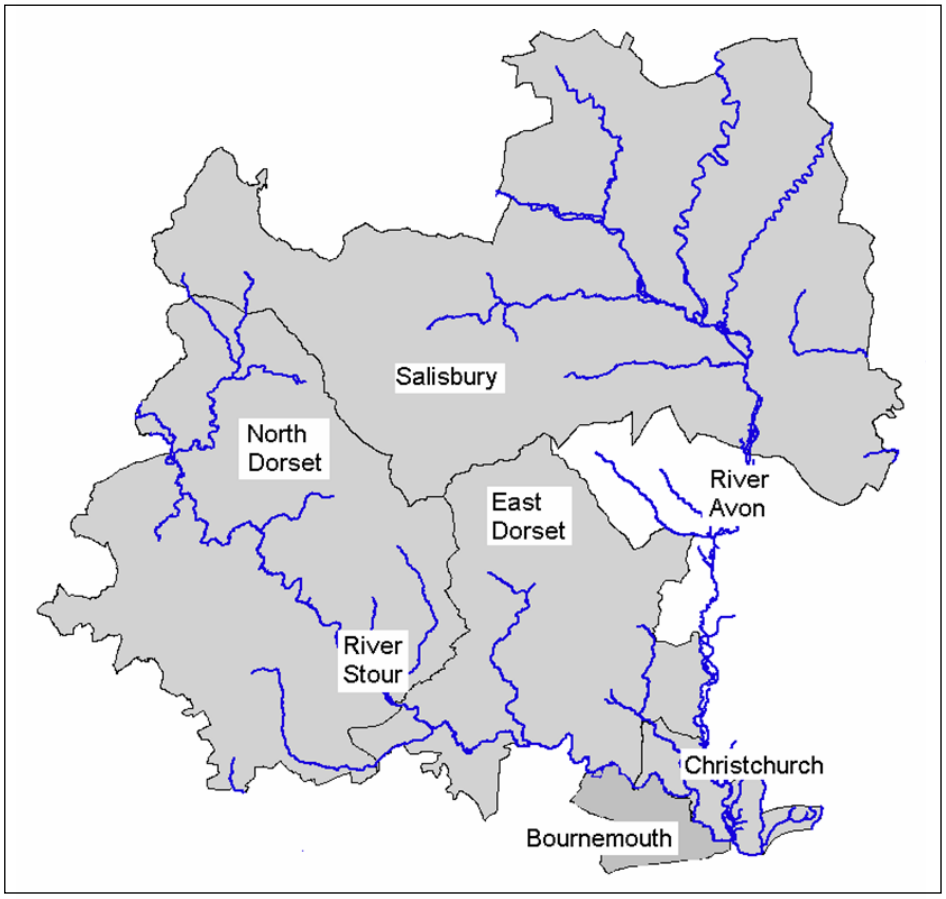

Figure 2.1 SFRA Study area

2.2 *Hydrology*

2.2.1 River Stour

The Stour catchment is 1300km^2, the majority of which lies within the study area. The River Stour is fed by many tributaries including the Rivers Crane, Allen, Tarrant, Winterbourne, Lydden, Cale, and Lodden, Caundle Brook, Shreen Water and the Moors. The River Stour passes through several towns including Gillingham, Blandford Forum, Wimborne Minster, West Parley, Bournemouth and Christchurch, each of which has been affected by flooding. Additionally there are several villages within the Stour catchment which have suffered varying degrees of flooding. Within Christchurch there are significant flooding issues relating to coastal inundation.

2.2.2 River Avon

The Hampshire Avon catchment is 1750km^2, of which a large proportion is within the study area. The River Avon flows through Salisbury, Downton and Christchurch. There are also a number of villages which lie on the floodplain of the River Avon. At Salisbury the Avon is joined by its main tributaries the Rivers Bourne, Nadder and Wylye. To the south of Salisbury the Avon is joined by the River Ebble. The lower Avon, south of Salisbury, is characterised by a complex network of artificially controlled channels, and is fed by a number of small tributaries. At Christchurch the Avon joins the River Stour before flowing into Christchurch Harbour.

2.3 *Geology and Hydrogeology*

The geology of the SFRA study area is shown on a number of the BGS 1:50,000 Scale Geological Map Sheets as detailed in ***Appendix B***. The geological and hydrogeological setting provides a background both for an evaluation of the potential for groundwater flooding and for an understanding of the role of infiltration drainage either as part of SUDS systems, or within the overall natural water cycle.

Geological strata in the study area range from recent drift deposits such as alluvium and plateau gravels to older Jurassic strata such as Inferior Oolite and Kimmeridge Clay (in the north west). The succession of Tertiary deposits to the south of the area in particular is variable and complex. A simplification of the main geological strata present around the study area, identifying both their key hydrogeological properties and their potential for infiltration drainage is provided in ***Appendix B***.

1.2 Soils

Soil type also provides a generic description of the drainage characteristics of soils. This will dictate, for example, the susceptibility of soils to water logging or the capacity of a soil to freely drain to allow infiltration to groundwater. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types (soil association) found beneath the study area may be used as an indicator of permeability and infiltration potential.

3 SFRA Approach & Methodology

3.1 ***SFRA aims***

The aims of PPS25 planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.

The findings of the SFRA will feed directly into the preparation of Local Development Documents, including the Core Strategy and Site Allocation DPDs (see ***Figure 3.1***)

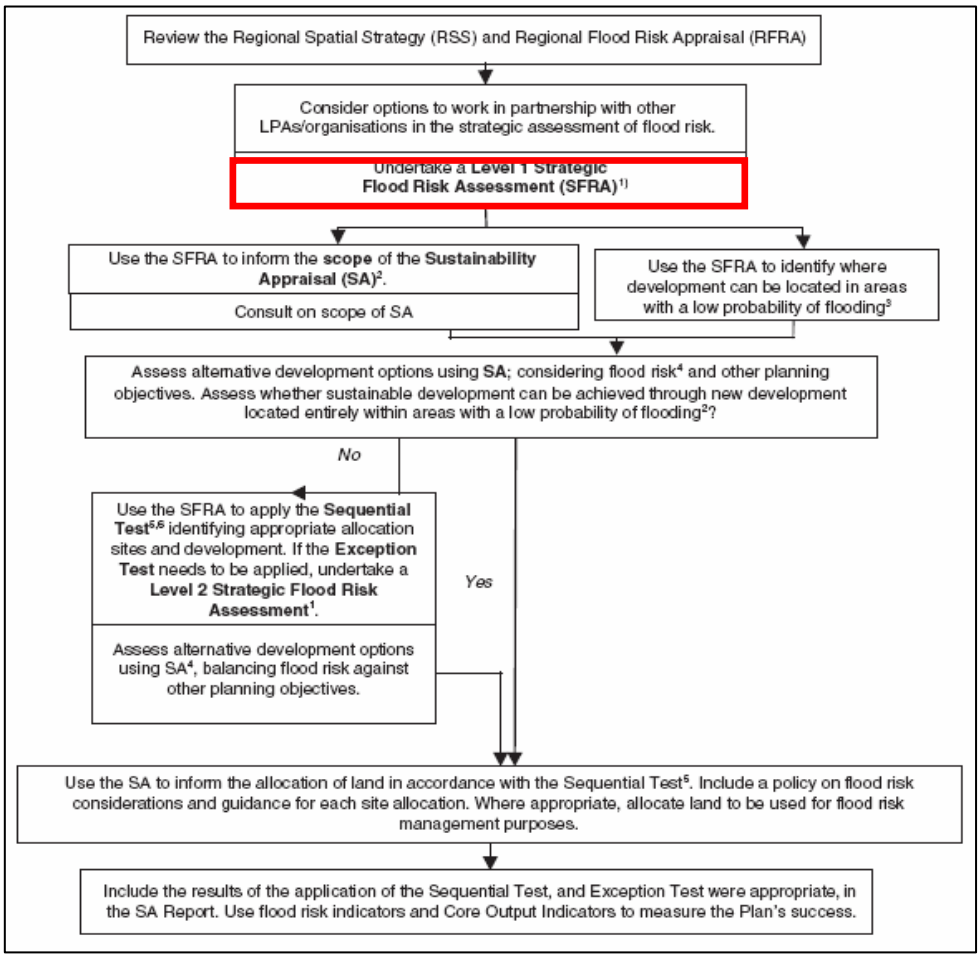

Figure 3.1 How the SFRA is used to inform site allocations

Where new development is necessary in areas at highest risk, the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. Safe in the context of this study means that dry pedestrian egress is possible through the floodplain and emergency vehicles can gain access.

The aim of this SFRA is to map all forms of flood risk and use this as an evidence base to locate new development primarily in low flood risk areas (Zone 1). Where development cannot be located in Flood Zone 1 the respective council will need to apply the Sequential Test to land use allocations and, where necessary, the Exception Test. In addition, it allows a planning authority to:

- Prepare appropriate policies for the management of flood risk;
- Inform the sustainability appraisal so that flood risk is taken account of, when considering options and in the preparation of strategic land use policies;
- Identify the level of detail required for site-specific Flood Risk Assessments (FRAs);
- Determine the acceptability of flood risk in relation to emergency planning capability.

3.2 Outcomes of the SFRA Process

A Strategic Flood Risk Assessment provides sufficient data and information to enable a planning authority to apply the Sequential Test to land use allocations and, where necessary, the Exception Test (see Sections 3.3 and 3.4).

PPS25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area. Under the Town and Country Planning (Local Development - England) Regulations 2004, a Sustainability Appraisal (SA) is required for all LDFs. The purpose is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The Regulations stipulate that SAs for LDFs should meet the requirements of the SEA Directive. A SFRA is used as a tool by a planning authority for the production of development briefs, setting constraints, identifying locations of emergency planning measures and requirements for Flood Risk Assessments.

It is important to reiterate that PPS25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for future development must also meet the requirements of other planning policy. Clearly a careful balance must be sought in these instances, and the SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

3.3 *The Sequential Test*

A planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed. ***Figure 3.2*** shows the Sequential Test process as advocated in PPS25.

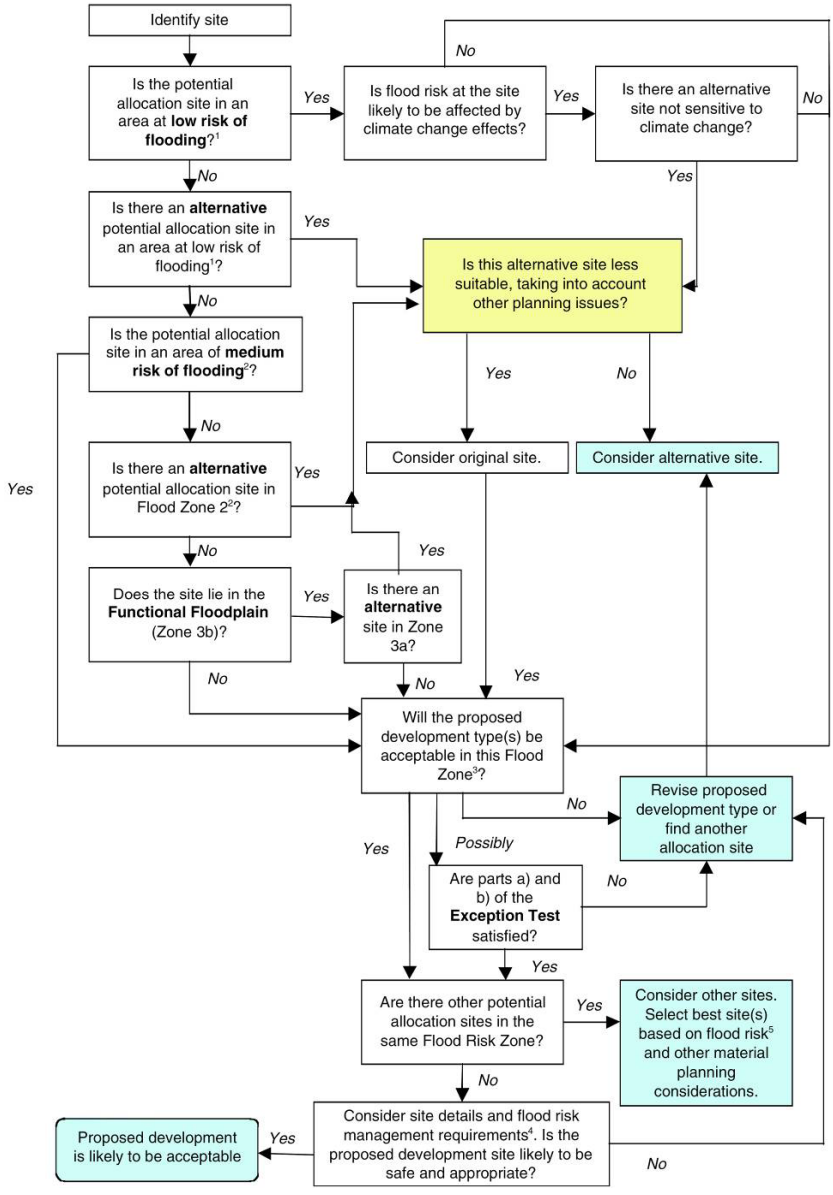

Figure 3.2 Application of the Sequential Test – Source: Development and Flood Risk: A Practice Guide Companion 'Living Draft' (2007)

Preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability (see Table D.2 in PPS25) of the proposed development can be taken into account in locating development in Flood Zone 2 (Medium Probability) and then Flood Zone 3 (High Probability).

Within each Flood Zone new development should be directed to sites with lower flood risk (towards the adjacent zone of lower probability of flooding) from all sources as indicated by the SFRA.

3.4 The Exception Test

If, following application of the Sequential Test, it is not possible, or consistent with wider sustainability objectives, for the development to be located in zones of lower probability of flooding, the Exception Test can be applied. This test provides a method of managing flood risk while still allowing necessary development to occur.

The Exception Test is only appropriate for use when there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites, but where some continuing development is necessary for wider sustainable development reasons (the need to avoid social or economic blight and the need for essential civil infrastructure to remain operational during floods).

The Exception Test may also be appropriate to use where restrictive national designations such as landscape, heritage and nature conservation designations, e.g. Sites of Special Scientific Interest (SSSIs) and World Heritage Sites (WHS), prevent the availability of unconstrained sites in lower risk areas.

For the Exception Test to be passed:

a) It must be demonstrated that the development provides wider sustainability benefits to the community which outweigh flood risk, informed by a SFRA where one has been prepared. If the Development Plan Document has reached the 'submission' stage (see Figure 4 of PPS12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;

b) The development should 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 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 is possible the exception test may need to be applied when considering sites for development within the 'areas of search for development' or existing urban areas as part of these areas fall within Flood Zone 3 (see ***Section 10.3 and 10.4***).

3.5 ***Level 1 SFRA methodology***

This report forms a Level 1 SFRA, which is defined in the Practice Guide Companion to PPS25, as a desk-based study using existing information to allow application of the Sequential Test (see ***Figure 3.1***) and to identify whether application of the Exception Test is likely to be necessary.

The main tasks undertaken during the study were as follows:

- Understanding the planning context (***Section 4***)
  A review of the Local Development Framework process and Local Policy was undertaken to get a clear picture of the challenges faced by the planning teams, and the various opportunities and constraints guiding the site allocation process.
- Data Sources (***Section 5***)
  A review and the collation of the available data regarding flood risk within the SFRA study area was undertaken.
- Assessment of potential causes of flooding (***Section 6***)
  A series of GIS maps were produced using the data gathered. The main outputs are PPS25 Flood Maps for the entire study area taking into account flooding from all sources. Other maps contain information on flood defences and flood storage areas. An assessment of flood risks posed by reservoirs and the variation of flood risks within flood zone 3 was also undertaken.
- Assessment of flood risk management practices (***Section 7***)
  The existing flood defences, flood warning and emergency planning procedures were reviewed, together with policies for the maintenance and upgrade of defences.
- Assessment of the capacity for the use of SUDS (***Section 8***)
  A review of the types of Sustainable Drainage Systems (SUDS) available and the applicability of these to the SFRA study area.

- Flood risk and climate change (***Section 9***)
  The potential impact of climate change on the current flood zones and other sources of flooding were reviewed, together with the potential increase in flood risk caused by future development. Sustainable land uses for medium and high risk flood areas are detailed.
- Strategic land Use Planning (***Section 10***)
  Planning recommendations to enable appropriate planning responses with regards to flood risk are given, together with recommendations for reducing existing flood risks.

3.6 ***The need for a level 2 SFRA methodology***

Where the need to apply the Exception Test is identified, due to there being an insufficient number of suitably available sites for development within zones of lower flood risk or due to possible increases in flood risk arising from climate change, the scope of the SFRA will need to be widened to a Level 2 assessment.

This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding) taking into account the presence of flood risk management measures such as flood defences.

A Level 2 SFRA often includes 2D modelling and breach/overtopping analysis for certain locations. Such an assessment may be required if development is proposed behind defences (see Section 7.2) or downstream of reservoirs (see Section 6.2.5). However, the need for a Level 2 assessment cannot be fully determined until the Sequential Test has been undertaken on all possible site allocations.

Level 2 SFRA outputs, should a study be required for study area include:

- An appraisal of any likely future policy for flood risk management;
- An appraisal of the probability and consequence of breach or overtopping of defences and water retaining structures;
- Maps showing the distribution of flood risk across zones;
- Guidance on appropriate policies for making sites which satisfy parts a) and b) of the Exception Test safe; and the requirements for satisfying part c) of the Exception Test,
- Guidance on preparation of FRAs for sites with varying flood risk across the flood zone.

4 Policy Framework

4.1 ***Overview***

This section provides an overview of the planning policy framework relevant to this Strategic Flood Risk Assessment (SFRA). Information contained in this SFRA on flooding and flood risk will provide evidence to facilitate the preparation of robust policies for flood risk management. The SFRA should be used to inform the Sustainability Appraisal of Local Development Documents (LDDs) and will enable informed decisions to be made relating to land use and development allocation within the respective Development Plan Documents (DPDs).

4.2 ***Planning Policy Framework***

The UK planning system has a comprehensive hierarchy of policies and plans, beginning with national guidance which provides a broad framework for regional plans through to development plans at the local level. Development plans are intended to provide clear guidance for prospective developers. They are prepared following public and stakeholder involvement and are intended to reconcile conflicts between the need for development and the need to protect the wider built and natural environment.

The Government is currently implementing reforms to the planning system with Planning Policy Statements (PPS) replacing Planning Policy Guidance (PPG), Regional Spatial Strategies (RSS) replacing Regional Planning Guidance (RPG) and Local Development Frameworks (LDF) replacing Structure and Local Plans and Unitary Development Plans.

The following paragraphs provide an overview of the relevant policy documents and a brief explanation of their significance for this SFRA.

4.3 ***National Policy***

4.3.1 Planning Policy Statement 1: Creating Sustainable Communities (2005)

PPS1 sets out the Government's objectives for the planning system. It confirms that good planning should deliver the right development in the right place and time, and protect the environment. It identifies sustainable development as the core principle underpinning planning and requires that development plans ensure it is pursued in an integrated manner. PPS1 also encourages regional and local

planning authorities to use sustainable drainage systems, this is discussed in more detail in Chapter 8.

In December 2006, the Department for Communities and Local Government (DCLG) sought views and comments on a draft Planning Policy Statement (PPS) 'Planning and Climate Change'. This sets out how planning, in providing for the new homes, jobs and infrastructure needed by communities, should help shape places with lower carbon emissions and resilient to the climate change now accepted as inevitable. When finalised, it is intended that this PPS will supplement PPS1.

4.3.2 Planning Policy Statement 3: Housing (2006)

PPS3 has been developed in response to recommendations in the Barker Review of Housing Supply (March 2004). Its principal aim is to underpin the necessary step change in housing delivery, improving the supply and affordability of housing in all communities including rural areas. PPS3 states that the Government's key housing policy goal is to ensure that everyone has the opportunity of living in a decent home, which they can afford, in a community where they want to live. The specific outcomes that the planning system should deliver are:

- well designed, high quality housing that is built to a high standard;
- a mix of market and affordable housing for all households in all areas;
- a sufficient quantity of housing, taking into account need and demand and seeking to improve choice;
- housing developments in suitable locations offering a good range of community facilities and with good access to jobs, key services and infrastructure;
- a flexible, responsive supply of land; which is used efficiently and effectively, including the use of previously developed land.

Housing policies should help to deliver sustainable development objectives, in particular seeking to minimise environmental impact taking account of climate change and flood risk, and take into account market information, in particular housing need and demand.

4.3.3 Planning Policy Statement 9: Biodiversity and Geological Conservation (2005)

PPS9 sets out policies on protection of biodiversity and geological conservation through the planning system. The broad aim is that development should have minimal impacts on biodiversity and geological conservation interests and enhance

them where possible. Appropriate weight should be attached to the need to protect international and national designated sites.

4.3.4 Planning Policy Guidance 15: Planning and the Historic Environment (1994)
PPG15 sets out policies on the protection of the historic environment and recognises that planning plays an important role in preserving built and natural heritage.

4.3.5 Planning Policy Guidance 17: Planning for Open Space and Recreation (2002)
PPG17 recognises the importance that public open spaces, green areas and recreational rights of way can play in supporting regeneration and contributing to local quality of life. Public open spaces and recreational areas provide important environmental assets that do not necessarily conflict with flood zones.

4.3.6 Planning Policy Statement 25: Development and Flood Risk (2006)
PPS25 sets out a plan led approach to flood risk. It confirms that all forms of flooding and their impact on the natural and built environment are material planning considerations. It clarifies the Sequential Test that matches types of development to degrees of flood risk and strengthens the requirement to include flood risk assessments at all levels of the planning process.

Regional planning bodies and local planning authorities (LPA) should, inter alia, reduce flood risk by safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water and flood defences.

PPS25 is considered in more detail elsewhere within this SFRA, as appropriate.

4.4 ***Recent Changes to Town and Country Planning Legislation***
Amendments to the Town and Country Planning (General Development Procedure) Order 1995 came into force on 1 October 2006 introducing further requirements for LPA to consult the Environment Agency before determining applications for development in flood risk areas.

The Town and Country Planning (Flooding) (England) Direction 2007 was published in December 2006. To safeguard against inappropriate development in flood risk areas, it introduces a requirement for LPA to notify the Secretary of State of any application for major development (e.g. 10 or more dwellings) in a

flood risk area which it proposes to approve against Environment Agency advice. The Direction came into force on 1 January 2007.

4.5 ***Regional Planning Policy***

Regional Planning Guidance for the South West (RPG10) covers the period up to 2016 and sets the regional planning policy framework for the area. RPG10 has assumed the status of RSS pending its review, and is considered as part of the statutory Development Plan for each of the five authorities.

RPG10 is now being reviewed and will be taken forward as the Regional Spatial Strategy for the South West (RSS) covering the period up to 2026. The Draft RSS was the subject of an Examination in Public between April and July 2007, with the Panel Report expected in November 2007. Following this, Proposed Changes will be published for consultation (expected in Spring 2008) before issue of the Draft RSS, expected in summer 2008.

The South East Dorset conurbation (comprising Bournemouth, Poole, Christchurch and its immediate hinterland) is particularly applicable to this SFRA; to which Policy SR29 refers. Designated as a 'Strategically Significant Town or City', Policy SR30 (and paragraph 4.3.15) relates specifically to Salisbury; and the more generic Policy HD1 relates to both Salisbury and the more rural areas of North Dorset. Table 4.1 (Draft South West Regional Spatial Strategy) sets out housing totals and phasing, and is applicable to all areas.

Policy SR29 of the draft RSS states that the South East Dorset area should make provision for an average of about 1,555 to 1,720 dwellings per annum (dpa) over the plan period, distributed as follows:

- **Bournemouth Borough Council:** an average of about 680 to 780 dpa;
- **Christchurch Borough Council:** an average of about 165 to 180 dpa, including an urban extension;
- **East Dorset District Council:** an average of about 260 dpa, of which about 120 dpa are extensions to existing settlements;
- **Salisbury District Council:** an average of about 460 dpa;
- **North Dorset District Council:** an average of 255 dpa.

Development in South East Dorset will focus on the intensification of Bournemouth, Poole and Christchurch's urban areas through the re-use of

previously developed land and buildings, including urban renewal, maximising densities whilst seeking high-quality design standards.

This will be complemented by the provision of urban extensions closely related to local centres at the following locations:

- north of Christchurch urban area, within Christchurch Borough, about 600 dwellings (Area of Search M);
- within East Dorset District a total of about 2,400 dwellings (Area of Search N – north west of the main urban area at Corfe Mullen, Area of Search O – north and west of Wimborne Minster, and Area of Search P – east and south east of Ferndown)

This housing growth will be accompanied by job growth within the Bournemouth and Poole Travel to Work Area (TTWA) of about 42,000 jobs over the plan period (23,000 at Bournemouth and 19,000 at Poole). In addition, within East Dorset District, 20ha of employment land is allocated to the west of Ferndown (Area of Search Q).

Employment growth at Salisbury is projected to be between 10,800 and 13,600 over the Plan period, but it is acknowledged that 'outward expansion' is restricted due to the proximity of designated Areas of Outstanding Natural Beauty and flood risk factors. Accordingly, Policy SR30 requires the LDD to enable job growth of between 11,000 and 13,500 jobs, with an average housing provision of *"…about 250 dwellings per annum at Salisbury' over the plan period"*.

North Dorset will attract only 'locally significant development' at its three main towns.

In respect of flood risk, the Draft RSS states that: *"The risk of coastal and river floods will increase significantly over the plan period … due to the predicted effects of climate change, including rising sea levels and increased winter rainfall"* (paragraph 7.2.19). Policy F1 prioritises the defence of existing properties from flooding and the location of new development in areas that have little or no risk from flooding. In taking into account the risk of climate change and the increasing risk of flooding, Policy F1 seeks to:

- defend existing properties and, where possible, locate new development in places with little or no risk of flooding;

- protect flood plains and land liable to tidal or coastal flooding from development;
- follow a sequential approach to development in flood risk areas;
- use development to reduce the risk of flooding through location, layout and design;
- relocate existing development from areas of the coast at risk, which cannot be realistically defended, and
- identify areas of opportunity for managed realignment to reduce the risk of flooding and create new wildlife areas.

The section continues on to provide advice as to how LDDs should implement Policy F1:

- To require strategic flood risk assessments to guide development away from floodplains;
- To ensure that the location of new development is compatible with other existing relevant strategies;
- Seek to reduce the causes of flooding;
- Require all development on the perimeter of towns and villages to take account of local flooding

Policy SD2 (Climate Change) seeks to prepare the region for the effects of global warming by avoiding the need for development in flood risk areas and incorporating measures in design and construction to reduce the effects of flooding.

4.6 ***Local planning policy***

These 'high-level' targets will be taken forward in emerging Local Development Frameworks for the five planning authorities. The existing and emerging policy context for each authority is set out in ***Appendices C to G***.

4.7 ***Summary***

The Draft Regional Spatial Strategy sets out requirements for each of the districts to allocate land for growth in homes, jobs and infrastructure. This development has the potential to impact upon flood risk over the medium to longer term, for example by contributing to increased runoff. The information contained within this SFRA will inform the preparation of policies relating to flooding, managing flood risk, land use and development allocations within future Development Plan Documents.

5 Data Sources

5.1 ***Overview***

Throughout the data collection process it has been crucial to make best use of the significant amount of information which already exists with respect to flood risk (held by the five Councils, the Environment Agency, Wiltshire County Council, Dorset County Council, Wessex Water and other key consultees). This has included a review of:

- Environment Agency Flood Zone Maps and detailed flood risk mapping outputs.
- Localised flooding information from the five Councils, the Environment Agency, Wiltshire County Council, Dorset County Council and Wessex Water.
- Detailed information on the major flood defences (from the National Fluvial and Coastal Defence Database).
- Past flood risk assessments, detailed modelling reports, the Hampshire Avon and the Dorset Stour CFMPs.

A full data register is provided in ***Appendix A.***

5.2 ***Consultation process***

Consultation has formed a key part of the data gathering stage of the SFRA. The following stakeholders were consulted during the SFRA:

- *The five Councils, Wiltshire County Council and Dorset County Council*
  Planners from the five Councils were consulted regarding site allocations (see ***Section 4.6***) and emergency procedures (see ***Section 7.3.3)***. Drainage Engineers were consulted about localised flooding (see ***Section 6.2)***.

- *Environment Agency*
  The Environment Agency Development Control, and Flood Risk Mapping and Data Management teams from the Wessex Area office (Blandford) were consulted on the SFRA approach. This is essential given that the Environment Agency is a Statutory Consultee under PPS25 and therefore must be in agreement with regard to the scope, key

findings and recommendations of the SFRA. In addition, the Environment Agency was consulted on data availability/suitability, historical fluvial and groundwater flooding, modelling studies, flood risk assessments, flood defences, flood warning procedures and the flood risk from reservoirs within the study area (see ***Sections 6 & 7***).

- *Wessex Water*

Wessex Water were consulted regarding known incidences of sewer flooding, sites at risk from sewer flooding and planned schemes to alleviate flooding (see ***Section 6.2***).

As part of the consultation process, key stakeholders within the five Councils and the Environment Agency reviewed the draft flood maps and provided feedback on the initial findings.

5.3 ***Environment Agency flood zone maps & detailed hydraulic modelling***

The Environment Agency Flood Zone Maps show the areas at risk of flooding from rivers and the sea, ignoring the presence of defences. The Flood Zone Maps have been produced initially from a National generalised computer model (JFlow)

The Environment Agency Flood Zone Map is continuously being improved as new studies are undertaken, detailed hydraulic models are constructed and more flooding data and information becomes available. Three such studies have recently been completed but the results have not yet been added to the latest available version (July 2007) of the Environment Agency Flood map. These studies all commissioned by the Environment Agency and recently approved are detailed below:

- Hampshire Avon (2007) models for Tisbury, Downton, Christchurch and Ringwood. These studies involved the development of detailed hydraulic models and the production of flood maps for the 1% and 0.1% annual probabilities without defences.
- Salisbury (2007) model. This study involved the development of a detailed hydraulic model and the production of flood maps for the 1% annual probability without defences.
- Stanpit & Mudeford (2007) model. This model was originally constructed to derive flood extents for the 0.5% annual probability. These flood extents have been used to update the Environment Agency's Flood Zone 3, but the model

was re-run as part of this SFRA to generate flood extents for the 0.1% annual probability.

The model outputs for these areas have been used in preference to the existing Environment Agency Flood Zone Maps. The SFRA maps should now be used by the Five Councils in preference to the existing Environment Agency flood maps. As further flood mapping studies are approved by the Environment Agency, it is recommended that the outputs are used to update future versions of this SFRA.

5.4 ***Localised flooding***

Evidence of flooding within the study area has been gathered from past studies and reports and through consultation with key stakeholders. In accordance with PPS25, this has included a review of flooding from all sources, i.e. fluvial, groundwater, surface water, drainage and sewerage infrastructure and other artificial water bodies such as canals and reservoirs (see ***Section 6.2***).

6 Assessment of potential causes of flooding

6.1 ***Overview***

Evidence of flooding in the study area has been gathered and a number of maps have been produced for the study area in accordance with emerging best practice, guidance from PPS25 (and its companion Guide) and the terms of the SFRA contract. Hard copies of the maps are provided in Volume II of this report, at the 1:25,000 scale. ArcView GIS layers are also available.

The mapping outputs provided in Volume II are as follows:

- Tile Set 1: Historic flood map and current flood zones, including flood defences and flood storage areas

- Tile Set 2: SFRA Climate Change Flood Zone map (2025-2115), and the coastal flood zones for the 0.5% annual probability flood event in 2070 and 2115 (***Section 9.2***)

This Section details historical flooding incidents and the current flood map ***(Tile Set 1)***. ***Section 7*** provides an assessment of the flood management practices. ***Section 9*** investigates the potential implications of climate change (***Tile Set 2***).

6.2 ***Localised flooding***

Flood risk from: fluvial, groundwater, surface water and drainage are included on the historical flood map together with the SFRA flood zones (***Volume II, Tile Set 1***). Flood risk from all sources is to be used to guide the Sequential Test.

6.2.1 *Fluvial Flooding*

The Environment Agency has records of historical flood events which affected the study area in various years. The locations affected by these flood events are illustrated in ***Volume II, Tile Set 1*** and are described ***Table 6.1***

Table 6.1. Historical fluvial flood events

Source: Environment Agency

Flood event	Area affected
January 1959	Rivers Wylye, Nadder, Avon and Stour
December 1979	Rivers Avon and Stour
1989	River Stour
1990	Rivers Wylye, Nadder and Stour
1993	River Nadder (in Tisbury only)
1995	Rivers Wylye, Till, and Avon. The hamlet of Pitton
October 2000	Rivers Avon, Bourne, Nadder and Stour
2002	Rivers Avon and Nadder,
Jan 2003	Rivers Avon, Bourne, Stour
Unknown date	Rivers Ebble, Avon, Nadder, Wylye and Stour

6.2.2 *Flooding from the sea*

Information about flooding from coastal waters is recorded by the Environment Agency on their FRIS (Flood Reconnaissance Information System) database, which was created in 2001. These records show flooding from the sea has in the past affected coastal areas of Christchurch, but not Bournemouth. Coastal flooding within Christchurch has been caused by high tide levels in combination with high river levels, often exacerbated by heavy rain and strong winds. The tidal flooding events are mapped in ***Volume II: Tile Set 1*** with details of individual events provided in GIS format.

6.2.3 *Groundwater Flooding*

The occurrence of groundwater flooding as an identifiable phenomenon has really only been recognised in the last decade, primarily as a result of the extensive groundwater flooding in the Chalk areas of Southern England (including significant parts of the study area) that occurred in the Winter of 2000/2001. Some locations in the study area were badly affected during this period (see further below).

PPS 25 states that "groundwater flooding occurs when water levels in the ground rise above surface elevations," however groundwater may also cause harm in other ways, for example when it enters sub-surface structures (such as basements etc).

Research currently being carried out for Defra, identifies seven types of groundwater flooding event, as follows:

(i) rise of typically high groundwater levels to extreme levels in response to prolonged extreme rainfall;
(ii) rising groundwater levels in response to reduced groundwater abstraction in an urban area (termed groundwater rebound) or a mining area (termed minewater rebound);
(iii) subsidence of the ground surface below the current groundwater level;
(iv) rise of groundwater level in aquifers in hydraulic continuity with high in-bank river levels or extreme tidal conditions;
(v) rise of groundwater levels due to leaking sewers, drains and water supply mains;
(vi) faulty borehole headworks or casings causing upward leakage of groundwater through confining layers driven by artesian heads;
(vii) increases in groundwater levels and changed flow paths due to artificial obstructions or pathways, and loss of natural storage and drainage paths.

Of these, (i), (iv) (v) and (vii) are the most likely to apply in the study area, although type (vi) may be possible, it is likely to be localised and the responsibility for actions to address any such occurrence may, in most cases, be readily identified.

The Defra research also identifies the following impacts observed as a direct result of excess groundwater at or close to surface:

- flooding of basements of buildings below ground level;
- flooding of buried services or other assets below ground level;
- inundation of farmland, roads, commercial, residential and amenity areas;
- flooding of ground floors of buildings above ground level; and

overflowing (surcharging) of sewers and drains.

Often, effects of groundwater flooding are indistinguishable from the effects of fluvial flooding, or are not obviously attributable to groundwater (e.g. surcharge of sewers). As a result the recording of groundwater flooding is often inconsistent. However, groundwater flooding from the Chalk can be particularly onerous, as the flooding event may persist over a number of weeks (or even months) causing significant disruption to residents, commercial activities, transport networks and other infrastructure.

The Environment Agency South West Region retains records of flooding events on their FRIS (Flood Reconnaissance Information System) database. This database, created in 2001 following the flooding of the previous winter, records all flood events, regardless of their source. The record was populated with data back dated 30 years (from 2001). Groundwater events identified on this database (nearly 350 within the study area) are mapped in ***Volume II: Tile Set 1*** with details of individual events provided in GIS format.

Although FRIS identifies, for example, the "cause" of groundwater flooding, the source (aquifer) of the flooding is not identified – although this may generally be determined from mapped flooding locations and geological/hydrogeological mapping.

A number "causes" of groundwater flooding were identified including:

- Spring water (including from high ground)
- High water Table
- Water unable to drain due to blocked water courses/culverts
- Basement flooding
- Inundation of gardens
- Surcharging of sewers
- Back up of surface water drainage

Domestic and commercial properties, transport links and farmland have all been subjected to damage and disruption. The areas most impacted by groundwater flooding were within Salisbury and North Dorset District, with a handful of events in East Dorset and no groundwater flooding recorded in Bournemouth or Christchurch. However given the difficulty sometimes found in distinguishing groundwater flooding from fluvial flooding, such events may have occurred (but not been recorded as such) in these areas. The great majority of the groundwater flooding events were caused by flooding from the Chalk aquifer. Flooding from the Upper Greensand aquifer, likely to be associated with conditions in the overlying chalk, is also observed. A few flooding events were also noted in the Corallian (North Dorset District).

Appendix B identifies the groundwater flooding potential for the geological units identified. This is based on observations of the hydrogeological properties of the units, and is not currently based on any formal risk assessment. To date, there is

no formalised approach to the undertaking of a risk assessment for groundwater flooding. This relates to the large number of (often independent) variables that may contribute to a groundwater flood event. The current approach is to map all known incidences of groundwater flooding (although reports of groundwater flooding by "lay" observers may be unreliable) and to use these to develop an understanding of the susceptibility of an area to groundwater flooding. Until further researches are undertaken, this use of the historical records will remain the only method for deriving an understanding of the risks of groundwater flooding. As described above, mapped incidences of groundwater flooding within the study area are shown in ***Volume II, Tile Set 1.***

6.2.4 *Surface Water (Land Drainage) Flooding*

Consultations were undertaken with the five Councils, the Environment Agency, Wiltshire County Council and Dorset County Council to identify known local drainage issues (surface water flooding). Known areas of surface water flooding are shown in ***Volume II, Tile Set 1.*** Details of sites affected by surface water flooding can be obtained by referring to the GIS database. GIS points and polygons have been used to delineate locations and areas where surface water flooding occurs. The identification number given to flood incidents can be used to locate a flood incident within the GIS flood history database.

The data collated is not considered to be an exhaustive assessment of surface water flooding since these data are based on historical events rather than predictive modelling (and therefore may not represent very rare events), hence, the full extent of these flooding mechanisms may not have been captured. It is therefore recommended that during future updates to the SFRA, additional reviews and consultations are undertaken to ensure that the best available information is used to inform site allocations.

6.2.5 *Sewer Flooding*

Urban sewer flooding occurs when flows entering the sewer network are in excess of those leaving the network at the associated treatment works or outfall. These events manifest due to a number of possible causes such as: general incapacity in the sewerage system, ground water infiltration, blockages and pipe failure, pumping station failures or incapacity, excess surface water connectivity, and overwhelming rainfall events. The problem has been exacerbated over the last decade, as a result of the EU Directive to reduce the number of consented overflows to watercourses and the increasing popularity to pave grassed areas. During an incapacity flooding scenario, the volume of flow entering the sewerage network is in excess of the

volume of sewage that is able to be conveyed through the pipe under gravity. The pipes and associated manholes then surcharge and flooding may be witnessed at manholes or property connections depending on the systems hydraulic grade line and local topography.

The South Wessex Area is operated by Wessex Water, who is responsible for the performance and maintenance of the network. The South Wessex area is largely rural, with big urban centres in Bournemouth, Christchurch and Poole. The South Wessex area comprises approximately 400 Sewage Treatment Works (STW), of which some 150 serve populations of less than 250. There are also an extensive number of Sewage Pumping Stations (SPS), of varying size which are required due to the undulating topography.

Wessex Water has advised that their DG5 sewer flooding register currently lists 12 properties in Bournemouth, 4 in Christchurch, 20 in East Dorset, 8 in North Dorset and 4 in Salisbury at risk of flooding within the study area (refer to ***Volume II, Tile Set 1***). Further information about sewer flooding specific to each Local Authority can be found in each of the separate council appendices (***Appendices C to G***).

Wessex Water has undertaken extensive investigations to determine the cause of flood incidents recorded on their DG5 Flooding Register and where appropriate have built hydraulic models to replicate the performance of their networks. It is likely that Wessex Water have developed a Macro-model of the network serving Bournemouth, Christchurch & Poole and that this model has been used to assess the performance of the network in areas of known flooding. Such a model may also be used to investigate the capability of the sewer network for accommodating further growth. Wessex Water intend to implement solutions, where appropriate, to remove all properties in Bournemouth, Christchurch, East Dorset, North Dorset and Salisbury from their DG5 Register through an ongoing programme of flood alleviation works by the end of AMP4 (March 2010).

Further information about sewer flooding, flooding investigations and general engineering solutions is provided in ***Appendix H***.

6.2.6 *Reservoirs and Other Artificial Water Retaining Structures*

As part of the SFRA it is necessary to consider the risk of overtopping or breach of reservoirs and canals. The Environment Agency were consulted to determine the risk of flooding from reservoirs as detailed below. A section of the partially

built Salisbury & Southampton canal lies within the study area, but this is dry, and hence there is no flood risk from canals.

Reservoirs

The majority of reservoirs situated within the study area are small impounding reservoirs formed by earth embankment dams. The Environment Agency (Wessex Area (Blandford Office) South West) has recently (February 2007) undertaken an assessment of 104 of the reservoirs within the Environment Agency's South West region. The numbers of reservoirs situated within the SFRA study area are detailed below and mapped in ***Figure 6.1***:

Bournemouth: none

Christchurch: 1 (Service reservoir)

East Dorset: 15

North Dorset: 12

Salisbury: 21

All reservoirs pose some level of threat to the area and persons living near them. Under the Reservoirs Act 1975, reservoirs >25,000m^3 have been designated a category (A/B/C/D) which describes the danger posed in the event of a dam breach. The definitions of these categories are given below:

(i) Category A – a breach could endanger lives in a community
(ii) Category B – a breach could endanger lives not in a community or result in extensive damage
(iii) Category C – a breach would pose negligible risk to life and cause limited damage
(iv) Category D – no loss of life can be foreseen as a result of a breach and very limited additional flood damage would be caused

As part of the Environment Agency's assessment of their South Wessex reservoirs all of the reservoirs mapped in ***Figure 6.1*** have been designated a category based on the definitions given above. Category A and B reservoirs can be considered as posing danger to human life in the event of dam breach. The risk of failure of reservoirs need not constrain the location of development, but it is likely that should any major development be proposed in the area downstream of these reservoirs that an extended scope SFRA (Level 2) will be required to determine the residual risk of overtopping or breach of the embankment and inform appropriate

mitigation measures. Details (name, flood category and capacity) of these reservoirs are provided in the respective Appendix for each Local Authority (***D to G***) and as GIS files. The only reservoir situated within Christchurch Borough is a service reservoir. The flood risks to service reservoirs are of a different nature to embankment dams. This is because the inflow is controlled and they are usually constructed of concrete (with or without an embankment surround), and as a result service reservoirs are intrinsically safer than embankment dams.

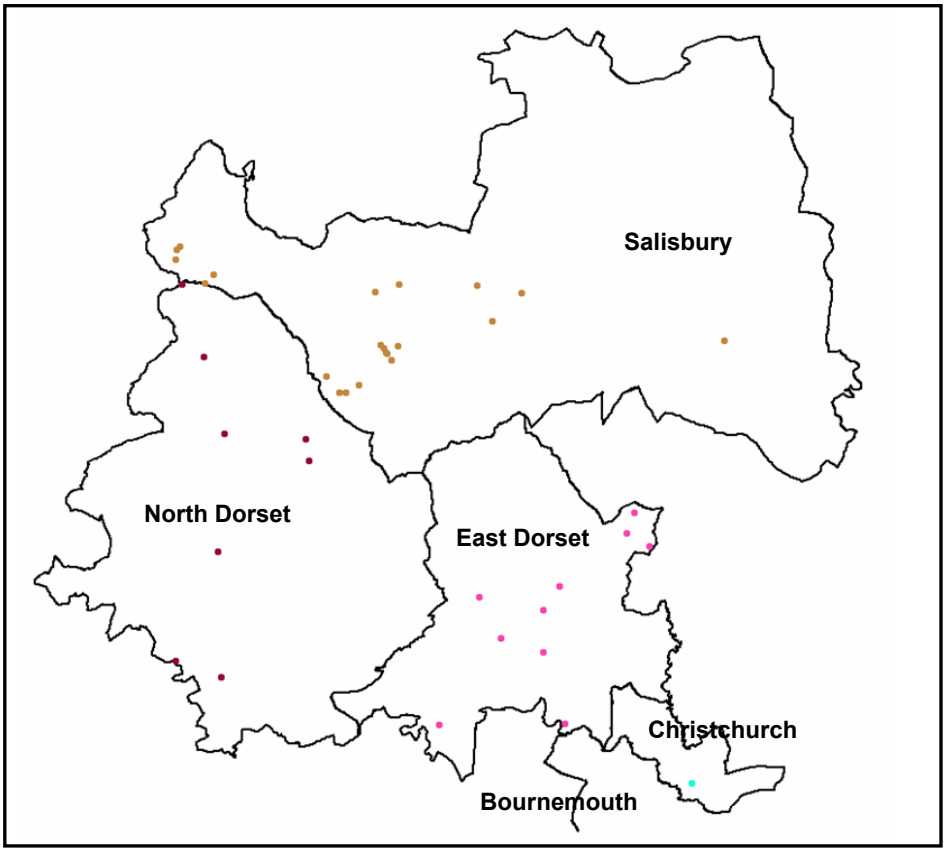

Figure 6.1 Location of reservoirs within the Five Local Planning Authorities

6.3 ***PPS25 Flood Zones***

6.3.1 Tile Set 1 illustrates the current SFRA flood zones. These are defined below:

6.3.2 *Zone 3b – Functional Floodplain*

Functional Floodplain Zone 3b is defined as those areas in which water has to flow or be stored in times of flood. The functional floodplain is typically defined by the following criteria:

- Land subject to flooding in the 5% annual probability flood event
- Land which provides a function of flood conveyance or flood storage, through natural processes or by design (e.g. washlands, flood storage areas)
- Areas which would naturally flood with a 5% annual probability or greater, but which are prevented from doing so by existing buildings, defences and other flood risk management infrastructure will not normally be defined as Functional Floodplain

The PPS25 Companion Guide recommends that all areas within Zone 3 should be considered as Zone 3b Functional Floodplain unless, or until, an appropriate FRA shows to the satisfaction of the Environment Agency that it can be considered as falling within Zone 3a (High Probability). In all areas it has been necessary to make conservative assumptions about the extent of the functional floodplain in the absence of historical flood outlines and detailed models.

The approaches used to map Zone 3b for each watercourse and their associated confidence levels are summarised in ***Table 6.5***. It is recommended that detailed modelling is undertaken as part of a FRA when seeking to allocate sites for development.

Table 6.5 Flood Zone 3b (Functional Floodplain) mapping

Watercourse	Zone 3b Data Source	Confidence
Avon and Nadder at Tisbury, Downton, Christchurch and Ringwood	Hampshire Avon ABD (2007) models for Tisbury, Downton, Christchurch and Ringwood Modelled 1% annual probability undefended flood outlines	Low
Avon, Nadder, Bourne, Wylye at Salisbury	Salisbury (2007) model Modelled 1% annual probability undefended flood outline	Low
Bure Brook	Bure Brook (2007) model Modelled 1% annual probability undefended flood outlines	Low
All watercourses excl. reaches at Tisbury, Downton, Christchurch, Ringwood and Salisbury	Zone 3b is assumed to be the same as Zone 3a	Low

6.3.3 *Zone 3a – High Probability*

The High Probability Zone 3a is defined as those areas within the study area which are situated within the undefended 1% annual probability fluvial flood extent or 0.5% annual probability tidal flood extent. As a conservative approach has been used to define the functional floodplain (i.e. 1% annual probability), in all cases Flood Zone 3b = Flood Zone 3a for fluvial reaches. The confidence level for Flood Zone 3a is summarised in ***Table 6.6***. For areas of low to medium confidence the onus should be on developers to provide more refined information as part of a site-specific FRA (***see Section 10.9***).

Table 6.6 Flood Zone 3a (high probability) mapping

Watercourse	Zone 3a Data Source	Confidence
Avon and Nadder at Tisbury, Downton, Christchurch and Ringwood	Hampshire Avon ABD (2007) models for Tisbury, Downton, Christchurch and Ringwood Modelled 1% annual probability undefended flood outlines	High
Avon, Nadder, Bourne, Wylye at Salisbury	Salisbury (2007) model Modelled 1% annual probability undefended flood outline	High
Bure Brook	Bure Brook (2007) model Modelled 1% annual probability undefended flood outlines	High
All watercourses excl. reaches at Tisbury, Downton, Christchurch, Ringwood, Salisbury and Bure Brook	Environment Agency tidal and fluvial Flood Map outlines based on coarse national computer model (using JFlow) and previously approved (prior to July 2007) modelled fluvial 1% annual probability and tidal 0.5% annual probability undefended flood outlines	Low to high

6.3.4 *Zone 2 – Medium Probability*

The Medium Probability Zone 2 is defined as those areas within the study area which are situated between the undefended 0.1% and 1% fluvial or 0.5% tidal annual probability flood extents. The approaches used to map Zone 2 for each watercourse and their associated confidence levels are summarised in ***Table 6.7***. For areas of low to medium confidence it is recommended that detailed modelling is undertaken as part of a FRA when seeking to allocate sites for development. It

should be noted that given a flood event with a 0.1% annual probability is a rare event, it is very difficult to attach a high level of confidence in this delineation of this zone. The approach used to map Zone 2 and its associated confidence levels are summarised in ***Table 6.7***.

Table 6.7 Flood Zone 2 (medium probability) mapping

Watercourse	Zone 2 Data Source	Confidence
Avon and Nadder at Tisbury, Downton, Christchurch and Ringwood	Hampshire Avon ABD (2007) models for Tisbury, Downton, Christchurch and Ringwood Modelled 0.1% annual probability undefended flood outlines	Medium to High
Avon, Nadder, Bourne, Wylye at Salisbury	Salisbury (2007) model Modelled 0.1% annual probability undefended flood outline	Medium to High
Stanpit and Mudeford	Stanpit and Mudeford (2007) model Modelled 0.1% annual probability undefended flood outline	Medium to High
Bure Brook	Bure Brook (2007) model Modelled 0.1% annual probability undefended flood outlines	Medium to High
All watercourses excl. reaches at Tisbury, Downton, Christchurch, Ringwood, Salisbury, Bure Brook and Stanpit and Mudeford	Environment Agency tidal and fluvial Flood Map outlines based on coarse national computer model (using JFlow) and previously approved (prior to July 2007) modelled 0.1%annual probability undefended flood outlines	Low to high

6.3.5 *Zone 1 – Low Probability*

The Low Probability Zone 1 is defined as those areas within the study area which are situated outside of the undefended 0.1% annual probability flood extent. For the purpose of the SFRA maps, this includes all land that is outside of Zone 2 and Zone 3 flood risk areas. It is important to note however that for sites greater than one hectare it will still be necessary for a developer to produce a site-specific FRA which takes account of all sources of flooding (see ***Section 10.9***)

6.4 ***Variations in actual flood risk***

Within each flood zone new development should be directed to sites with lower flood risk, which is generally towards the adjacent zone of lower probability of flooding. For the high probability Flood Zone (Zone 3a) an indication of the actual variation in flood depth is presented for the following river reaches and as such it is recommended that any development within Flood Zone 3a is directed to the areas of lowest flood depth as determined by the subsequent Level 2 SFRA:

- River Nadder at Tisbury (see ***Figure 6.2***)
- River Avon at Downton, Ringwood[i] and Christchurch (see ***Figures 6.3 to 6.5***)
- Rivers Avon, Nadder, Bourne, Wylye at Salisbury (see ***Figure 6.6***)

This analysis is not possible for the existing Environment Agency tidal and fluvial flood zone 3 as these flood extents do not have any attribute information associated with them which describe variations in flood depth. The variations in flood depths are also available as GIS shapefiles.

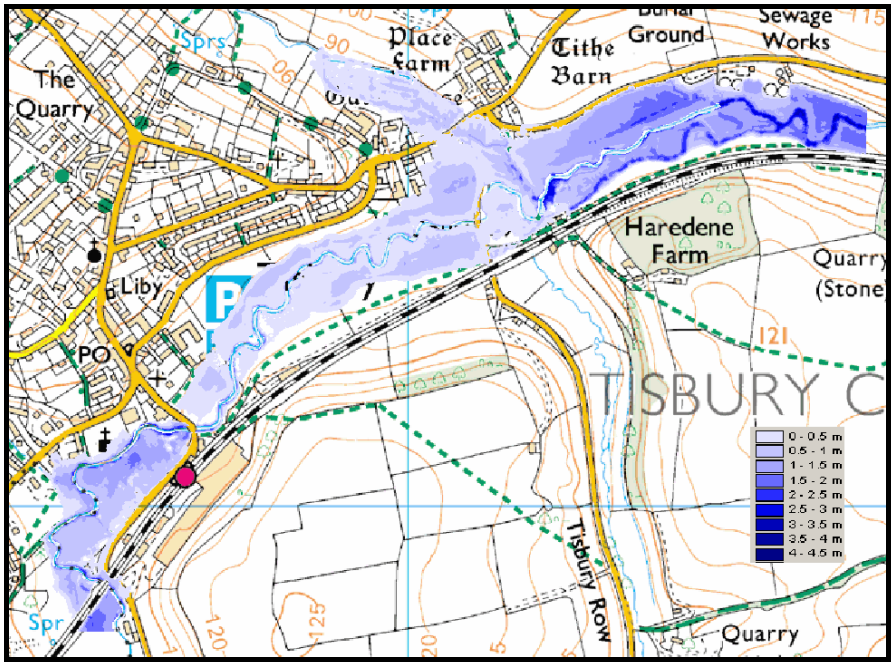

Figure 6.2 Variation in flood depth for the River Nadder at Tisbury

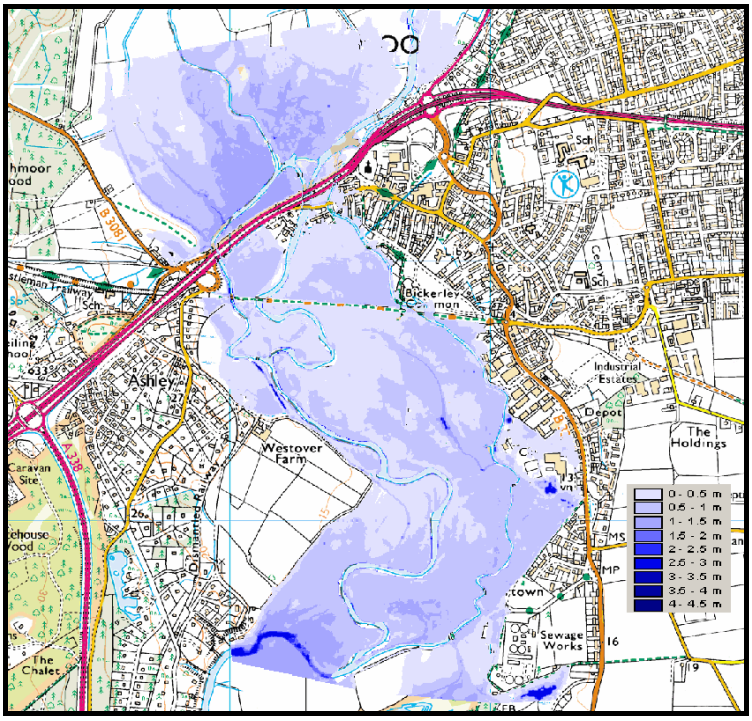

Figure 6.3 Variation in flood depth for the River Avon at Ringwood

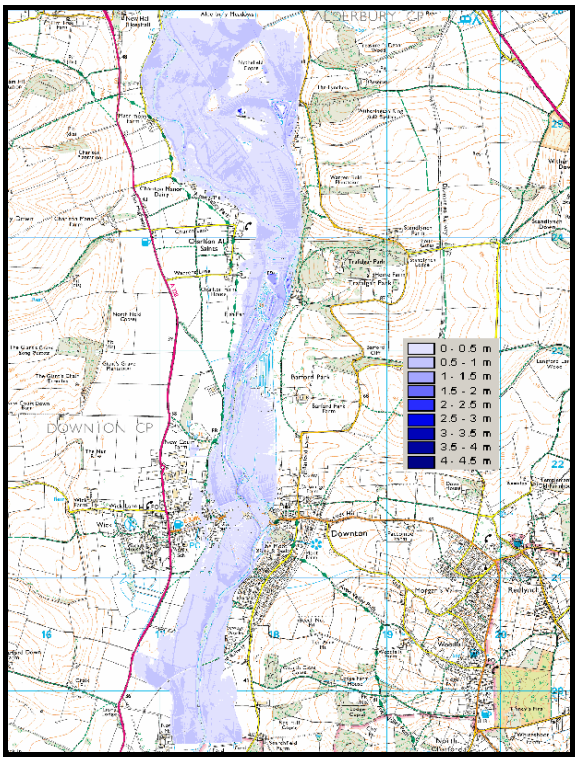

Figure 6.4 Variation in flood depth for the River Avon at Downton

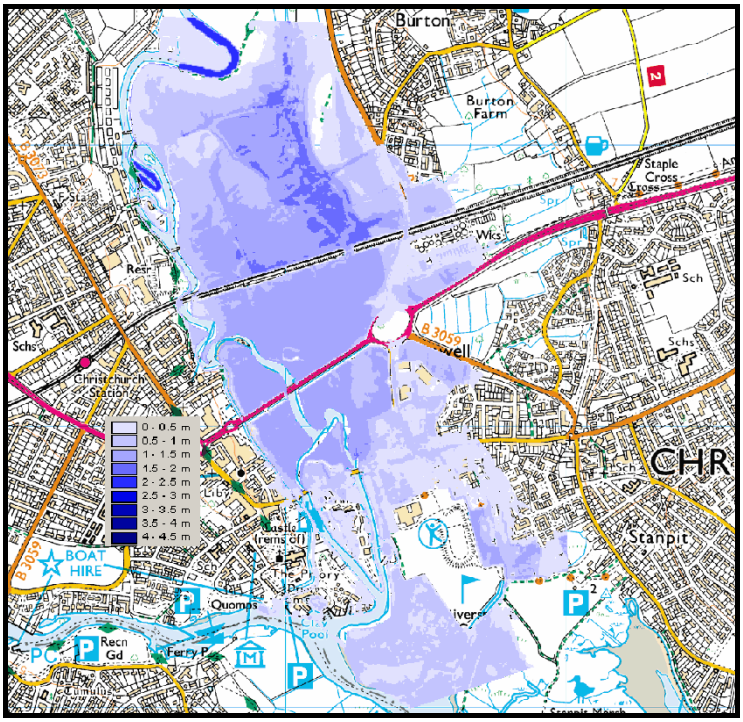

Figure 6.5 Variation in flood depth for the River Avon at Christchurch

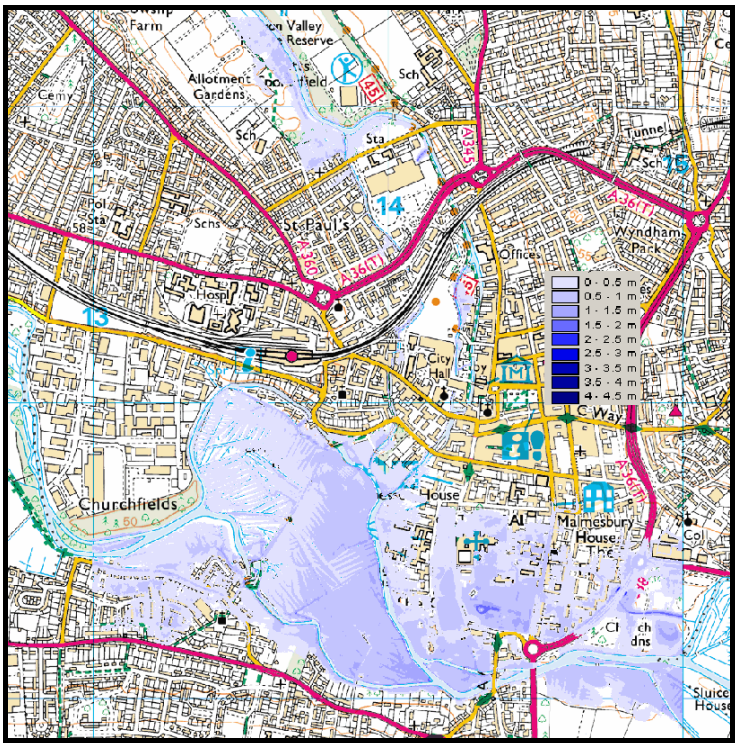

Figure 6.6 Variation in flood depth for the River Avon, Nadder, Bourne and Wylye at Salisbury

7 Assessment of flood risk management practices

7.1 ***Overview***

This chapter reviews the flood defences, flood warning areas and emergency planning procedures currently in place within the SFRA study area.

7.2 ***Existing Flood Defences***

Flood defences are structures which affect flow in times of flooding. They generally fall into one of two categories: 'formal' or 'defacto'. A 'formal' defence (termed 'raised defence (man-made) in NFCDD) is a structure which has been specifically built to control floodwater. It is maintained by its owner (this is not necessarily the Environment Agency) so that it remains in the necessary condition to function.

A 'defacto' defence includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function. Other structures are identified on the Environment Agency database, but these have not necessarily been built to control floodwater and are not maintained for this purpose.

In accordance with the scope of a Level 1 SFRA, a review of formal flood defences has been carried out using data from the National Flood and Coastal Defence Database (NFCDD) and the Local Authorities. The NFCDD is a good starting point for identifying significant flood defences and potential areas benefiting from defence, but the quantity and quality of information provided differs considerably between structures.

The NFCDD is intended to give a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA where the need arises).

A total of 304 flood defences on the NFCDD database were identified as 'formal' flood defences. These defences are mapped in ***Volume II, Tiles C***, together with one additional defence at Mudeford Quay (identified by Christchurch BC) and the 7 flood storage areas within the study area that reduce the frequency and extent of

flooding. The Standard of Protection (SoP; labelled Design Standard in NFCDD) provided by these defences is shown on the Tile B maps.

7.3 ***Flood Warning Procedures***

7.3.1 *Existing Flood Warnings*

The current flood warning service in the study area is operated by the Environment Agency. The Environment Agency monitors rainfall, river levels, tide levels and groundwater levels 24 hours a day at a number of Flood Warning telemetry stations throughout the study area and uses this information to forecast the probability of flooding. Flood warnings are issued using a set of four codes, each indicating the level of risk with respect to flooding. The warnings issued are Flood Watch, Flood Warning, Severe Flood Warning and All Clear. A Flood Warning is issued if property is expected to flood and a Severe Flood Warning if there is extreme danger to life. The 'All Clear' is issued to indicate receding flood waters.

Flood warning procedures are in place for the following areas/rivers, with sites at particular risk of flooding detailed in ***Appendix I***:

- Christchurch to tidal Avon and Stour (within Christchurch)
- Stour catchment (within North Dorset, East Dorset, Christchurch and Bournemouth)
- River Wylye (within Salisbury)
- Upper Avon and tributaries (within Salisbury)
- River Nadder (within Salisbury)
- Middle and Lower Avon (within East Dorset)
- Cranborne Chase (Groundwater catchment within East Dorset)
- Salisbury Plain (Groundwater catchment within Salisbury)

The Environment Agency encourages those residents and businesses within Flood Zone 3 to sign up to the Floodline Warnings Direct Service (FWD). The FWD service enables individuals, emergency services, local authority emergency planners and response teams to be effectively warned about fluvial flood risks by delivering warnings simultaneously via telephone, mobile, pager, fax, email, SMS text messaging, digital TV and radio.

Groundwater flood warnings are issued within the study area on a parish basis. Within each parish a warden is responsible for issuing flood warnings to their parish based on the water levels in boreholes. A warden will warn residents whose

properties have flooded in the past about the impending flood risk and put up posters to warn the rest of the community.

7.3.2 *Future improvements to Flood warning*

The on-going National Flood Risk Area/Flood Warning Area Project being undertaken by the Environment Agency is working towards refining fluvial flood risk areas, thus providing a more targeted flood warning service to local communities. These new flood warning areas will provide flood warnings on a community basis similar to that already in place for groundwater flood warnings. The Environment Agency also has an investment strategy in place which aims to produce increased coverage of their telemetry network, which will lead to more specific, targeted warnings in the future.

7.3.3 *Emergency Planning*

There are several Major Incident Plans (MIPs) in place throughout the study area. MIPs describe the nature of the flood risk, defences, flood warning procedures and roles and responsibilities before, during and after a flood incident.

A program of MIP reviews is currently being undertaken by the Environment Agency. A summary of the status of MIPs within the study area is provided in ***Table 7.1***. There are also a number of community flood plans in place within the study area which provide a very local level of response to a flood incident.

Table 7.1 Status of Major Incident Plans within the SFRA study area

Source: Environment Agency

Plan	Type	Standard	Last update
Blandford (North Dorset)	Flood Specific Multi Agency Plan	Basic	Unknown
Bournemouth (Local Incident plan (LIP))	Flood Specific Multi Agency Plan LIP	Good, but Iford needs to be separated out and escalated to MIP	2004
Christchurch	Flood Specific Multi Agency Plan	Very good	Dec 2002
Gillingham (North Dorset)	Flood Specific Multi Agency Plan	Good	Ongoing
Salisbury	Flood Specific Multi Agency Plan	Under review	Ongoing
Wimborne (East Dorset)	Flood Specific Multi Agency Plan	Basic – Stour only	Unknown
Sturminster Marshall (East Dorset)	Flood Specific Multi Agency Plan	Basic. Area no longer meets MIP criteria	Unknown
Shapwick (East Dorset)	Flood Specific Multi Agency Plan	Basic. Area no longer meets MIP criteria	Unknown

7.4 ***Potential effect of flood defence failure (residual risk)***

There are 305 defences (304 identified on NFCDD and one identified by Christchurch BC) within the study area that currently provide localised protection against flooding. As with any flood defence there is a residual risk that these defences may fail, as a result of either overtopping and/or a breach. Should such an event occur it may result in rapid inundation of the local community behind the flood defence, and may pose a risk to life. In the event that the Exception Test needs to be applied to specific site allocations behind a flood defence, the scope of the SFRA should be extended to a Level 2 assessment to refine information on the flood hazard in the location.

7.5 ***Extent and cost of works required to raise flood defence standard to 1% and 0.5%***

Design standards of 1% annual probability for fluvial defences and 0.5% annual probability for coastal defences are taken as appropriate design standards for these types of defence. There are 90 fluvial defences on NFCDD in the study area with a SoP less than 1% annual probability and a further 103 for which no SoP has been determined. There are no formal coastal defences listed on NFCDD.

The cost of raising these defences to the 1% (fluvial) and 0.5% (coastal) design standards will vary widely. Halcrow estimate indicative costs to raise a defence by a linear metre are £0.5-3K for fluvial defences, and up to £5K for coastal defences. However, often it is not possible to simply raise a flood defence and a new flood defence system may be required to meet the 1% and 0.5% design standards.

7.6 ***Current policy for maintenance and upgrade of defences***

7.6.1 The Environment Agency are only able to invest in flood defences where they can justify the cost of doing so. As a consequence, most defences are in the large urban areas at risk of flooding which include Bournemouth, Christchurch, Ringwood and Downton. However, a smaller scheme was recently constructed in Tisbury protecting 11 properties from flooding. As section 7.2 has shown the standard of protection provided by a defence varies. General policies for the management and upgrade of defences are summarised for locations throughout the SFRA study area in Section 10.2.1

7.6.2 As well as capital expenditure on structures and schemes, the Environment Agency maintains defences within the study area through a programme of repairs and

upkeep of flood defence structures. This includes grass cutting, desilting, maintenance of drains, debris removal and scrub clearance.

8 Assessment of the capacity for the use of SUDS

8.1 ***Overview***

PPS1 "Delivering Sustainable Development" and PPS25 require that LPAs should promote Sustainable Drainage Systems (SUDS). LPAs should ensure policies encourage sustainable drainage practices in their Local Development Documents. SUDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment.

The management of rainfall (surface water) is considered an essential element for reducing future flood risk to both the site and its surroundings. Indeed maintaining the existing rate of discharge from urban sites, even after climate change has occurred, is one of the most effective ways of reducing and managing flood risk in watercourses.

8.2 ***Types of SUDS Systems***

SUDS may improve the sustainable management of water for a site by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- reducing volumes of water flowing directly to watercourses or sewers from developed sites;
- improving water quality, compared with conventional surface water sewers, by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open space and wildlife habitat;
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

A developer should seek to maximise the reduction in the runoff from a site. If the cumulative effects of reductions in runoff into a watercourse are considered from a number of sites, the overall reduction in runoff can be significant.

There are numerous different ways that SUDS can be incorporated into a development. The appropriate application of a SUDS scheme to a specific development is heavily dependent upon the topography and geology of the site and the surrounding areas. Careful consideration of the site characteristics is necessary to ensure the future sustainability of the adopted drainage system.

8.3 ***SUDS at the Planning Stage***

At the drainage design concept stage an assessment can be made of the superficial and underlying geology as this has a fundamental impact on the approach to be followed for the SUDS system. The main variation in SUDS systems is:

- the use of infiltration within the attenuation facilities to partly or fully dispose of runoff,
- not using any infiltration techniques but providing attenuation facilities that maintain the discharges at pre-development levels,

Either of these approaches balances the increase in runoff due to climate change and hence minimises the effect of any development work on the receiving watercourses.

For any significant site the Environment Agency will be consulted by the Planning Authority during the outline planning process. The Environment Agency will want assurances that the requirements of PPS25 are being implemented and will be followed during the detailed planning stage and through to construction.

To provide these assurances, a Zone 1 Flood Risk Assessment is required that demonstrates an achievable layout and details the methodology for the construction of SUDS within the boundary of the development site. The FRA must comply with PPS25 requirements and for the SFRA study area should also accord with Defra/Environment Agency publication "Preliminary Rainfall Runoff Management for Developments Revision D".

8.4 ***Application of SUDS within the SFRA Study Area***

It is recommended that priority is given to utilising surface water infiltration drainage techniques wherever possible. This is due to the presumption that

infiltration techniques are viable over most of the areas considered for development due to generally permeable soils. However each site should confirm that the presumption is correct and that the use of infiltration drainage will not increase the risk of groundwater flooding. The key benefit from utilising infiltration is that these SUDS systems will attenuate peak flows and may also significantly reduce flood volumes in watercourses. Discharging attenuated site runoff directly to watercourses is preferable to the use of sewers.

Large increases in impermeable areas contribute to significant increases in surface runoff volumes and peak flows and could increase flood risk elsewhere unless adequate SUDS techniques are implemented. It is relatively simple to avoid the increase in peak flows by providing attenuation or detention storage that temporarily store the required amounts of runoff within the site boundary. SUDS elements may also be able to prevent increases in surface runoff volumes where significant infiltration is practicable. The use of water recycling and permeable paving, that can allow evapotranspiration of up to 20% of the water attenuated, have limited impact on the volume ultimately discharged, but have a positive benefit overall.

SUDS techniques will be required for all proposed land allocations unless suitable facilities can be provided at a suitable adjacent downstream location. The attenuation of flows to the undeveloped condition discharge, less a minimum betterment of 5%, should be the norm. The techniques employed will depend on the individual circumstances. Developers should consult with the Environment Agency at an early stage about their SUDS proposals, to ensure that they are adopting the most affective methods for their site.

There are a number of SUDS elements that could be used within development sites in the SFRA study area. The Environment Agency would expect that the initial assumption of any drainage designer would be to include infiltration where possible and in the study area this assumption looks well founded given the underlying geology. The provision of significant infiltration should be utilised wherever possible as a disposal option to reduce flows into watercourses. Thus infiltration should be used unless ground investigation and in particular infiltration tests determine that it is not practicable. Investigations into the potential infiltration drainage to increase the risk of groundwater flooding must be also be undertaken. It should also be noted that the Building Regulations Part H state the preferred option for the disposal of property runoff should be via a soakaway. However, cliff stability problems exist over the length of the Bournemouth coastline and the Council has a policy which prevents soakaways being used within

a strip approximately 200 metres inland from the cliffs (Bournemouth District Wide Local Plan Adopted 2002). While no similar adopted policy exists for Christchurch, Borough engineers discourage the use of soakaways near cliffs.

Specific attenuation and infiltration elements for the study area could comprise of:

Swales that can be constructed alongside roads and within green areas to transfer runoff to storage facilities. They can also be used themselves for limited storage. The preferred type would be an infiltration swale that will keep them dry between rainfall events and prevent them becoming marshy. It will also allow as much infiltration as the surrounding ground can accommodate.

Pond / dry basin to provide the majority of the volume required to attenuate the surface water runoff. This storage facility will be online or offline for the sewers. It is proposed that the ponds are to be offline to meet adoption criteria. Dry basins usually allow some infiltration from the base, often as a measure to prevent marshy conditions developing between rainfall events.

Permeable or porous paving may be used within development areas to attenuate runoff at source as it will collect the rainfall below the surface and discharge it after a significant delay. For roadways the use of these will be subject to consideration of the adoption issues with the highway department. On all sites that are suitable for infiltration unlined systems are to be encouraged as these pavements can infiltrate large amounts of water due to the significant contact area with the ground.

Green roofs: Vegetated roofs that reduce the volume and rate of runoff and remove pollution.

Filter drains: Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.

Filter strips: Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.

Infiltration Devices: Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.

Bio-retention areas: Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground

8.4.1 *Constraints on Discharges to Ground*

The nature of an aquifer body and the groundwater within it provide significant constraints when considering the potential of SUDS that rely on infiltration to the ground to provide the means of (storm water) drainage, storage and flow attenuation. Constraints on discharges include:

- Groundwater will be a receptor of man-made drainage – whether this be deliberately (e.g. through soakaways, infiltration drainage) or incidentally (e.g. through mains water pipe or sewer leakage)
- In an urban/ semi urban environment groundwater is under considerable pressure with respect to quality, for example from contaminants on brownfield sites; from uncontrolled drainage; leachates from uncontrolled landfill; leakage from sewers, agro chemicals in field drainage; drainage from roads and other hard surfaces; and seepage from poor quality surface water bodies (channels, ditches, streams, rivers).
- Even though locally groundwater may not have value as a major drinking water resource, it may have value in supporting local water and have a role in determining the water quality of these water bodies and any dependant ecosystems.
- UK groundwater policy has just been revised and the Environment Agency have recently released their first report on the state of groundwater in England and Wales. These documents stress the need to protect groundwater.
- A daughter directive of the European Water Framework Directive (Directive 2000/60/EC) which will replace current groundwater specific legislation provides for more stringent protection of groundwater.

8.4.2 *The Role of Groundwater and Aquifer Bodies in Sustainable Drainage*

Drainage to groundwater is a significant component for the discharge of sustainable drainage systems. Aquifers provide for both storage and transmission of collected drainage water and provide the opportunity to attenuate flow from stormwater discharges. In addition, the unsaturated zone of aquifers may provide for the attenuation of contaminants introduced at the surface.

Other than those described above, constraints on groundwater as a receptor of drainage also include:

- Hydrogeological – requires permeable "free draining" strata, providing means to store and transmit water.
- Groundwater occurrence – near surface water tables limit potential drainage.
- Potential to cause waterlogging or groundwater flooding down gradient or downslope (see also below).
- Topographic setting - infiltration drainage at higher elevations may re-emerge downslope.

The benefits of using infiltration as part of a sustainable drainage system include:

- Infiltration of (good quality) drainage discharges recharge the aquifer and may benefit local groundwater use (or groundwater dependent ecosystems)
- In naturally permeable soil locations, infiltration may mimic the natural water cycle otherwise lost under the development process
- Significant flow attenuation may be provided

8.5 ***Conclusion***

SUDS techniques will be required for all proposed developments in all flood zones unless suitable facilities can be provided at a suitable downstream location. Developers will be required to install SUDS networks, but to ensure this happens Local Planning Authorities will be required to develop policies which encourage sustainable development practices.

9 Flood Risk & Climate Change

9.1 ***Overview***

There is increasing scientific evidence that our climate is changing as a result of human activity. In the UK, it is expected that short-duration, high intensity rainfall events will become more frequent with implications for river flooding and local flash flooding. These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other sources. Global sea levels will also continue to rise, dependant on human activity and the sensitivity of the climate system. Current guidance for incorporating the effects of regional sea level rise are detailed in ***Table 9.1***. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels, assuming no change in storminess. There may also be secondary impacts such as changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events. Current guidance on incorporating climate change effects on rainfall intensities, river flow, wave height and wind speed into flood risk assessments are detailed in ***Table 9.2***.

Table 9.1 Recommended contingency allowance 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

Table 9.2 Guidance for potential climate change impacts on rainfall intensities, river flow, wave height and wind speed (from PPS25)

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%	

9.2 ***Flood Risk & Climate Change***

Fluvial Flood risk

The approaches used to map the potential impacts of climate change on Flood Zone 3b (Functional Floodplain) and Flood Zone 3a (High Probability) are detailed in ***Table 9.3***. Climate Change Flood Zone 2 is assumed to equal the current flood zone 2 as there is very little certainty about the effect climate change will have on extreme events. The SFRA flood zone maps which account for climate change are presented in ***Volume II, Tile Set 2***.

Table 9.3 Climate change mapping (Future = 2025 – 2115, Present = 2007)

Watercourse	Climate Change Assumptions
Avon and Nadder at Tisbury, Downton, Christchurch and Ringwood	*Future* Flood Zone 3b = *Present* Flood Zone 3a *Future* Flood Zone 3a = *Present* Flood Zone 2
Avon, Nadder, Bourne, Wylye at Salisbury	*Future* Flood Zone 3b = *Present* Flood Zone 3a *Future* Flood Zone 3a = *Present* Flood Zone 2
All watercourses excl. reaches at Tisbury, Downton, Christchurch, Ringwood and Salisbury	*Future* Flood Zone 3b = *Present* Flood Zone 3a *Future* Flood Zone 3a = *Present* Flood Zone 2

A review of the available hydraulic models and Flood Zones using the assumptions detailed in ***Table 9.3*** suggests that the changes in the aerial extent of inundation are likely to vary throughout the study area. There are localised areas, often in the larger towns where climate change has the potentially greatest effect. These

include: Salisbury, Wilton, Warminster, Downton and Christchurch. Within the Stour catchment, climate change is found to have the potentially greatest impact on flood extents in rural areas. However, larger flood extents as a result of climate change are also predicted for the Moors and Uddens water (both in East Dorset) and Christchurch.

Coastal flood zones for 2070 and 2115

The design life for a commercial development shall be taken as 60 years and the design life for a residential development shall be taken as 100 years. To correspond with this planning horizon, coastal flood zones have been delineated for a 0.5% annual probability flood event (1 in 200 year) in 2070 and 2115 *(**Volume II, Tile Set D**)*. The approaches used to model and map the potential impacts of climate change on tidal levels along the coastline are detailed in ***Table 9.4*** The increase in tidal levels was calculated based on the Environment Agency's report on Regional Extreme Tide Levels (Feb 2003; Posford Haskoning). By 2070 and 2115 tide levels for the 0.5% annual probability flood event are expected to increase to 2.48m and 3.09m above Ordnance Datum for Christchurch, respectively. The implications of these changes on coastal policy are considered in Section 9.4. However, it should be recognised that these coastal flood zones do not make an allowance for the potential effects of increased wind speeds and wave heights as detailed in Table 9.2. Given the significance that wave impact can have in coastal locations this element can not be ignored within the SFRA and the planning process, and will need to be considered in a Level 2 SFRA should development be proposed in coastal areas.

Table 9.4 Methods used to delineate tidal levels along the coastline for 2070 and 2115

Section of coastline	Modelling approach
Christchurch	Christchurch model (2007) was used with levels revised to those projected for 2070 and 2115
Stanpit and Mudeford	Stanpit and Mudeford model (2007) was used with levels revised to those projected for 2070 and 2115
Bournemouth and Christchurch coastline, excluding Christchurch and Stanpit and Mudeford	Tidal levels were projected onto the coastline using the Environment Agency's report on Regional Extreme Tide Levels (Feb 2003; Posford Haskoning).

Other Sources of Flooding

It is expected that flood risk from groundwater, sewer or surface water flooding will generally increase due to the expected wetter winters (causing more frequent and prolonged groundwater flooding) and the incidence of short-duration high intensity rainfall events associated with summer convective storms (causing more frequent surface water and sewer flooding). Further guidance on how planning should secure new development to the effects of climate change will soon be available in the new Planning Policy Statement: Planning and Climate Change (a supplement to PPS1). It is recommended that future updates to the SFRA take account of this and other emerging guidance.

9.3 ***The implications of the 2070 and 2115 tidal flood extents on the current coastal planning policy***

9.3.1 Planning Policy Guidance Note 20: Coastal Planning (PPG20, September 1992)

PPG20 provides guidance on defining a coastal zone, noting that, *"The inland limit of the zone will depend on the extent of direct maritime influences and coast-related activities. In some places, the coastal zone may be relatively narrow, such as where there are cliffs. Elsewhere, particularly where there are substantial areas of low-lying land and inter-tidal areas, it will be much wider"* (paragraph 1.7).

It goes on to set out the key policy issues for coastal planning, which are:

- conservation of the natural environment;
- development, particularly that which requires a coastal location;
- risks, including flooding, erosion and land instability; and
- improving the environment, particularly of urbanised or despoiled coastlines.

Of these, the risk of flooding is most relevant to this SFRA document, PPG20 goes on to advise that *"Policies should seek to minimise development in areas at risk from flooding, erosion and land instability"* (2.14). More directly in terms of climate change, it goes on to state that: *"Rising sea levels and recent cases of severe coastal flooding have focussed attention on minimising both the risk to life and damage to property"* (2.15).

PPG20 also promotes strong partnership working in coastal areas, to fully understand the natural and physical processes at work, development impact and development trends. It also sets out the role that local plans (now Local Development Frameworks) have in defining in detail the specific coastal policy areas which may include:

- a coastal zone;
- Heritage Coasts and conservation;

- coast related uses, proposals or developments; and
- areas at risk from flooding, erosion and land instability.

9.3.2 The Draft South West Regional Spatial Strategy

At Chapter 7 the Draft RSS includes policy guidance on defining the coastal zone. Policy CO1 seeks to protect the undeveloped coast, advising a presumption against development unless certain criteria are met, namely it:

- *"does not detract from the unspoilt character and appearance of the coast, and*
- *is essential for the benefit of the wider community, or*
- *is required to improve public access for informal recreation, or*
- *is required to support the sustainable management of fisheries, and*
- *cannot be accommodated reasonably outside the undeveloped coast zone"*

Paragraph 7.2.18 stresses the need for Local Development Documents to take into account other relevant guidance, in particular Shoreline Management Plans. It goes on to state that: *"One of the main outputs from this work will be a better coordination between the LDD and Shoreline Management Plans in identifying critical assets within the defined coastal zone. This will also need to take account of the likely impacts of climate change on the coast, including sea level rise, increased storminess and accelerated coastal processes; and the need to adapt to predicted climate conditions."* In line with this, Policy CO2: Coastal Planning promotes cross-boundary working to help improve coastal planning.

9.3.3 Bournemouth Borough Council, District Local Plan, Adopted February2002

Coastal zone management is covered within the Natural Environment chapter, and Policy 3.25 is applicable (see Appendix C).

"Proposals for development or redevelopment within 200 metres of cliffs and chines, or in proximity to steep embankments, will incorporate the measures necessary to demonstrate that such development will have no adverse effect upon existing cliffs, chines or steep embankments. Proposals for major developments in these areas will be required to submit a development impact assessment to show the proposal will have no adverse effect on land stability".

Analysis and comment: The 0.5% tidal annual probability flood extent for 2070 and 2115, with an allowance for climate change, has potential implications on the following policy areas:

- Green Belt
- Flood Plain
- Site of Special Scientific Interest

- Site of Special Scientific Interest, Special Area of Conservation & Special Protection Area
- Site of Nature Conservation Interest
- Heathland
- Area of Archaeological Importance
- Mobile Home Park

A large proportion of these implications are within the Hengistbury Head area. However, there are some implications further inland. In particular, both the 2070 and 2115 scenarios have implications on residential properties within Wick, and it is noteworthy that the 2115 scenario includes land either side of the railway line. The A35 and Iford Bridge are also potentially impacted.

9.3.4 Borough of Christchurch, Local Plan, Adopted March 2001

Coastal planning and management is covered within 'Conservation of the Natural Environment'. Policy ENV9 is applicable to the coastal zone, it states that:

"Within the coastal area identified on the proposals map development will only be permitted provided that the following criteria are satisfied:

1) *Proposals do not prejudice existing or proposed public access to the water or beach.*
2) *Proposals are designed to respect the scale and character of neighbouring buildings and landscape features and to ensure that the existing skyline is not broken.*
3) *Proposals do not detract from the visual dominance of the cliffs, being subservient to them.*
4) *Existing trees are lost only in the interests of good arboricultural practice. Where a tree belt is affected to such a degree as to prejudice its overall effect when viewed from the sea, and other parts of the coast, then new trees will need to be planted to compensate for the losses.*
5) *Geological features area respected.*
6) *Proposals no not prejudice coast protection works."*

Analysis and comment: The 0.5% tidal annual probability flood extent for 2070 and 2115, with an allowance for climate change, has potential implications on the following policy areas:

- Green Belt
- Flood Plain
- Coastal Area
- Harbour Policy Area
- Site of Special Scientific Interest
- Built Environment Policies
- Nationally Important Archaeological Site

- Existing Open Space

These implications fall across the breadth of the Harbour Area, as well as implications further inland. In particular, both the 2070 and 2115 scenarios have implications on residential properties within the Purewell, Stanpit and Mudeford areas, around the town centre and further upstream for the Avon (around Bridge Street, the A35 and the railway line) and the Stour (particularly east of Stour Road).

9.3.5 Changes required to the current policies

There is a need to re-consider the wording of these policies to ensure that they take into account the guidance set out in the draft RSS, particularly in respect of ensuring that the likely impacts of climate change are taken into account, and that Local Development Documents are fully integrated with other relevant guidance, in particular and where appropriate, the Poole & Christchurch Bays Shoreline Management Plan. There is also a need to ensure that the Coastal Zone is appropriately delineated, based on the most up to date technical evidence.

9.4 ***Potential increase in flood risk caused by future development***

The Flood Zones and localised flood incidents (***Volume II, Tiles A, B & C***) require careful consideration before sites for development are allocated, but once allocated a SUDS network can be constructed to ensure runoff from the site is the same after development is completed as it was before development started.

In an undeveloped area a percentage of the rainfall seeps or infiltrates into the soil and so does not contribute to runoff into watercourses, ditches or sewers. In the SFRA study area this percentage will be relatively high due to the presence of permeable underlying geology. A SUDS network creates a series of opportunities for this same degree of infiltration to continue when a site is developed with properties, buildings and roads all of which cut off the natural path of the rainfall to the soil.

The SUDS system will take into account climate change that is predicted to occur. It should be noted that existing sites could discharge up to 30% greater runoff in the future even if there was no change at all made to the site, purely as a result of increased rainfall landing on the ground within the site.

To achieve this equivalency or slight betterment the site drainage and SUDS network should be designed to meet the requirements set out in PPS25. To determine the actual design the approach set out in the Defra/Environment

Agency publication "Preliminary Rainfall Runoff Management for Developments Revision D" can be used.

A SUDS network will accommodate all rainfall, including the extra as a result of climate change, falling onto the site for all storm events up to and including a 1% annual probability event. This storm can be described as occurring on average once in 100 years. However with all probabilities it is possible that this event could occur more frequently than once every 100 years.

For the storm events within the design parameter of up to a 1% annual probability the outflow from the site will be equal to or slightly better than the existing arrangement. The storage can be within formal elements, e.g. a pond, but during extreme events, i.e. in excess of a 2% annual probability, informal storage areas such as car parks, playing fields and public open space can be utilised. In addition, buried attenuation facilities equivalent to a maximum of 3.3% annual probability event can often be provided within an adoptable sewerage network, providing the requirements of "Sewer for Adoption (Sixth edition)" are complied with.

The drainage and SUDS networks on a site will collect and transfer all of the rainfall to attenuation or storage areas without any surface flooding affecting properties or key infrastructure. In extreme events sites should be designed to meet the requirements of "Designing for exceedance in urban drainage – good practice" by CIRIA reference C635.

The CIRIA document defines an approach that minimises damage caused when the flow carrying capacity of the piped drainage system or SUDS network is exceeded. The key outcome is that excess flow is managed. It can be designed to be carried as overland flow along road surfaces, cycleways or along depressions in public open space.

9.5 ***Integrated urban drainage***

Development will not have an impact on the drainage system provided that it is well designed to current SUDS best practice, including PPS25 climate change allowances. However, there are, as the historical flood maps show (***Volume II, Tiles A***), existing deficiencies in the system that lead to urban flooding from integrated pathways.

Halcrow are currently coordinating a series of 'Integrated Urban Drainage Pilot Studies' on behalf of Defra. The 15 projects will test new approaches to reduce the

impact of urban drainage flooding, so that towns and cities across the country are better prepared for the impacts of climate change. The pilots were set up primarily to plug the gap between the well studied pathways of flooding, fluvial and coastal flooding; and the lesser understood 'other causes' of flooding.

The government's Foresight and Making Space for Water projects identified that these other sources of flooding can make up a large proportion of the damage caused by, and cost incurred by flooding, and this proportion is likely to increase as the impacts of climate change start to become more frequent.

9.6 ***Sustainability of land uses in medium and high risk flood areas***

The following types of land uses are outlined in PPS25 as suitable for medium and high risk flood areas:

Zone 2 – Medium probability of flooding

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure as detailed in Table D.2 of PPS25 are appropriate for this site, subject to the Sequential Test being applied. The highly vulnerable uses are only appropriate in this zone if the Exception Test (***refer to Section 3.4***) is passed.

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.

Zone 3a High Probability

The water-compatible and less vulnerable uses of land in Table D.2 of PPS25 are appropriate in this zone. The highly vulnerable should not be permitted. The more vulnerable and essential infrastructure uses should only be permitted in this zone if the Exception Test (***refer to Section 3.4***) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

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 zones with a lower probability of flooding; and

- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Only the water-compatible uses and the essential infrastructure listed in Table D.2 of PPS25 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 (***refer to Section 3.4***).

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.

9.7 ***Conclusion***

Climate change may lead to increased flood risks from all sources and so the potential impacts of climate change require careful consideration before sites for development are allocated. Once sites are allocated for development, a SUDS network can be used to ensure runoff from a site is the same after development as before it started, and include an allowance for climate change. New approaches are also being investigated (Integrated Urban Drainage Studies) to reduce deficiencies in existing drainage systems, so that existing urban areas are better prepared for the impacts of climate change.

10 Strategic Land Use Planning

10.1 ***Overview***

This section provides planning policy recommendations to enable appropriate planning responses for low, medium and high risk areas as regards flood risk. Council policy is considered essential to ensure that the recommended development control conditions can be imposed consistently at the planning application stage.

The policy recommendations provided in this chapter are not exhaustive and it is therefore recommended that the Councils refer to the following key flood risk management documents in order to fully inform their own flood risk management policies.

- **Planning Policy Statement 25: Development and Flood Risk** – sets out national policy for development and flood risk and supports the Government's objectives for sustainable communities.
- **Hampshire Avon Catchment Flood Management Plans** –strategic planning document through which the Environment Agency will work with other stakeholders to identify and agree policies for long-term flood risk management over the next 50 to 100 years.
- **Dorset Stour Catchment Flood Management Plan** - strategic planning document through which the Environment Agency will work with other stakeholders to identify and agree policies for long-term flood risk management over the next 50 to 100 years.
- **Poole & Christchurch Bays Shoreline Management Plan** – this is a strategic planning document which provides the basis for sustainable coastal defence and sets the objective for future management of this section of coastline.
- **Making Space for Water** - outlines the Government's proposals for forward planning of flood management over the next 20 years advocating a holistic approach to achieve sustainable development. The protection of the functional floodplain and creation of blue corridors are central to the strategy.
- **Water Framework Directive** - European Community (EC) water legislation which requires all inland and coastal waters to reach good ecological status by 2015.

10.2 ***Strategic Flood Risk Management Studies: CFMPs and SMPs***

The Environment Agency advocates a strategic approach to flood risk management on a 'whole catchment' basis. In line with this thinking, the Hampshire Avon and Dorset Stour Catchment Flood Management Plans (CFMPs, 2007) have been undertaken by the Environment Agency. A brief overview of these CFMPs and their main recommendations for flood risk management are provided below.

10.2.1 *Catchment Flood Management Plans (CFMPs)*

There are two CFMPs which cover the SFRA study area. These are:

- Hampshire Avon CFMP (encompasses the River Avon and its tributaries to the confluence with the Dorset Stour at Christchurch harbour)
- Dorset Stour CFMP (encompasses the River Stour and its tributaries to the confluence with the Hampshire Avon at Christchurch harbour)

Both CFMP are high-level strategic planning documents through which the Environment Agency will work with other stakeholders to identify and agree policies for long-term flood risk management over the next 50 to 100 years. They take into account the likely impacts of climate change and future development across the region. The plans do not propose specific or detailed measures but identify where further work is needed.

The CFMP reports for both catchments outline proposed flood risk management policies. Six policies have been developed to manage flood risk within CFMPs. Four of these (P3 – P6) have been selected as appropriate policies for the management of flood risk in various parts of the Hampshire Avon and Dorset Stour catchments (referred to as policy units, see ***Figures 10.1 and 10.2***). These are:

P3 – Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase overtime)

P4 – Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change and climate change)

P5 – Take further action to reduce flood risk (now and/or in the future)

P6 – Take action to increase the frequency of flooding to deliver benefits locally or elsewhere, (which may constitute an overall flood risk reduction, for example for habitat inundation)

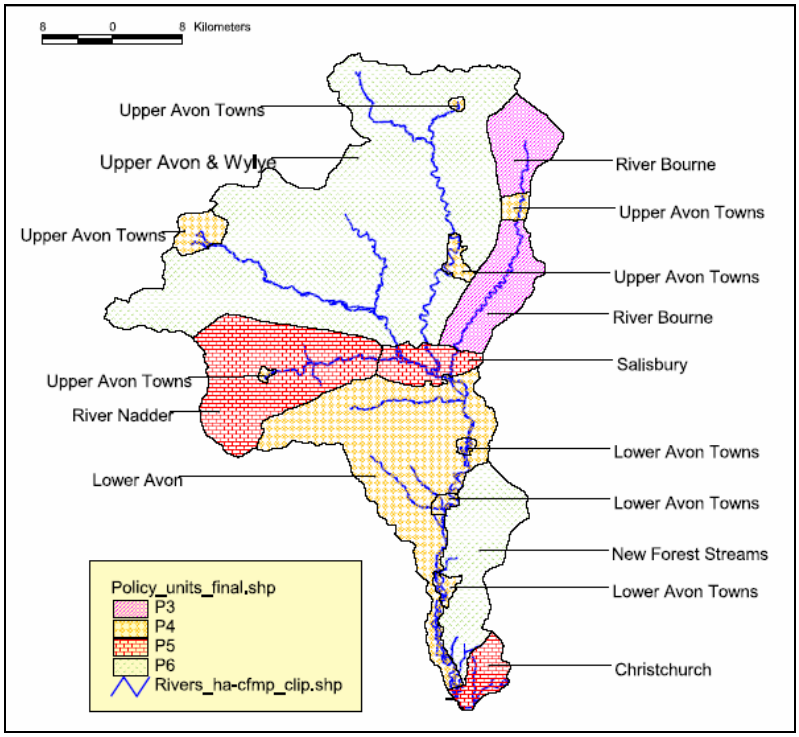

Figure 10.1 Policy units and selected policies for the Hampshire Avon catchment

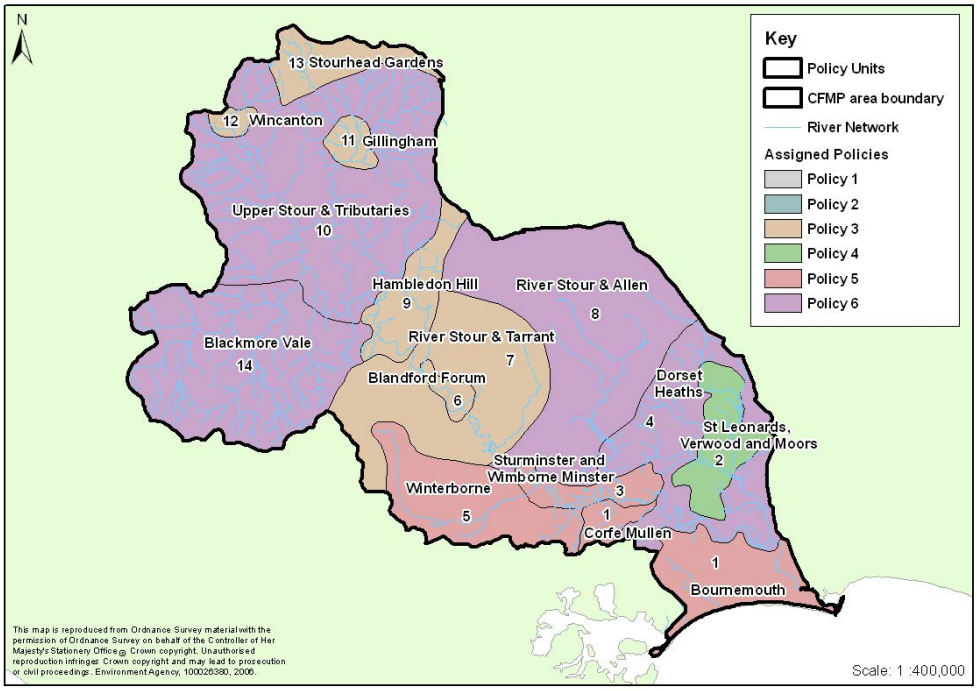

Figure 10.2 Policy units and selected policies for the Dorset Stour catchment

Poole & Christchurch Bays Shoreline Management Plan (SMP)

Coastal flooding of the Bournemouth and Christchurch coastline is managed through the Poole and Christchurch Bays SMP, which are under review. Policies adopted within the SMPs for the Bournemouth and Christchurch coastline include 'do nothing', 'observe and monitor', 'hold the existing line' and 'hold the beach width'.

10.3 ***Areas of search for development***

Within Christchurch BC, East Dorset DC and Salisbury DC, areas of search have been identified by the Draft Regional Spatial Strategy[1]. A preliminary review of these 'Areas of Search for Development' has been undertaken. ***Table 10.1*** provides a summary of these sites according to PPS25 Flood Zones taking into account climate change (as depicted on Tile Set 2) and other sources of flooding (as depicted on Tile Set D). It should be noted that the Sequential Test has not yet

[1] The areas of search identified at the Core Strategy Issues and Option Stage are subject to revision

been undertaken across these sites and the areas of search are themselves are subject to review so the flood risks detailed in ***Table 10.1*** are likely to change.

Table 10.1 Flood Zone classification of the Areas of Search for development

LPA	Total No. of areas	No. of areas intersecting with Climate Change Flood Zone 3b	No. of areas intersecting with Climate Change Flood Zone 3a	No. of areas affected by other sources of flooding
Christchurch	1	1	1	0
East Dorset	4	3	3	4
Salisbury	7	4	4	3

It is apparent that some of the areas of search for development intersect with Flood Zone 3b (Functional floodplain) and 3a (High Probability) when the potential effects of climate change are taken into account. In allocating sites for development the Local Authorities will be required to undertake the Sequential Test if promoting any areas of search that lie within Flood Zones 2, 3a or 3b at any point throughout the developments life. By applying the Sequential Test the more vulnerable uses of land can be allocated to the lowest risk sites. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in flood zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

If following application of the Sequential Test (and the Exception Test, if required) a site is being considered for development that lies within Flood Zone 3b, those proposing development may wish to undertake a more detailed FRA given the relatively low levels of confidence in the delineation of Flood Zone 3b (Section 6.3). This may show, to the satisfaction of the Environment Agency, that a site can be considered as falling within Zone 3a (high probability).

10.4 ***Flood risk to existing urban areas***

Within each of the Five Council areas many of the sites allocated for future development will be sited within existing urban areas. Table 10.2 provides a summary of the flood risks to the larger urban areas situated within the LPA boundaries, according to the PPS25 Flood Zones taking into account climate change and other sources of flooding.

Table 10.2 Flood Zone classification for existing urban areas

LPA	Urban area	Does the urban area intersect with Climate Change Flood Zone 3b?	Does the urban area intersect with Climate Change Flood Zone 3a?	Is the urban area affected by other sources of flooding?
Bournemouth	Bournemouth	√	√	√
Christchurch	Christchurch	√	√	√
East Dorset	Wimborne	√	√	√
	Ferndown			√
	St Leonards		√	√
	Verwood		√	√
	Alderholt			√
	Corfe Mullen			√
	Shapwick	√	√	√
	Sturminster Marshall	√	√	√
North Dorset	Blandford Forum	√	√	√
	Pimperne	√	√	√
	Shaftesbury			√
	Gillingham	√	√	√
	Child Okeford			√
	Shillingstone		√	√
	Okeford Fitzpaine			√
	Milborne St. Andrew	√	√	√
	Sturminster Newton			√
	Marnhull			√
	Bourton	√	√	√
	Stalbridge			√
Salisbury	Salisbury	√	√	√
	Tisbury	√	√	√
	Wilton	√	√	√
	Mere	√	√	√
	Downton	√	√	√
	Amesbury	√	√	√
	Bulford	√	√	√
	Durrington	√	√	√
	Shrewton	√	√	√

Table 10.2 shows that some of the existing urban areas interest with the higher probability flood zones. When allocating any new sites for development, whether within existing urban areas or elsewhere, the sequential test must be applied (as detailed in Section 10.3 – above) to ensure the lowest flood risk sites are selected.

10.5 ***Policy recommendations***

For the purposes of development control, detailed policies will need to set out by each Local Planning Authority to ensure that flood risk is taken account of appropriately for both allocated and non-allocated sites. The following policy recommendations are made:

- Each LPA is required to adopt the climate change flood zone maps (Tile Sets C+D 2115) extended by any additional flood risk areas identified in the Historic Flood Map (Tile Set 1) as the extent of 'critical drainage problem areas' to define flood risk areas and for the purposes of article 10 of the Town and Country Planning (General Development Procedure) Order 1995 as amended by the Flooding Directive 2007.

- A Planning Application falling in a 'critical drainage problem area' or on a site exceeding one hectare will not be registered by the Local Planning Authority unless it is supported by a Flood Risk Assessment (FRA). The FRA should be prepared in accordance with PPS25 and Council Development Control policies.

- It is not appropriate to use conditions to require the submission of a Flood Risk Assessment (FRA) or details to support a FRA which cannot be demonstrated in the FRA to be practicable and / or acceptable in terms of other planning considerations.

- A development should not increase flood risk elsewhere, and where possible, opportunity should be taken to decrease overall flood risk.

- Where development is proposed in areas bordering onto areas defined as 'critical drainage problem areas' floor levels should be set above the 1% fluvial, 0.5% tidal or other flood level where the critical drainage problem area is identified due to other sources of flooding. For critical drainage problem areas the predicted maximum flood level for the life of the development should be calculated with an allowance for climate change, plus a minimum freeboard of 600mm.

- The development should be safe throughout its life, to achieve this dry pedestrian egress should be possible above the 1% fluvial or 0.5% tidal flood level and emergency vehicular access should be possible during times of flood. Should this not be possible an evacuation plan should be prepared and the advice from the Local Authorities emergency planning officer and the emergency services must be sought.

- SUDS should be implemented to ensure that runoff from the site (post development) is reduced, with space set-aside within the confines of the site to allow its implementation. The use of SUDS techniques and attenuation should take into account the local geological and groundwater conditions. Should the surface water drainage system be designed to current standards for adoption, then; the surface water generated by a peak rainfall intensity, for all events up to that with an annual probability of 1%, in excess of the systems designed capacity shall be contained on site without causing a risk to property. The design peak rainfall intensity shall include the climate change allowances set out in Table B.2 of PPS 25 appropriate to the design life of the development.

- Basements should not be used for habitable purposes. Where basements are permitted for commercial and ancillary use, it is necessary to ensure that the basement access points and any venting or other penetrations are situated 600mm above the 1% fluvial or 0.5% tidal level plus the climate change predicted maximum level for the life of the development. Near the coast wave action must be considered and an allowance for it added.

- Development should be set-back from watercourses to allow appropriate access for routine maintenance and emergency clearance, if necessary. Any works or structures in, under, over or within 8 metres of the top of the bank of a main river is controlled under the terms of the Water Resources Act and the Land Drainage Byelaws. This requires a separate consent which is administered by the Environment Agency. Development should not propose culverting or the building over of watercourses.

- In areas protected to an appropriate standard by flood defences or down slope of water retaining structures (reservoirs) a detailed breach and overtopping assessment shall be carried out to inform the Sequential test and to ensure that the potential risk to life can be safely managed throughout the lifetime of the development. Unless absolutely necessary,

flood defences should not be used as an option to make development within higher flood risk areas permissible due to the risks of flood defence failure'.

10.6 ***Development within areas affected by surface water and sewer flooding***

Areas with no flooding should not always be viewed as areas best placed to accommodate new development. What is essential is that all development locations are checked to ensure capacity exists within the network. Where capacity does not exist it is vital that upgrades are provided ahead of development. Failure to do so will increase the risk of internal / external flooding of properties and pollution of the wider environment.

Each Council can ensure all future development is sustainable through close collaboration with Wessex Water. The best way is to ensure capacity exists in the network or can be accommodated through additional infrastructure is to model the existing sewer network (as already undertaken by Wessex Water) and then add in additional flows where development sizes and locations are known.

Wessex Water expect to have resolved all existing sewer flooding problems as shown on the historical flood maps (***Volume II, Tile Set 1***) by March 2010. Where Wessex Water has identified potential sewer flooding sites through computer modelling, these issues will be addressed as part of their ongoing programme of flood alleviation works.

10.7 ***Recommendations for reducing existing flood risks***

10.7.1 The following recommendations are made for reducing existing flood risks:

- Where possible, identify long-term opportunities to remove development from the functional floodplain through land swapping.
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels).
- Enhancement opportunities should be sought when renewing assets (e.g. deculverting, the use of bioengineered river walls, raising bridge soffits to take into account climate change)
- Avoid further culverting and building over of culverts. All new developments with culverts running through their site should seek to deculvert rivers for flood risk management and conservation benefit.

- Seek to protect Greenfield functional floodplain from future development and where possible reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).
- Seek to improve the emergency planning process using the outputs from the SFRA. It is further recommended that the Five Councils work with the Environment Agency promote awareness of flood risk to maximise the number of people signed up for the Flood Warning Direct service
- Encourage all those within Flood Zone 3a and 3b (residential and commercial occupiers) to sign-up to Flood Warnings Direct service operated by the Environment Agency.

10.8

The need for flood risk assessments

A SFRA is a strategic document that provides an overview of flood risk throughout the study area. Site-specific Flood Risk Assessments (FRAs) will be required for most proposed developments and the level of detail will depend on the level of flood risk at the site. The onus is on the developer to provide this information in support of a planning application.

Since the release of PPS25 in December 2006, the Environment Agency has power of direction over the determination of planning applications, which can be refused on the grounds of flood risk. Should any of the Five Councils wish to disregard the advice of the Environment Agency then in exceptional circumstances the planning application could be put before the Secretary of State. It is therefore imperative that developers hold discussions over the need for Flood Risk Assessment (FRA) early on within the planning process.

Consultation should be undertaken with the Environment Agency and the relevant Council to ensure that the Council's policies on flood risk management are respected and taken account of, and that the scope of the FRA is commensurate with the level of flood risk. Those proposing development should also be directed towards Annex F of PPS25.

11 Conclusions & Recommendations

11.1 ***Conclusions***

11.1.1 The risk of flooding within the study area arises from river, surface water, groundwater, sewer and coastal flooding. The SFRA flood maps with an allowance for climate change (***Volume 11, Tile Set 2***) show that many urban areas within the study area are at risk of flooding from a 1% fluvial or 0.5% tidal annual probability flood extent (Flood Zone 3). ***Table 10.1*** also shows that parts of several (1/1 in Christchurch, 3/4 in East Dorset and 4/7 in Salisbury) of the areas of search for development lie within Climate Change Flood Zone 3, although in many cases the area affected is small. The Sequential Test should be applied to direct any development away from these higher flood risk areas, but where this is not possible a Level 2 SFRA will be required to inform flood risk and the exception test must be passed.

11.2 ***Recommendations***

11.2.1 *Recording flood incidents*

It is recommended that all Five Councils, Wiltshire County Council and Dorset County Council collate information regarding flood incidents in GIS format. It is suggested that a flood incident is recorded as a polygon on a GIS database to show the spatial extent of the flood. Information recorded about a flood incident should be stored in the GIS database (as a table) and include details of the following:

- National Grid Reference
- Date of flood incident
- House number
- Road
- Community
- Source of flooding (e.g. heavy rain, blockage etc.)
- Whether properties flooded internally
- Time the property flooded
- Maximum depth of flooding
- Whether property was flooded externally
- Any preventative measures taken to stop flooding
- Source of information
- Any additional comments

It is suggested that information is collated on each of the above parameters to be compatible with the information collated by the Environment Agency on flood

incidents on their FRIS database (see ***Appendix J***). As good practice, it is also recommended that information on flood incidents is readily shared between the Environment Agency, the Five councils, Wiltshire County Council and Dorset County Council. A national web-based FRIS database may be the easiest and best way to facilitate this process so that all flood incident information is collated in a single database. However, should this recommendation be progressed further it will be vital that access to the database is controlled (e.g. via a password) and that amendments and updates made to the database can be traced to the user who has made them.

11.2.2 *Site Allocation Process*

It is recommended the outputs from this study are used as an evidence base from which to direct new development where possible to areas of low flood risk (Flood Zone 1). Where development cannot be located in Flood Zone 1, a Level 2 SFRA will be required. The output from the Level 2 SFRA should be used to sequentially test the remaining land use allocations.

Where the need to apply the Exception Test is identified, due to there being an insufficient number of suitable sites for development within zones of lower flood risk, the scope of the SFRA will need to be widened to a Level 2 assessment. The need for a Level 2 SFRA cannot be fully determined until the Sequential Test has been applied. It is recommended that as soon as the need for the Exception Test is established, Level 2 SFRA(s) are undertaken by a suitably qualified engineer so as to provide timely input to the overall LDF process.

11.2.3 *Possible Funding Mechanisms - Planning Obligations and Statutory Planning Charges*

Funding flood risk defences and other facilities is likely to be an important policy consideration. Circular 05/2005 provides for S106 planning obligations to be sought where they meet the tests set out in the Circular. Such obligations are intended to secure contributions from developers to address the impact of new development, without which such development should not be permitted. Such impacts can include flood water conveyance/storage and flood defences. The provision of defences to enable development should be considered as a last result as such defences raise issues of sustainability and long term maintenance requirements.

There have been a number of recent initiatives to achieve enhanced contributions via S106 planning obligations. One of the most advanced schemes involves a tariff-

based funding system covering development in the Expansion Areas in Milton Keynes. The objective of the approach is to ensure that Expansion Area development is supported by appropriate facilities, amenities and infrastructure. Milton Keynes' tariff includes flood risk management and drainage provision.

The Government recently announced that it intends to introduce a 'statutory planning charge' in the forthcoming Planning Reform Bill (as opposed to a Planning Gain Supplement) to, inter alia. *"capture more planning gain to finance additional investment in local and strategic infrastructure*… [and]… *provide a fairer means of securing contributions from developers for infrastructure".*

The Councils may wish to consider the potential of S106 planning obligation contributions, or charges, to fund (or part fund) strategic flood risk management facilities. In some cases it may be reasonable for the developer to contribute to the up-grade or replacement of existing flood defences and surface water infrastructure, or to flood alleviation schemes which provide benefit to the wider community.

11.2.4 *Council Policy*

Council policy is essential to ensure that the recommended development control is imposed consistently and ultimately leads to sustainability with respect to flood risk management. It is recommended that the current Council policy is reviewed in light of PPS25 and this SFRA to ensure a consistent policy is being promoted with regard to flood risk, and the following key considerations are adhered to:

- Seeking to protect the functional floodplain from development
- Directing vulnerable development away from flood affected areas
- Ensuring all new development is 'Safe', meaning that dry pedestrian egress through the floodplain and emergency vehicular access is possible
- Promoting the application of sustainable drainage techniques for all new development
- Supporting flood alleviation measures under consideration by the Environment Agency by safeguarding possible sites for flood storage and other channel works
- Seeking developer contributions via S106 planning obligation to fund (or part fund) strategic flood risk management facilities and bring benefit to the wider community

11.2.5 *Emergency Planning*

It is recommended that Major Incident Plans are reviewed and updated in light of the findings of the SFRA to ensure that all sources of flood risk are recognised and safe evacuation and access for emergency services is possible during times of flood both for existing developments and those being promoted as possible sites within the LDF process. It is further recommended that the Five Councils work with the Environment Agency to promote the awareness of flood risk and encourage communities at risk to sign-up to the Environment Agency flood warning service.

11.2.6 *Future Updates to the SFRA*

The SFRA should be retained as a 'living' document and reviewed on a regular basis in light of better flood risk information and emerging policy guidance.

Planning Policy Statement: Planning and Climate Change (supplement to PPS 1) (DCLG, due to be released in 2007) – will provide further guidance on how planning should secure new development to the effects of climate change

References

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National SUDS Working Group, 2004. Interim Code of Practice for Sustainable Drainage Systems

Planning Policy Statement: Planning and Climate Change (supplement to PPS 1)

Planning Policy Statement 25: Development and Flood Risk (2006)

SUDS –Design manual for England & Wales (CIRIA C522)

SUDS – Best practice manual (CIRIA C523)

SUDS – hydraulic, structural and water quality advice (CIRIA C609)

The Groundwater Regulations 1998. Statutory Instrument 1998. No 2746 Environmental Protection

The SUDS Manual, (CIRIA C697)

Appendix A – Audit Trail database

Appendix B – Geology

Appendix C – Bournemouth Appendix

Appendix D – Christchurch Appendix

Appendix E – East Dorset Appendix

Appendix F – North Dorset Appendix

Appendix G – Salisbury Appendix

Appendix H – Sewer flooding

Appendix I – Sites at risk from flooding

Appendix J – FRIS database template