West Dorset District Council

Strategic Flood Risk Assessment for
Local Development Framework
Level 1
August 2008

Volume 1 – Final Report

Halcrow Group Limited

West Dorset District Council

Strategic Flood Risk Assessment for Local Development Framework Level 1

Volume 1 – Final Report

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1		Draft Report	May 08	JMD
2		Final Report	August 08	JMD

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1 Introduction

1.1 Terms of reference

In June 2007 West Dorset District Council (hereafter referred to as the District Council) commissioned Halcrow to produce a Level 1 Strategic Flood Risk Assessment (SFRA) in accordance with Planning Policy Statement 25 (PPS25). This report presents the findings of the SFRA. An executive summary report has also been produced to summarise the Level 1 report.

1.2 Project 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. Where new development is necessary in such areas, exceptionally, 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 access to and from the development is possible without passing through the 1 in 100 year return period plus climate change floodplain, and emergency vehicular access is achievable for extreme events. Return period can also be expressed as Annual Exceedance Probability (AEP) - the probability of an event being exceeded in any year. Fuller definitions of return period and AEP are provided in the Glossary, Section 13 of this report.

The aim of this SFRA therefore 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 planning authority will need to apply the Sequential Test to land use allocations and, where necessary, the Exception Test (Level 2 SFRA). 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

The Strategic Flood Risk Assessment (SFRA) will inform the site selection process for future development sites and provide recommendations for policies to deal with non-allocated sites. The SFRA will feed into the Local Authorities Sustainability Appraisals of the 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).

This SFRA report is a 'living' document in that as new information becomes available updates will be made to ensure that the best information is used to guide the site selection process for future developments. In particular, Environment Agency flood zones can be updated every three months due to changes in flood modelling results or information from site specific flood risk assessments. For this reason users of this SFRA are recommended to check that they are using the latest SFRA version and the latest flood zone maps associated with this study.

1.3 Project objectives

Halcrow has carried out this project in accordance with the methodology outlined in the District Council's Strategic Flood Risk Assessment Project Brief, dated June 2007. The assessment also follows the guidance contained in the document "Development and Flood Risk: A Practice Guide Companion to PPS25". The SFRA has also followed advice from the Environment Agency.

For this study, a Level 1 SFRA approach has been agreed with the District Council 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 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.

The best available data within the study timescale has been collected for use in this study; however it is important to recognise that the SFRA is a 'living' document. As new information becomes available (such as improved river models) updates will be made to the Flood Maps and this should be reflected in the SFRA document, to ensure that the best information is used to guide the site selection process for future developments.

1.4 Project deliverables

The project outputs for Level 1 SFRA have been adopted for this study. The deliverables of this assessment are as follows:

- A technical report
- A summary document

Following the advice from Section 2.34 of the Practice Guide Companion to PPS25, the key project outputs are as follows:

1) Plans showing the administrative boundaries of the study area, watercourse centreline, modelled watercourses and flood defences (Volume 2, Drawing A)

2) Strategic flood risk maps showing areas flooded historically or at risk of flooding, including fluvial flood zones (Volume 2, Drawings B1 to B9)

3) An assessment of the implications of climate change for flood risk in the study area over an appropriate time period (Volume 2, Drawings C1 to C9)

4) Solid and drift geology within the study area (Volume 2, Drawings D(i) and D(ii))

5) The coverage of the current flood warning system (Volume 2, Drawing E)

6) Guidance on the application of the Sequential Test (see Section 9)

7) Guidance on the preparation of Flood Risk Assessments for development sites (see Section 10).

8) Guidance on the likely applicability of different SuDS techniques for managing surface water run-off at key development sites (see Section 11)

1.5 Outcomes of the SFRA process

A Level 1 SFRA provides sufficient data and information to enable a planning authority to apply the Sequential Test to land use allocations, and can therefore identify when it is necessary to apply the Exception Test (see Sections 1.5.1 and 1.5.2 respectively).

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 District 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.

1.5.1 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. Appendix B shows the Sequential Test process as advocated in PPS25.

Preference should be given to locating new development in Flood Zone 1, Low Probability (see Section 3.3.1 for further information). If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development (see table below) 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.

For the full Flood Risk Vulnerability Classification list refer to Table D.2 of PPS25.

Flood Risk Vulnerability and Flood Zone 'Compatibility' (Table D3 of PPS25)

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

Key:

✔ Development is appropriate

✗ Development should not be permitted

1.5.2 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). It may also be appropriate to use it where restrictive national designations such as landscape, heritage and nature conservation designations, e.g. Areas of Outstanding Natural Beauty (AONBs), 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:

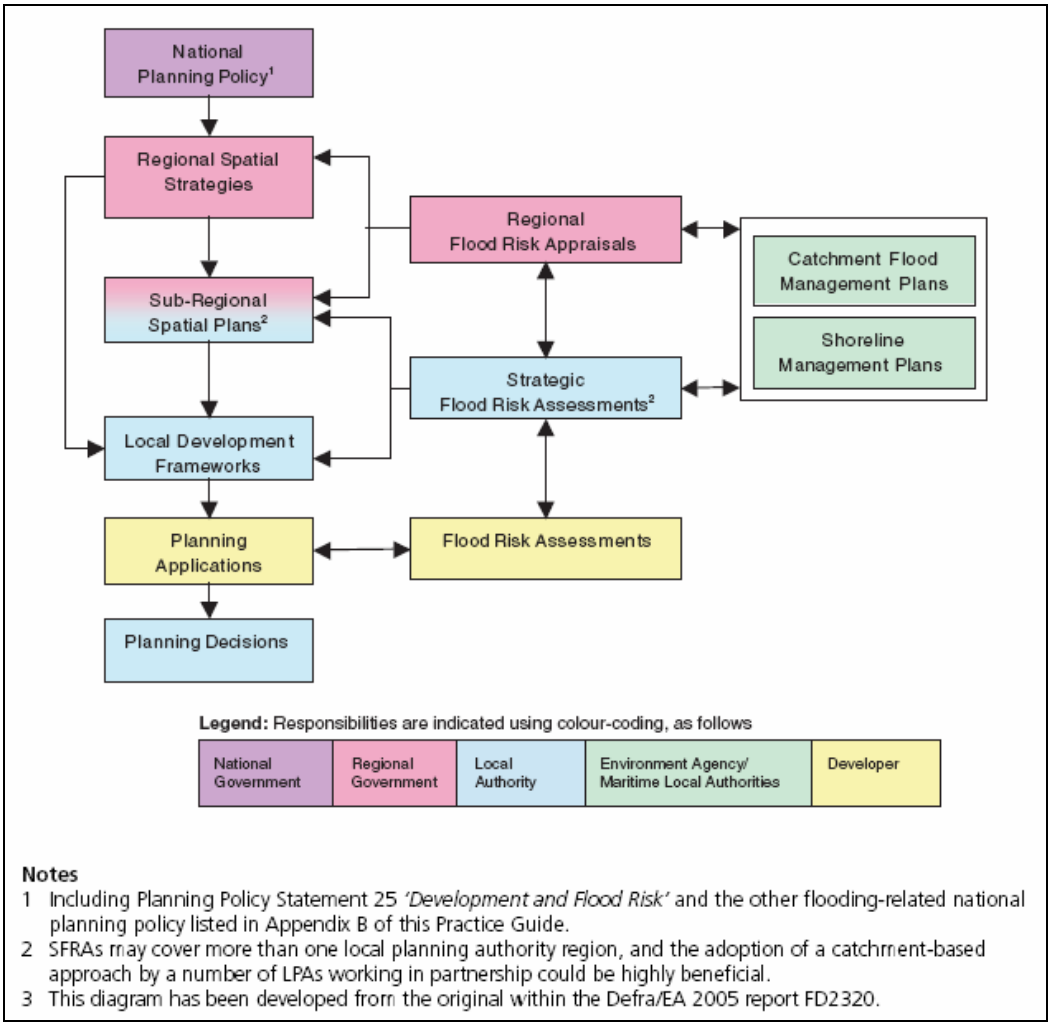
a) It must be demonstrated that the development provides wider sustainability benefits to the community which outweigh flood risk, informed by a SFRA where one has been prepared. If the Development Plan Document has reached the 'submission' stage (see Figure 4 of PPS12: Local Development Frameworks)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

1.6 SFRA context

The figure below, taken from the PPS25 Practice Guide, illustrates the responsibilities for the production of key documents required to effectively manage flood risk through each stage of the spatial planning process, and, importantly, shows the link between other strategic documents.



1.7 The study area

West Dorset District Council covers an area of approximately 1081km². West Dorset is a thriving mixture of urban and rural areas. The total population is approximately 95,000. Much of the built environment of the District is of a very high quality, including over 6,000 buildings listed as being of architectural or historic interest, 79 Conservation Areas and 17 Historic Parks and Gardens of national significance. There are about a thousand Scheduled Monuments and 4,000 entries in the Historic Environment Record of known archaeological sites and finds and historic landscape features. Natural assets include 71% of the District being designated as an Area of Outstanding Natural Beauty. In

December 2001 the coastline from Orcombe Point in East Devon to an area east of Swanage was declared a World Heritage Site. There are 56 Sites of Special Scientific Interest wholly or partly within the District, and several of these are also identified as being of international importance.

1.7.1 Main rivers and hydrology

Despite there being close to 2000km of watercourses within the District, less than 10% of these are classified as main rivers. The headwaters of the River Frome, Piddle, Yeo, Parrett, Stour and Axe are all located within the District, as are the catchments of the River Brit, Bride and Char. With its proximity to the coast and the relative steepness of the topography (particularly in the headwaters of the catchments), the District is at risk from 'flashy' floods that are caused by intense, often localised rainfall that may be relatively short lasting. Such events typically result in flooding of urban areas or within steep, small catchments that respond quickly to rainfall, and are expected to increase in severity in the future under climate change projections.

Some rivers, such as the Frome, are slower responding and flood risk may result from longer duration events. As the District provides the headwaters of the River Frome and several other rivers listed above, the management of flood risk within the District will impact on the adjoining authorities to the west, east and north – for example, the provision of flood storage in the upper catchments to reduce flows downstream could impact on flood risk areas within and outside of the District.

The largest catchment within the District is the upper catchment of the River Frome, which drains the central part of the District. The River Frome rises at Evershot and flows in a southerly direction until it is joined by the River Hooke at Maiden Newton. It then flows in a broadly south-easterly direction towards Dorchester. Several kilometres upstream of Dorchester the river channel splits and the floodplain widens. The river passes to the north of Dorchester and then flows east to the District boundary. Downstream of Dorchester, the Winterbourne River joins the River Frome at West Stafford.

The River Char is located in the west of the District and has a catchment area of just under 60km^2. It rises as a line of springs on Burstock Down to the south of Broadwindsor at an elevation of over 250m and then flows in a south-westerly direction to Charmouth. The River Char is joined by a tributary approximately 1km from the coast, which drains the narrow, steep-sided valleys to the south of Lambert's Castle Hill. The total river length is approximately 15km.

The River Brit is located to the east of the Char catchment and has a catchment area of approximately 115km^2. The River Brit rises at the base of hills just north of Beaminster where springs occur at the junction of Upper Greensand and underlying clay. It then flows south through Netherbury and continues onto Bridport, where it discharges into the sea at Westbay Harbour. A number of larger tributaries join the River Brit in the Bridport area: the River Simene from the north west and the Mangerton River from the north east. The total length of the River Brit is approximately 14km.

To the east of the Brit catchment is the River Bride, a small catchment of just under 50km^2 which rises from the higher ground to the south of Littlebredy and flows westwards, discharging into the sea downstream of Burton Bradstock. A number of small tributaries drain the areas to the north and south of the main river. The total length of the River Bride is approximately 12km. The Bride valley is generally wide and gently sloping, though it narrows where it passes through a gap in the limestone coastal ridge prior to reaching the sea.

There are no canals within the District, meaning that there is no need to undertake further work to assess any associated flood risk.

1.7.2 Coastline

West Dorset has approximately 44km of coastline, all of which is part of the Jurassic Coast World Heritage Site. The coastline of West Dorset is split into two sections; the first covers the coastline from Lyme Regis to south west of Weymouth and the second stretches for approximately 7km to the east of Weymouth. The section between Lyme Regis and Weymouth includes Chesil Beach, which is a Special Conservation Area (SCA) and Special Protection Area (SPA).

Coastal protection schemes protect approximately 4km of the West Dorset coastline from coastal flooding. The coastal defence schemes at Lyme Regis and West Bay are the most significant schemes along the West Dorset coastline. The Shoreline Management Plan (SMP) sets out the policies from which strategies will emerge for managing erosion to the coastline, which is the responsibility of West Dorset District Council. More information regarding the SMP can be found in Section 4.6. The Environment Agency has responsibility for protecting land and property from flooding by the sea.

The risk of coastal and tidal flooding from high tides and storm surges is considered within this SFRA.

1.7.3 Geology and topography

The geological and hydrogeological setting provides an indication of the potential for groundwater flooding and an understanding of the role of infiltration drainage either within the overall natural water cycle, or as part of sustainable drainage systems (SuDS).

The West Dorset coastline is part of the UNESCO (United Nations Educational, Scientific and Cultural Organisation) Dorset and East Devon World Heritage Site. It is considered of international importance particularly for its almost continuous sequence of Mesozoic (i.e. Triassic, Jurassic and Cretaceous) rock formations and is an important site for fossils and a classic locality for the study of coastal geomorphology.

The eastward-dipping, Jurassic sedimentary strata, which generally comprise alternations of clay and sands and are visible in the fine coastal exposures, were once blanketed by a continuous cover of sub-horizontal Cretaceous strata (i.e. Chalk and Greensand) and with Quaternary superficials (e.g. Clay-with-flints). This Cretaceous cover has been long-since eroded away across the central-western, southern and northern peripheries of the District. However, these strata are preserved in the eastern and central areas as a deeply incised plateaux, and as outliers on the high ground in the extreme west of the District (e.g. in the Char catchment). Where the Cretaceous strata have been eroded away, remnant deposits of hard, angular chert and flint frequently remain.

Bedrock geology tends to become progressively younger from west to east, this being due to the eastward-dip of the Mesozoic strata at the regional scale. In the catchments of the Rivers Lim and Char in the extreme west of the District the relatively impermeable Jurassic mudstones of the Lower Lias and lower-Middle Lias Groups form broad clay vales. The intervening ridges of high ground are capped by Cretaceous clays, and highly permeable sandstones and limestones belonging to the Greensand and Chalk Groups. Further to the east the catchments of the Rivers Brit and Simene are underlain by clays of the lower-Middle Lias, with more permeable upper-Middle Lias and Upper Lias

sandstones capping the intervening hills. East of the Mangerton Fault system this situation is reversed with the Mangerton River catchment being generally underlain by sands of the Upper Lias Group and the interfluves capped by Fuller's Earth clays. The catchments of the Rivers Yeo and Wriggle in the north of the District have a complex and varied geology, with the rivers trending generally perpendicular to geological outcrop. However, in the south the River Bride and the streams of the Weymouth Lowland generally run parallel to the geology, with sandstone and limestone ridges separating clay vales. The central and east of the district are dominated by the Chalk plateaux, and in the extreme east the Tertiary sediments of the Hampshire Basin. Here the Rivers Frome and Piddle drain the highly permeable Chalk aquifer.

In the Frome and Piddle catchments, and to a lesser extent elsewhere, there are significant alluvium deposits along the main watercourses and also river terrace deposits. The drift geology of the District is also characterised by clay with flints, most notably so in central and eastern parts. Head (undifferentiated) is found typically in northern and western parts of the catchment. There are small areas of tidal flat deposits in the far south of the District.

The underlying geology significantly affects the catchments' response to rainfall. It is primarily responsible for the topography of the catchments which directly influences the time to peak – in simple terms, the steeper the catchment the more rapid the flood response in the river. The chalk-dominated areas are characterised by a slow response to rainfall; chalk being relatively porous generally results in low run-off rates, and baseflows are sustained at a higher level for a much longer duration compared to some of the more responsive clay catchments, such as the River Brit, Char and Lim.

A simplification of the main geological strata present beneath the study area, identifying both their key hydrogeological properties and their potential for infiltration drainage is provided in Appendix D and Section 11.3. Maps of the solid and drift geology can be found within Volume 2, Drawings D(i) and D(ii).

As well as influencing river characteristics, geology is important for flood risk as it can affect the suitability of sites for flood storage or certain sustainable drainage systems (SuDS). Upstream storage is a potential method to mitigate flood risk downstream and requires appropriate site selection to ensure that considerations including ground conditions are taken into account. Geology plays a part in this. A number of SuDS options operate by infiltration, for example soakaways. Similarly, consideration needs to be given to ground conditions and geology where such SuDS options are proposed. SuDS are discussed in Section 11. Flood risk management options such as upstream storage are considered within the relevant Environment Agency Catchment Flood Management Plans.

Infiltration characteristics are also strongly controlled by the soils overlying bedrock. Classification of soils into generic and recognised classes i.e. 'Soil Associations' allows an understanding of the drainage characteristics of otherwise disparate soils to be achieved, based upon empirical datasets. Soil type will dictate, for example, the susceptibility of a soil to water-logging or the capacity of a soil to freely drain so allowing infiltration to reach the groundwater table. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types found beneath the study area may be used as an indicator of permeability and infiltration potential.

In terms of elevation, the topography across the District varies from approximately 250m at the headwaters of the River Char, and 200m along the ridge north of the River Brit, to sea level along the south-west coast.

2 Planning context

2.1 Introduction

This section provides an overview of the planning policy framework relevant to the Strategic Flood Risk Assessment (SFRA) of West Dorset District Council.

The information about flooding and flood risk in the SFRA 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 (LDD) and will enable informed decisions to be made relating to land use and development allocation within the respective Development Plan Documents (DPD).

Current policies and plans considered most relevant to the SFRA are outlined in the following paragraphs.

2.2 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 debate. They are intended to reconcile conflicts between the need for development and the need to protect the wider built and natural environment.

Responding to the requirements of the Planning and Compulsory Purchase Act 2004, the Government is 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 Framework (LDF) documents replacing Structure and Local Plans and Unitary Development Plans.

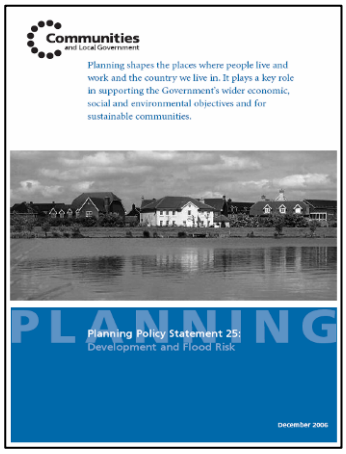
The following paragraphs provide an overview of the relevant policy documents and a brief explanation of their significance for the SFRA.

2.3 National Planning Policy

2.3.1 Planning Policy Guidance 20:

PPG20 covers the character of the coast, designated areas, heritage coasts and the international dimension. It discusses types of coasts, policies for their conservation and development and policies covering risks of flooding, erosion and land instability, as well as coastal protection and defence. It outlines policies for developments which may specifically require a coastal location, including tourism, recreation, mineral extraction, energy generation and waste water and sewage treatment plants.

2.3.2 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.

2.3.3 The Town and Country Planning (General Development Procedure) Order 1995 (as amended)

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.

LPA are required to consult the Environment Agency before granting planning permission for development, other than minor development, which is to be carried out on land:

- In an area within Flood Zones 2 or 3; or in an area within Flood Zone 1 which has been notified for the purpose of this provision to the LPA by the Environment Agency; and
- Any development of land of one hectare or more.

2.3.4 The Town and Country Planning (Flooding) (England) Direction 2007

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.

2.4 Regional policy and emerging regional policy

2.4.1 Regional Planning Guidance for the South West (2001)

Regional Planning Guidance for the South West (RPG10) covers the period up to 2016 and sets the regional planning policy framework for the area.

Policy RE2 Flood Risk acknowledges that climate change is likely to exacerbate the risk of flooding and requires that development should be guided away from areas at risk, or likely to be at risk in future from flooding.

2.4.2 Draft Regional Spatial Strategy for the South West (RSS)

RPG10 is to be replaced by a new spatial form of regional guidance, the Regional Spatial Strategy for the South West (RSS). The Draft RSS has been the subject of an Examination in Public, with the Panel Report published in December 2007. Following the Panel Report, Proposed Changes have been published for consultation on 22nd July 2008. There is now a 12-week period of consultation

with consultation responses due to be returned on 17th October 2008. The RSS is due to be adopted at the end of 2008.

The Revised Draft RSS sets out dwelling requirements for West Dorset which represent a significant increase on the 410 per annum of the submission draft. A total of 12,500 new dwellings are proposed in West Dorset between 2006-2026, a rate of 625 a year, to include 350 a year at Dorchester. This includes the proposal that there should be a significant urban extension to Dorchester, of an additional 3000 dwellings.

The Revised Draft RSS also makes provision for around 9,500 jobs in the Dorchester and Weymouth Travel to Work Area - the higher end of the range put forward in the submission draft.

Policy F1 Flood Risk 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.

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.

2.5 Local policy and emerging local policy

2.5.1 Bournemouth, Dorset and Poole Structure Plan (2000)

In the period 1994 to 2011, the Structure Plan sets out sets out a requirement for about 9,500 gross (9,000 net) additional dwellings to be provided in West Dorset District.

2.5.2 West Dorset District Local Plan (July 2006)

The Local Plan has an important role to play in the process of balancing development pressures and the environmental impact of new development in West Dorset. The Local Plan refers to the requirement to provide about 9,500 gross (9,000 net) additional dwellings in West Dorset in the period 1994 to 2011.

Table 6.1: Housing Land Supply of the Local Plan refers to the provision of 5,905 gross completed dwellings in West Dorset in the period between 1st April 1994 and 31st March 2005. This leaves a further 3,595 dwellings to be provided by 2011. Table 6.1 identifies the sources of future housing

provision, including: sites with planning permission, windfall estimates and allocations and an allowance for dwellings lost / demolished.

The total housing provision to 2011 identified in Table 6.1 is 3,206 gross additional dwellings. The Local Plan includes housing allocations to 2016

Local Plan Policy AH1: River and Coastal Flooding, states that development, will not be permitted unless an appropriate flood risk assessment demonstrates that it will not be subject to, or result in, an unacceptable risk of flooding on site or elsewhere.

2.5.3 West Dorset Local Development Scheme

The policies of the Local Plan are automatically saved for three years from the date it was adopted i.e. 14 July 2009, however in the case of West Dorset this is likely to be extended until the Core Strategy (see below) is adopted.

West Dorset District published the latest Local Development Scheme (LDS) in 2008. This provides the starting point for the local community to find out what the current planning policies are for the area and the programme for preparing new Local Development Documents (LDD) in the three years up to 2010.

The current priority within the programme is the preparation of the Core Strategy. The consultation on Core Strategy Preferred Options is expected in May – June 2009. A replacement Proposals Map Development Plan Document will be prepared alongside the Core Strategy if it is necessary to show designations or sites that are not shown on the proposals map of the saved Local Plan.

2.6 Flood risk defences and other facilities – Possible funding mechanisms

2.6.1 Planning obligations

Funding flood 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 and storage and flood defences.

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 tariff helps to ensure that Expansion Area development is supported by appropriate facilities, amenities and infrastructure. The Milton Keynes tariff includes flood risk management and drainage provision.

West Dorset District Council may wish to consider the potential benefits of planning policies that require S106 planning obligation contributions to fund (or part fund) strategic flood risk management facilities.

2.6.2 Planning Gain Supplement and the Statutory Planning Charge

The Government's decision how to take forward the Planning-Gain Supplement (PGS) proposed in the Barker Review of Housing Supply (2004) will influence how S106 planning obligations can be used to secure strategic flood risk management contributions. The Government's PGS consultation (December 2005) proposes that flood defence should remain within the scope of S106 planning obligations.

The Government published a further PGS consultation setting out their proposals for a new system of planning obligations in England in December 2006. These include scaling-back S106 planning obligations to cover only development site environment impact, which would include flood defence, and ensure they run smoothly alongside PGS. The Community Infrastructure Levy is the current Government proposal for dealing with planning gain payments.

3 Study methodology

3.1 Level 1 SFRA methodology

A Level 1 SFRA is defined in the Practice Guide Companion as a desk-based study using existing information to allow application of the Sequential Test and to identify where the Exception Test is likely to be necessary. The main tasks undertaken during the study were as follows:

a) Establishing relationships and understanding the planning context:

An Inception meeting was held to build relationships between the project team, the District Council and the Environment Agency. This allowed the partnering approach to form, and allow the free exchange of available information. The status of the District Council's Local Plan was discussed at the Inception meeting.

b) Gathering data and analysing it for suitability:

A data collection exercise was undertaken, during which all available relevant data were collated and reviewed. This included an assessment of the significance and quality of the data needed to drive the SFRA. Where possible, the main approach adopted for the SFRA was to build on previous studies and existing information, supplied during the data collection phase. Details of all data gathered and collated are contained in Section 4.

c) Producing strategic flood risk maps, GIS deliverables and a technical report

A series of GIS maps were produced using the data gathered in the early phases of the study. The main mapping outputs are the strategic flood risk maps (covering the entire study area), which show Flood Zones 1, 2 and 3 and flooding from all other sources, and should be used to carry out the sequential test. Other maps include the fluvial features of the study area, climate change maps showing the impacts of climate change on flood risk, geological maps and maps showing flood warning areas. Hardcopy maps are provided in Volume 2 of the SFRA report, while GIS layers can be found on the accompanying CD.

d) Providing suitable guidance

This report contains sections that provide guidance on policy considerations, the application of the Sequential Test, guidance for the preparation of flood risk assessments and guidance for the application of sustainable urban drainage systems in the study area. A project workshop was held on 10th October 2007 which provided further guidance on the application of the Sequential Test. The workshop was attended by Planning Policy, Development Control and Technical Services section of the District Council, the Highways Agency, Dorset County Council and the Environment Agency. Discussions were held such that all participants had the opportunity to question the SFRA process and to gain a full understanding of the process related to PPS25 guidance.

3.2 Need for a Level 2 SFRA

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 may 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. This could include 2D modelling and breach/overtopping analysis for certain locations.

Level 2 SFRA outputs include:

- An appraisal of the condition of flood defence infrastructure and likely future policy
- An appraisal of the probability and consequence of breach or overtopping of flood defence infrastructure
- Maps showing 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 the preparation of FRAs for sites with varying flood risk across the flood zone

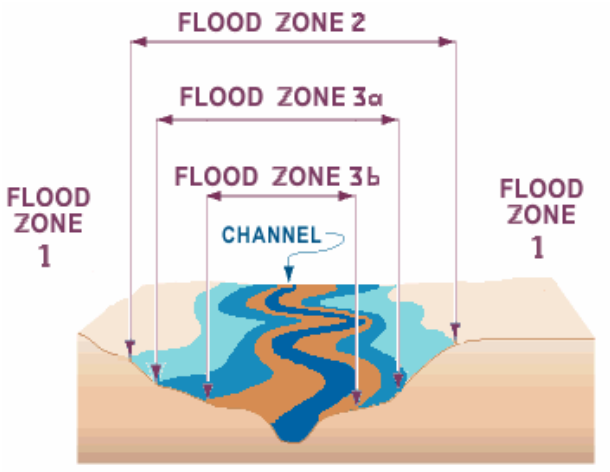
In general, the Level 2 SFRA should aim to provide clear guidance on appropriate risk management measures for adoption on sites within Flood Zone 3, which are protected by existing defences. This should minimise the extent to which individual developers need to undertake separate studies on the same problem. The scope of a Level 2 SFRA cannot be fully determined until the Sequential Test has been undertaken by each Council on all possible site allocations.

3.3 Technical background

It is useful to gain a good understanding of Flood Zones and the approach taken to satisfy the Level 1 SFRA requirements, using existing data.

3.3.1 Flood Zones

Flood Zones show the areas potentially at risk of flooding from rivers or the sea, ignoring the presence of defences.



PPS25 defines the flood zones as follows:

Zone 1: Low Probability

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1% AEP)

Zone 2: Medium Probability

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Zone 3a: High Probability

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

Zone 3b: The Functional Floodplain

This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone where possible (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

For the purposes of this SFRA, the most recent Flood Zone maps produced by the Environment Agency have been used.

3.4 Environment Agency Flood Zone maps

A national flood map dataset has been produced by the Environment Agency for the whole of England and Wales. In a large proportion of areas, fluvial Flood Zones 2 and 3 are derived from the modelling package JFLOW, which is a 'coarse' modelling approach (see Appendix A). Where more detailed flood mapping studies have been undertaken these have often been used in place of the JFLOW outlines as they are generally deemed to be of a higher accuracy. Such studies will usually involve detailed hydrological work, surveyed river cross sections, and more precise digital modelling such as ISIS and HecRas, and possibly even 2D modelling software such as TuFLOW.

The Environment Agency flood maps do not show the functional floodplain, Flood Zone 3b, which is a recent PPS25 requirement and is currently unavailable for West Dorset.

4 Flood risk in the study area

4.1 Approach to data gathering

Throughout the data collection and review process it has been critical to make best use of the significant amount of information which already exists with respect to flood risk. The main approach to the SFRA has been to build on previous studies and gathered information wherever possible. The primary sources of data for the study were the District Council, Environment Agency, water companies (South West Water & Wessex Water), Highways Agency and Dorset Fire & Rescue. The data were reviewed to assess the quality and significance to the SFRA.

The preferred format for the data was geo-referenced electronic information, to facilitate effective management of the data within a GIS environment. However, a significant proportion of the data were not available in this format, meaning that it was necessary to convert some of it to the required format. In addition to this, the District Council holds a large amount of hard-copy data at its Dorchester offices, all of which was reviewed and the relevant information collated. A log of all collated data has been made to ensure a record is available of all data obtained (see Appendix C).

Consultation has formed a key part of the data gathering stage of the SFRA. The main stakeholders were consulted during the SFRA and as part of the consultation process. An Inception meeting was held to allow key stakeholders to share their experience and knowledge of flooding issues across the study area. The benefits of adopting a partnering approach (as advocated by PPS25) are significant and have helped to ensure that the findings and recommendations of the SFRA are relevant and workable for the District Council.

Further to this, consultation was conducted with Parish Councils in West Dorset, which exceeds the standard SFRA consultation methodology. The information that was gathered was predominantly provided by the local Flood Wardens, volunteers who act as liaison between the Environment Agency and communities.

A list of all consultees is presented in Appendix E.

There is no standard methodology for the recording of flooding used by the various organisations which hold records of flooding. Over recent years, the Environment Agency has attempted to standardise the way in which data are recorded, though differences still exist between local Areas and Regions. The Environment Agency is just one of several organisations with data relevant to this SFRA and each organisation uses a different approach to the data collection and recording. Even within the same organisation, methods of data collection and recording have naturally evolved over time, particularly since the use of GIS has become widespread. The overall effect of this is that many of the flooding records held may be incomplete, or not to a uniform standard.

The Environment Agency office local to this area, at Blandford, has standards for the collection flood data to allow sources of flooding to be identified.

4.2 Historical flooding

Recent years have seen a number of large scale flood events throughout the UK including Easter 1998, Autumn 2000, February 2002, New Year 2003, February 2004 and more recently summer 2007.

There were very few formal flood reports of events within West Dorset obtained during the data collation phase, perhaps a reflection of the fact that there has not been a large-scale flood event within the District in recent years.

Bridport suffered significant flooding in 1979 and has since had a flood alleviation scheme built to improve the standard of protection.

In the floods of Autumn 2000, the Environment Agency issued a severe flood warning for the River Frome through Dorchester and the major incident plan was invoked here and also at West Bay. The A37 bypass around Dorchester was temporarily closed due to flooding. The Environment Agency brought in shingle to repair the damaged sea defences at West Bay.

In January 1994, low lying parts of the Castle Park housing estate in Dorchester flooded, swamping the foul sewage system causing polluted flooding for several weeks. Less severe problems occurred again in February 1995.

4.3 Flood risk in West Dorset as defined by the Flood Zone maps

By examining the Environment Agency's Flood Zone maps from May 2007 within the District it is possible to provide an indication of the locations at risk from fluvial and tidal sources. The assessment was undertaken using Flood Zones 2 and 3.

Table 4.1 shows the locations at which properties are at risk of flooding. The locations that are in **bold** have a significant number of properties at risk (typically more than 10).

Table 4.1 Locations with properties at risk of flooding within Flood Zones 2 and 3

Location	Primary source of fluvial/tidal flood risk	Location	Primary source of fluvial/tidal flood risk
Alton Pancras	River Piddle	Mosterton	River Axe
Askerswell	River Asker	Netherbury	River Brit
Beaminster	River Brit Several tributaries of River Brit	Oborne	River Yeo
Bradford Peverell	River Frome	**Osmington Mills**	Un-named watercourse
Bridport	River Brit River Asker River Simene Tidal flooding	**Piddlehinton**	River Piddle
Burton Bradstock	River Bride	Piddletrenthide	River Piddle
Cerne Abbas	River Cerne	**Puddletown**	River Piddle
Charminster	River Cerne	Purse Caundle	Tributary of Sherborne Lake
Charmouth	River Char Tributary of River Char	**Pymore**	River Brit
Cheselbourne	Tributary of River Piddle	**Sherborne**	River Yeo Minor tributary of River Yeo
Chetnole	Wriggle River	**Stratton**	River Frome
Chideock	River Winniford	**Sydling St Nicholas**	Sydling Water
Dorchester	River Frome	**Toller Porcorum**	River Hooke Tributary of River Hooke
Drimpton	Tributary of River Axe	**West Milton**	Mangerton River
Forston	River Cerne	**West Bay**	River Brit and tidal flooding
Godmanstone	River Cerne	**Winterborne Monkton**	South Winterborne
Grimstone	River Frome Sydling Water	**Winterbourne Abbas & Winterbourne Steepleton**	South Winterborne
Hooke	River Hooke	Woodbridge	Tributary of Caundle Brook
Lyme Regis	River Lim	**Yetminster**	Wriggle River
Maiden Newton	River Frome River Hooke	Yondover	River Asker
Martinstown	South Winterborne		

It should be noted that the Environment Agency's Flood Zone maps do not cover all watercourses within the District; typically, Flood Zone information is not available for catchments smaller than 3km^2. For this reason, there may be locations at risk of property flooding that are not listed in Table 4.1. Many of these locations not listed in Table 4.1 are in Volume 2 Drawings B1 to B9 as they are provided by other sources. Equally, the current Flood Zone maps are based on the best available information but the broad-scale modelling on which the outlines are based does have limitations, meaning that they may not be highly accurate in all areas.

Over half of the areas listed within Table 4.1 have a significant number of properties at risk of flooding (defined by more than 10 properties) within Flood Zone 2 and 3. From the GIS analysis, the areas with the greatest number of properties at risk are Beaminster, Bridport (including West Bay), Chetnole, Dorchester, Lyme Regis, Sherborne, Winterbourne Abbas & Winterbourne Steepleton, and Yetminster.

West Dorset is a tourist destination and there are a large number of caravan parks and holiday homes in the area, some of which are located within Flood Zone 3, for example at West Bay, Burton

Bradstock and Osmington Mills. The majority of these are intended for temporary occupation and are classified as 'more vulnerable' under PPS25. The attractiveness of waterside sites for holiday accommodation has to be recognised provided that proper warning and evacuation arrangements are put in place through appropriate planning conditions. More detail is provided in paragraphs D19 to D21 of PPS25.

Permanently occupied caravan parks are regarded as 'highly vulnerable' and if these are currently located within Flood Zone 3b relocation of these sites may be appropriate over the longer term.

4.4 Flooding from other sources

Information has been gathered on flooding experienced from sources other than rivers, and is described in this section.

4.4.1 Tidal and coastal flooding

There is a significant risk from coastal flooding at several locations along the West Dorset coastline. West Bay has a long history of flooding, having been badly affected in 1978, 1974 and 1970 as well as on several other occasions prior to this. The flooding of 1974 was particularly severe after the sea breached East Beach. A major coastal defence and harbour improvement scheme was completed in 2005 to provide additional protection.

Lyme Regis has been affected by coastal flooding in the past. The town's recently completed land stabilisation and coastal protection scheme was designed to reduce the risks from coastal erosion and landslides, but should also help reduce the risk from coastal flooding to properties on the sea front.

Tidal processes can have an influence on fluvial processes as far upstream as the A35 near Bridport on the River Brit. High tide levels, as well as posing a flood risk in their own right to settlements along the coast such as West Bay, can prevent or inhibit outflows from the mouth of rivers causing or exacerbating fluvial flooding. Tidal flooding is also an issue on the tidal stretch of the River Bride downstream of Burton Bradstock and on the lowest section of the River Char at Charmouth.

4.4.2 Flooding from artificial drainage systems

All water companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. More information on DG5 is available from www.ofwat.gov.uk. This register includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the water company. The full DG5 register tends to show, to a greater or lesser extent: the date of the most recent incident, the postal town, locality, street, post code, a type and problem description, if internal flooding occurred, details of flooding, and the eastings and northings of the flood incident. The recording of flood events by the authorities has often led to improvements intended to prevent reoccurrence, so historical flooding is not necessarily evidence of propensity for future flooding. Information on flooding caused by surface water runoff can also be obtained from local government, highway authorities and the Environment Agency.

Wessex Water has responsibility for the majority of the District, with the exception of the area around Lyme Regis which falls within South West Water's responsibility. During preparation of the SFRA Wessex Water has provided summary information from their DG5 register, while South West Water provided summary text detailing problem areas within Lyme Regis. The information from the DG5

register provided by Wessex Water identified a total of 56 properties within the District at risk of foul sewage flooding. Table 4.2 identifies the location of these properties. This information has been digitised and is shown within Drawings B1 to B9 in Volume 2.

Table 4.2 Properties at risk of foul sewage flooding, taken from Wessex Water's DG5 register

Location	Number of properties at risk
Chickerell	24
Piddletrenthide	19
Sherborne	7
Bridport	4
Osmington Mills	1
Dorchester	1

Table 4.2 shows that the majority of properties at risk of foul sewage flooding are located in Chickerell and Piddletrenthide.

The aim of the DG5 levels of service indicators is to measure the frequency of actual flooding of properties and external areas from the public sewerage system by foul water, surface water or combined sewage. Flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

In addition to identifying the properties at risk, the DG5 register also classifies the flood risk into one of the following categories:

- Properties / areas at risk of flooding twice in ten years or more
- Properties / areas at risk of flooding once in ten years but less than twice in ten years
- Properties / areas at risk of flooding more than once in twenty years but less than once in ten years

Wessex Water has not identified any properties / areas at risk of flooding on a greater than 20 year return period within West Dorset.

Wessex Water stated that the extent of flooding indicated by the data is only representative of the time of data provision (1st August 2007). Across the Wessex Water region as a whole there is an annual increase of approximately 40 dwellings per annum of new flooding incidents. However, an extensive programme of work to eliminate the majority of foul sewage flooding incidents by 2010 is currently underway. As a result, Wessex Water expects to see most or all of the locations at risk removed from the register by 2010.

Changes in rainfall intensity as predicted by climate change modelling are not typically assessed or modelled by UK water companies, therefore there is no information available on the likely impact of climate change on artificial drainage systems. It is likely that, without either significant investment in the drainage system in urban areas or a reduction in the areas draining into artificial drainage systems, that risk of urban flooding from artificial drainage systems will increase with climate change. For this reason, any redevelopment in the urban area should be required to use the SuDS philosophy to reduce the discharge into existing drainage systems (see Section 11 on the use of SuDS).

Local Planning Authorities should try to adopt a planning policy using Sustainable Drainage Systems (SuDS) as proposed in PPS25. PPS25 guidance should be followed to allocate land for development within Flood Zones to ensure that the risk of fluvial flooding is minimised. This should reduce the risk of fluvial flood waters entering public foul and surface water sewers and the resultant widespread flooding and pollution. Individual developments should be designed so that natural flood pathways are left free of buildings. Further guidance on the application of SuDS can be found in Section 11, and in the CIRIA Report C635, Designing for Exceedance in Urban Drainage (2006).

4.4.3 Flooding from surface water runoff

Surface water flooding is a common problem across many parts of the UK and West Dorset is no exception. This type of flooding is particularly common in urban areas, where surface water drainage is often unable to cope with intense rainfall events (in this case it is related to flooding from artificial drainage described in 4.4.1) It is also associated with steep-sided catchments, where the rate at which rainfall is able to infiltrate into the ground is reduced due to the catchment slope and consequently runoff increases.

Urban areas are particularly prone to surface water flooding, due mainly to the high proportion of impermeable areas found within urban environments. In rural areas surface water flooding can be exacerbated by land management practices that result in increased runoff rates.

Data collated during the early part of this study have been analysed to assess the extent of flooding from surface water across the District. As has been previously discussed, information on the source of flooding is not available for all recorded flood incidents, so a fully comprehensive list is not available. The locations at which surface water flooding has been identified as the principal flooding mechanism are shown below. Due to there being over 80 locations within the District at which this form of flooding has occurred historically, only those locations with ten or more recorded incidents are included.

Beaminster	Chickerell	Piddlehinton
Bishop's Caundle	Chideock	Sydling St. Nicholas
Bridport	Langton Herring	Symondsbury
Cerne Abbas		

Several of the larger urban areas within the District do not feature in the above list, notably Dorchester, Sherborne and Lyme Regis. Although this may be due to the fact that surface water flooding is not a problem in these areas, it may also in part be for the reason that the source of flooding is not available for all flood incidents and not all incidents are recorded. Where several sources of flooding combine, it is often difficult to distinguish the primary source and therefore the source may be incorrectly recorded.

Piddlehinton has close to 30 incidents of flooding attributed to surface water runoff, while Chickerell has just under 40 incidents. The remainder within the list above had between 10 and 20 incidents. It is important to note that these incidents do not necessarily relate to property flooding; some of them relate to incidents of road or undeveloped land flooding.

Sustainable Drainage Systems (SuDS) can play a significant role in the management of surface water. The intention of SuD schemes in this context is to seek an overall reduction in surface water discharge from development sites. More information on SuDs is presented in section 11.

4.4.4 Flooding from groundwater

The Environment Agency monitors groundwater levels using boreholes and the records of these are held on their WISKI database. Information from the District Council relating to groundwater flooding has identified that areas in the Piddle and South Winterbourne catchments are most at risk from groundwater flooding, with problems typically experienced during the winter or early spring after above average rainfall. The likelihood of groundwater flooding is strongly linked to the underlying geology, with the chalk areas of central and eastern parts of the District most at risk. Chalk geology typically absorbs rainfall through infiltration until saturation levels are reached. At this point moderate additional rainfall can result in chalk groundwater being mobilised and the appearance of surface water. Hence, such flooding generally follows periods of prolonged high rainfall over a period of months or longer, rather than from individual heavy rainfall events.

For some of the data provided for the SFRA, it was possible to identify the principal source as groundwater flooding. From this, the following locations were identified as having experienced groundwater flooding problems in the past:

Bridport*	Lower Burton*	Poyntington
Broadmayne	Lyme Regis	Puddletown*
Cerne Abbas	Martinstown*	Whitchurch Canonicorn
Charminster	Piddlehinton*	Winterbourne Abbas*
Godmanstone*	Piddletrenthide*	Winterbourne Steepleton*

* Locations marked as such have several records of groundwater flooding

4.4.5 Flooding from impounded water bodies

Records of flooding from reservoirs and canals are erratic as there is no requirement for the Environment Agency to show historic flooding from canals and raised reservoirs on plans. In particular, PPS25 does not require flood risk from canals and raised reservoirs to be shown on the flood map. Occasionally major bank breaches also occur, leading to rapid and deep flooding of adjacent land.

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act and are listed on a register held by the Environment Agency. Due to high standards of inspection and maintenance required by legislation, normally flood risk from registered reservoirs is moderately low.

The Environment Agency provided details of five formal reservoirs with an individual capacity of at least 25000m^3 within the District, as detailed within Table 4.3.

Table 4.3 Formal reservoirs within West Dorset

Name	Location	Type	Capacity (m^3)
Beaminster Flood Retention Reservoir	Beaminster	Non-impounding	43500
Cerne Abbas Flood Regulation	Near Cerne Abbas	Impounding	67500
Lucerne Lake	Near Evershot	Impounding	44600
Melbury Lake	Near Evershot	Impounding	27720
Sherborne Lake	Near Sherborne	Impounding	475000

The reservoirs at Beaminster and Cerne Abbas were built to help alleviate flooding, while the other three are artificial lakes. It is assumed that there is no additional flood risk posed by these as no information on this was provided by the Environment Agency.

Within the District there are no canals, so this area of flood risk need not be investigated further.

4.5 Existing site-specific flood risk assessments

Information from the Environment Agency stated that there is only one significant flood risk assessment (FRA) that has been undertaken within the District, this being at West Bay, south of Bridport. However, the conclusions of the FRA were not accepted by the Environment Agency and it seems that this is a matter that is not likely to be resolved in the near future. It was therefore agreed with the District Council that it was not appropriate to consider any of the conclusions of the FRA within the context of this SFRA.

4.6 Existing flood risk management strategies

The Environment Agency advocates a strategic approach to flood risk management on a 'whole catchment' basis. In line with this thinking, Catchment Flood Management Plans (CFMPs) are being undertaken for the whole of England and Wales. CFMPs are high-level flood risk management strategy documents, with two main aims:

- To understand the factors that contribute to Flood Risk within a catchment
- To recommend the best ways of managing the risk of flooding within the catchment over the next 50 to 100 years

A CFMP has three stages: Inception, Scoping and Main Stage. The latter stage is split into draft and final. To ensure each CFMP involves the relevant people and organisations, a steering group and consultation group is set up to bring together the required knowledge and expertise in the catchment. A CFMP might typically take a couple of years to complete, though the time taken will vary with the size of the catchment and specific flood risk management issues involved.

The District is covered by five separate CFMP areas, as shown in Figure 4.1. The current stage of each CFMP is also shown in Table 4.4.

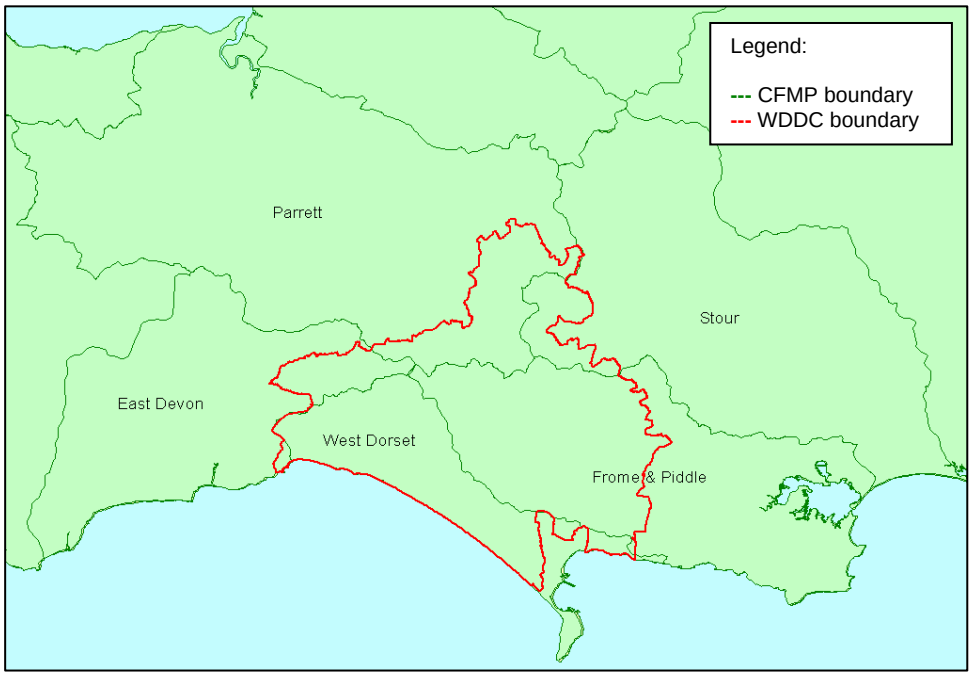


Figure 4.1 CFMP boundaries covering West Dorset

Table 4.4 CFMPs within West Dorset

CFMP	Current stage
West Dorset	Draft main stage
East Devon	Final main stage
Frome & Piddle	Draft main stage
Dorset Stour	Final main stage
River Parrett	Draft main stage

The Environment Agency are also funding Shoreline Management Plans (SMPs) for the whole of England and Wales. These plans set out strategic level guidance designed to assist coastal defence decision making, identifying sustainable coastal defence options by taking into account the influences and needs of both the natural environment and the human and built environment. The first SMPs were adopted in 1997 and looked ahead over a 50 year time horizon. A review of these SMPs (SMP2) is underway in which the time horizons are set out as

- 0 – 20 years (short term)
- 20 – 50 years (medium term)
- 50 – 100 years (long term)

There are four SMP scenarios considered for each time horizon; these are assigned to SMP ‘cells’. The policies are

- Hold the line
- Advance the line

- Managed realignment
- No active intervention

The first SMPs covering the West Dorset coastline were Lyme Bay and South Devon SMP (west of the Isle of Portland) and Portland Bill to Durlston Head SMP (east of the Isle of Portland). These have been merged in SMP2 into the South Devon and Dorset SMP which covers from Durlston Head to Rame Head, near Plymouth. This SMP2, which will set out the policies described above, is due for completion in 2009.

5 Strategic flood risk mapping

5.1 Strategic flood risk maps

A key output of the SFRA is a series of maps covering the LPA area, showing flood risk from sources including fluvial, tidal, surface water, foul and combined sewers, groundwater and impounded water bodies such as rivers and canals. The maps use the information detailed in Section 4. The strategic flood risk maps are presented as GIS layers, and can be interrogated to gain the associated descriptive information. These can be found in the CD attached to this report. A list of the maps and the information included on each is provided in Appendix F.

Level 1 SFRAs should seek to use flood zone outlines which have been produced using detailed modelling techniques in preference to the Environment Agency's flood zone maps. When representing the Flood Zones, Level 1 SFRAs should also show the functional floodplain, Flood Zone 3b, where such outlines exist. If Flood Zone 3b has not been produced as part of a detailed modelling project, similar outlines, such as the 1 in 20 year outline can be used, upon agreement with the Environment Agency. In the absence of such detailed information, a precautionary assumption has been adopted where Flood Zone 3b does not exist. When carrying out the Sequential Test the LPA should assume that where Flood Zone 3b does not exist, its extent would be equal to Flood Zone 3a.

This approach is suitable at the Level 1 SFRA stage when carrying out the Sequential Test, a process whereby development should be placed in the lowest risk zone, Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers should take into account the flood risk vulnerability of the development and consider reasonably available sites in Flood Zone 2. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3.

In the absence of a Flood Zone 3b outline, the implications of assuming Flood Zone 3b is equal to Flood Zone 3a can be summarised in the following example. PPS25 says that 'more vulnerable' developments, such as a housing development, can be placed in Flood Zone 3a provided it passes the Exception Test, but cannot be placed in Flood Zone 3b. If such a development was placed in Flood Zone 3a following the Sequential Test, further modelling work would have to be carried out as part of a Level 2 SFRA to define the extent of Flood Zone 3b, thereby defining the area where the development could not be placed. In the event that detailed modelling work is not possible, the LPA should assume that Flood Zone 3b extends to the 3a extent, and should therefore remove the development from this area. Should a developer wish to prove otherwise, it is at this stage that developer contributions can be given in order to carry out further modelling work. Such a scenario would be expected in an area where the development pressures are significant and there is little other developable land in lower risk areas.

Should sites be placed in Flood Zones 2 or 3, they should always be assessed through a more detailed Level 2 SFRA, which will refine flood zone information and allow the development to be located on parts of the site at lowest probability of flooding.

5.1.1 Hydraulic (river) models

River models have been collected and used for the production of the SFRA flood maps. The extent of the modelling is shown in Volume 2, Drawing A. Modelling work is currently underway on a number of

other rivers within the catchment, including the River Brit at Beaminster and Bridport. These models are being developed for the Environment Agency's Areas Benefiting from Defences (ABD) project. A model on the River Bride is also being developed.

5.2 Climate change maps

PPS25 sets out guidance for changes to flood risk as a result of climate change and this is shown overleaf. These climate change scenarios are now included in most Environment Agency river models and flood outlines are produced; for older river studies this is less likely.

The main Climate Change contingency allowances from Appendix B in PPS25 is shown below:

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%		
Allowance for net sea level rise in South West UK (mm/year) relative to 1990	3.5	8	11.5	14.5
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

In its November 2006 publication of the predicted effects of climate change on the United Kingdom, Defra described how short duration rainfall could increase by 30% and flows by 20%, and suggests winters will become generally wetter. These effects will tend to increase both the size of flood zones associated with the sea and rivers, and the amount of flooding experienced from "other sources".

Where climate change outlines have been produced from existing models these outlines have been used on the SFRA climate change maps. If these do not exist, analysis of other modelled scenarios has been undertaken to assess their suitability for use as a climate change proxy. In general our past experience has shown that the 0.1% AEP or 0.5% AEP outlines often show similar extents to the climate change scenarios of the 1% AEP event.

For watercourses where models do not exist, the most up-to-date Environment Agency flood zone maps have been used. A 1% AEP climate change scenario has been produced by assuming that Flood Zone 2 (0.1% AEP) will become Flood Zone 3 (1% AEP). We have also assumed that the functional flood plain (3b - 5% AEP) will become Flood Zone 3a (1% AEP). This approach is consistent with our past modelling experience, which has shown that the 0.1% AEP flood outline is often similar to the climate change scenario for the 1% AEP event. The LPA will use the climate change maps to carry out the sequential test, in order to give a particularly long-term risk-based approach to planning. This assumption is likely to be somewhat conservative for fluvial flood outlines. However, it may under-estimate the climate change impact on the 0.5% AEP (Flood Zone 3) tidal flood outline, due to recent projections (Defra 2006). In the absence of detailed modelling, the assumption is used for the preparation of the climate change maps in this SFRA.

This is the level of detail which PPS25 requires for a Level 1 SFRA, and has recently been successfully implemented on Halcrow's other SFRA projects, giving an indication of how flood zones and flood probabilities are likely to change over time. The climate change scenarios are provided in a series of maps covering the study area (Volume 2, Drawings C1 to C7).

5.3 Residual risk

Residual flood risks can arise due to:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system
- A severe flood event that exceeds a flood management design standard and results in, for example, overtopping.

Section 6.2 details the flood defences within the District. The majority of these defences are raised embankments and/or walls. Although the Environment Agency has a programme of asset inspection for the defences, the risk of overtopping or failure can never be eliminated. There are therefore residual flood risks affecting the local communities that are protected by the defences detailed in Section 6.2, particularly for those areas that benefit from the protection of 'major' defences.

All defences are mapped in Volume 2, Drawing A. These should be referenced by those proposing development to identify the possibility of localised residual risks.

6 Flood warning systems and flood risk management measures

6.1 Flood management

Flood risk management can reduce the probability of occurrence though the management of land, river systems and flood defences, and reduce the impact though influencing development in flood risk areas, flood warning and emergency response. The various CFMPs and SMPs that are being undertaken by the Environment Agency (see Section 4.6) within the District will help form the future management strategies for reducing flood risk.

6.2 Flood defences

Flood defences are designed to reduce the risk and/or severity of flooding in the areas that they are designed to protect. They generally fall into one of two categories: 'formal' or 'informal'. A 'formal' defence is a structure which has been specifically built to control floodwater. It is maintained by its owner (which is not necessarily the Environment Agency) to ensure that it remains in a suitable condition. An 'informal' defence has not necessarily been built to control floodwater and is not maintained specifically for this purpose, but it does have a beneficial effect in terms of reducing flood risk. Such 'informal' defences may include road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as barriers to water or create storage areas for attenuating water.

A study of informal defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study, it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal defences should be identified as part of site-specific detailed FRAs and the residual risk of their failure assessed.

In accordance with the scope of a Level 1 SFRA, data relating to flood defences have been obtained from the NFCDD. The location of these flood defences is shown in Volume 2, Drawing A. A review of formal flood defences has been carried out, based on the data held within the NFCDD. This has allowed an overview of the defences within the District to be established. Should a Level 2 SFRA be required then it is likely that more detailed information would be required.

The list below details where the significant flood defences within the District are, as identified from the NFCDD.

- Beaminster
- Bridport
- Burton Bradstock
- Cerne Abbas
- Charmouth
- Dorchester
- Lyme Regis
- Maiden Newton
- Piddletrentide
- Puddletown
- Sherborne
- South Perrott
- West Bay

Table 6.1 below provides additional details for the locations for the principal flood defences

Table 6.1 Details of major flood defences within the District

Area	Details	Maintenance responsibility	Standard of protection (yrs)
Beaminster	Flood storage area on River Brit, with raised embankments. Upstream of Beaminster	Environment Agency	100
Bradford Abbas	Raised embankment upstream of Bradford Abbas on River Yeo	Environment Agency	5
Bridport	West Bay sea/coastal defences, mostly walls	Environment Agency*	varies
	Walls and embankments (mainly on right bank) protecting Bradpole and Bridport from River Asker	Environment Agency*	100
	Raised defences (walls & embankments) on the River Brit, protecting Bridport	Environment Agency*	100
Burton Bradstock	Raised defences (walls & embankments) protecting Burton Bradstock and caravan park from River Bride	Environment Agency / Private	100
Cerne Abbas	Raised embankment forming part of Cerne Abbas flood alleviation scheme, River Cerne	Environment Agency	n/a
West Bay	Walls and embankments protecting West Bay and area behind West Bay Road from the River Brit	Environment Agency	100
Yetminster	Flood defence embankment on River Wriggle, upstream of Yetminster	Environment Agency	20

* Partial responsibility for these defences also rests with other organisations

6.3 Flood storage areas

Information taken from NFCDD shows that there are a number of flood storage areas within the District. These are summarised below in Table 6.2.

Table 6.2 Flood storage areas within the District

Location	River	Description	Owner	SoP
East of Beaminster	River Brit	Flood storage area formed by an earth embankment. Includes a spillway	Environment Agency	100yr
Upstream of Cerne Abbas	River Cerne	Embankments perpendicular to channel create a flood storage area	Environment Agency	n/a
Littlemoor	Tributary of River Wey	Embankments create flood storage area	Private	n/a
Millenium Green, South Perrott	River Parrett	Flood storage area formed by an earth embankment. Includes a spillway	Environment Agency	n/a

It is important that any storage areas used as a means of attenuation of flood waters should be maintained to ensure their efficient operation during a flood event. If the storage areas are not maintained this may lead to an increased risk of flooding at locations downstream of the storage areas.

6.4 Existing flood warning system

The Environment Agency is the lead organisation on flood warning and its key responsibilities include direct remedial action to prevent and mitigate the effects of an incident, to provide specialist advice, to

give warnings to those likely to be affected, to monitor the effects of an incident and to investigate its causes. This requires the Environment Agency, local authorities and the emergency services to work together to protect people and properties. The District is largely within the South Wessex Area of the South West Region of the Environment Agency, though small portions of the District are within the boundaries of the North Wessex Area and Devon Area.

It is the responsibility of the Environment Agency to issue flood warnings to the Police, Fire and Rescue Service, to the relevant local authorities, to the public and to the flood wardens. The primary method of warning dissemination to the public is via Floodline Warnings Direct (FWD), which uses various means of communication (telephone, mobile, fax or pager) to inform people of warnings.

A flood warning system is in operation for the majority of main rivers within the District. There are four levels of warnings, as outlined below.

- **Flood Watch:** Flooding of low lying land and roads is expected. Be aware, be prepared, watch out! The following actions are recommended:

  - Watch water levels
  - Stay tuned to local radio or TV
  - Ring Floodline on 0845 988 1188
  - Make sure you have what you need to put your flood plan into action
  - Alert your neighbours, particularly the elderly
  - Check pets and livestock
  - Reconsider travel plans

Flood Watch Areas cover all main rivers within the District. Flood Watches are issued for expected flooding, which could occur anywhere within the Flood Watch Area but with low or minor impact. The trigger for Flood Watch is a forecast that flooding of low impact land is expected.

- **Flood Warning:** Flooding of homes and businesses is expected. Act now! The following actions, in addition to those associated with Flood Watch, are recommended:
  - Move pets, vehicles, food, valuables and other items to safety
  - Put sandbags or floodboards in place
  - Prepare to turn off gas and electricity
  - Be prepared to evacuate your home
  - Protect yourself, your family and others that need your help

The flood warning areas in the District are shown in Volume 2, Drawing E and cover the majority of all main rivers. These areas can be summarised as follows:

- English Channel at West Bay
- River Asker at Bridport
- River Asker from Mangerton to Bridport
- River Bride from Long Bredy to Burton Bradstock
- River Bride at Burton Bradstock
- River Brit from Beaminster to West Bay
- River Brit at Bridport
- River Char at Charmouth
- Dorset Frome (lower) from Dorchester to East Stoke
- Dorset Frome (upper) from Maiden Newton to Dorchester
- River Frome at Dorchester
- River Piddle from Alton Pancras to Wareham
- River Wey from Upwey to Weymouth
- River Axe Area
- South Devon Coast from Plymouth to Lyme Regis
- River Yeo (upper) from Sherborne to Yeovil
- River Yeo from Yeovil to Langport
- Stoford and Barwick Streams at Stoford and Barwick
- River Wriggle from Chetnole to Bradford Abbas
- River Wriggle at Chetnole and Yetminster

Note that the entire extent of each of these flood warning areas is not necessarily included within the District.

Severe Flood Warning: Severe flooding is expected. There is extreme danger to life and property. Act now! The following actions, in addition to those associated with Flood Warning, are recommended:

- Be prepared to lose power supplies - gas, electricity, water, telephone
- Try to keep calm, and to reassure others, especially children
- Co-operate with emergency services and local authorities
- You may be evacuated

Severe flood warnings are issued for the areas defined by the flood warning areas, as described above.

- **All Clear:** Flood Watches or Warnings are no longer in force. The following is recommended:
  - Flood water levels receding
  - Check all is safe to return

- Seek advice

6.5 Flood response plan

Dorset County Council's Civil Emergency Plan contains a section that describes the response to severe flooding from fluvial or tidal sources. The Major Incident Plan (MIP), as it is known, details measures that should be taken by the various organisations involved. Details of the MIP are available in the Dorset County Emergency Plan.

In some areas, particularly for existing properties and proposed developments behind defences, it may be necessary to extend the scope of the SFRA to Level 2. The outputs from detailed overtopping and breach analysis of the key defences will provide refined hazard information on flood depths, velocities and flow paths, which could be used by the LPA emergency planning teams to define new or refine existing emergency plans for these areas.

7 Raising the standard of protection of existing defences to 1% annual probability on the River Brit and tributaries

7.1 Introduction

The purpose of this element of the assessment is to provide a broad indication of the extent and cost of works required to raise existing defences on the River Brit and its tributaries to a fluvial flood defence standard (Standard of Protection or SoP) of 1%. This assessment considers the stretches of watercourse from Bridport to West Bay for which the Environment Agency's Areas Benefiting from Defences (ABD) project has undertaken fluvial modelling. It was agreed with the District Council that the flood data available for the other stretches of the River and its tributaries was insufficient to enable an adequate assessment of the SoP within the scope of this SFRA.

7.2 Assessing the existing Standard of Protection

The approach to assessing the existing SoP has been as follows:

- Obtain data from the Environment Agency, including NFCDD records and model output from the recently completed Areas Benefiting from Defences (ABD) project.
- Generate mapping to indicate the existing defences and the 100yr flood extent.
- Identify locations where the flood extent is evident behind existing defences – i.e. flooding on the defended side.
- Analyse modelled water levels, flood defence type, level and extent and animations of the flood model to determine whether flooding is due to over-topping or bypass of the existing defences.

It has been assumed that hard defence levels should include a minimum freeboard of 200mm, and soft defences 300mm above the 100 year flood water level. Therefore in instances where the existing defence level is within 200 or 300mm (as applicable) of the 100 year flood level, it has been recommended that the defence level should be raised.

7.3 Assessment findings

The assessment identified the following four locations where the 100 year flood extent was evident behind the existing defences:

A) River Brit at West Bay – affecting the Caravan Park, Quayside and George Street.

B) River Brit East bank, near Wych – affecting land and property adjacent to West Bay Road.

C) River Asker at East Bridge - affecting land and property to the south-west of the roundabout.

D) River Asker at East Bridge – affecting land north-east of the roundabout.

These locations are presented in Figures 7.1 – 7.4 below.

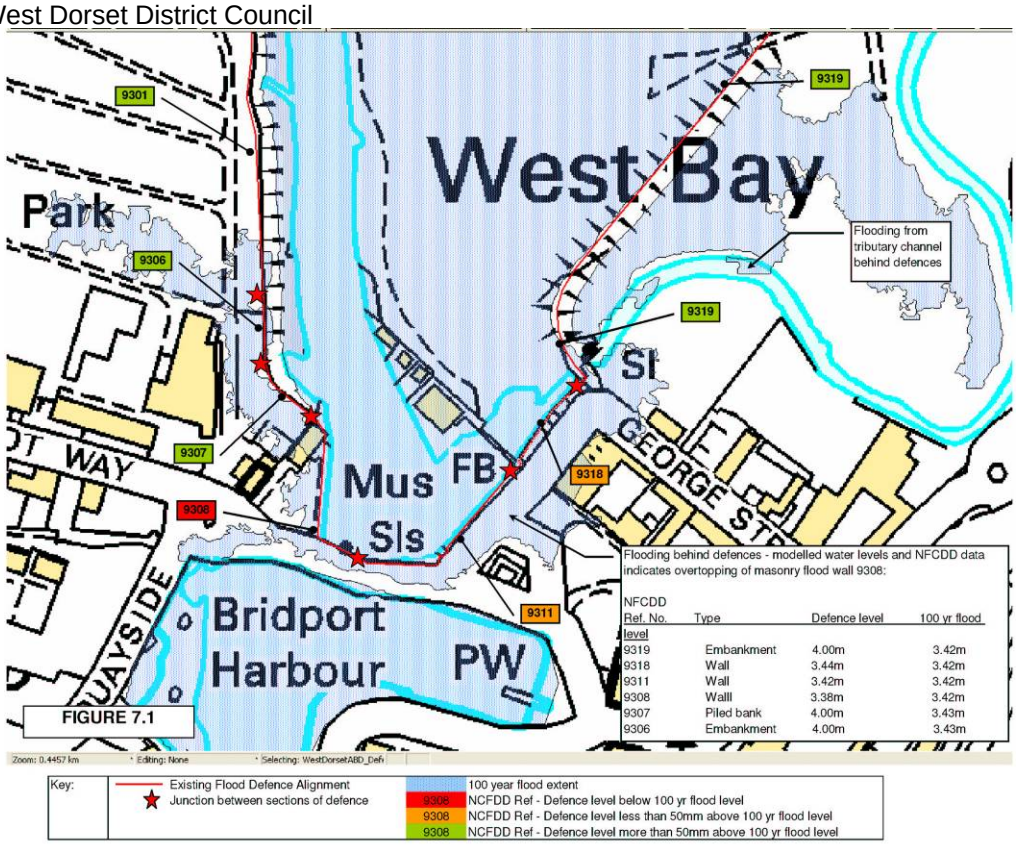


Figure 7.1 Location A - River Brit at West Bay

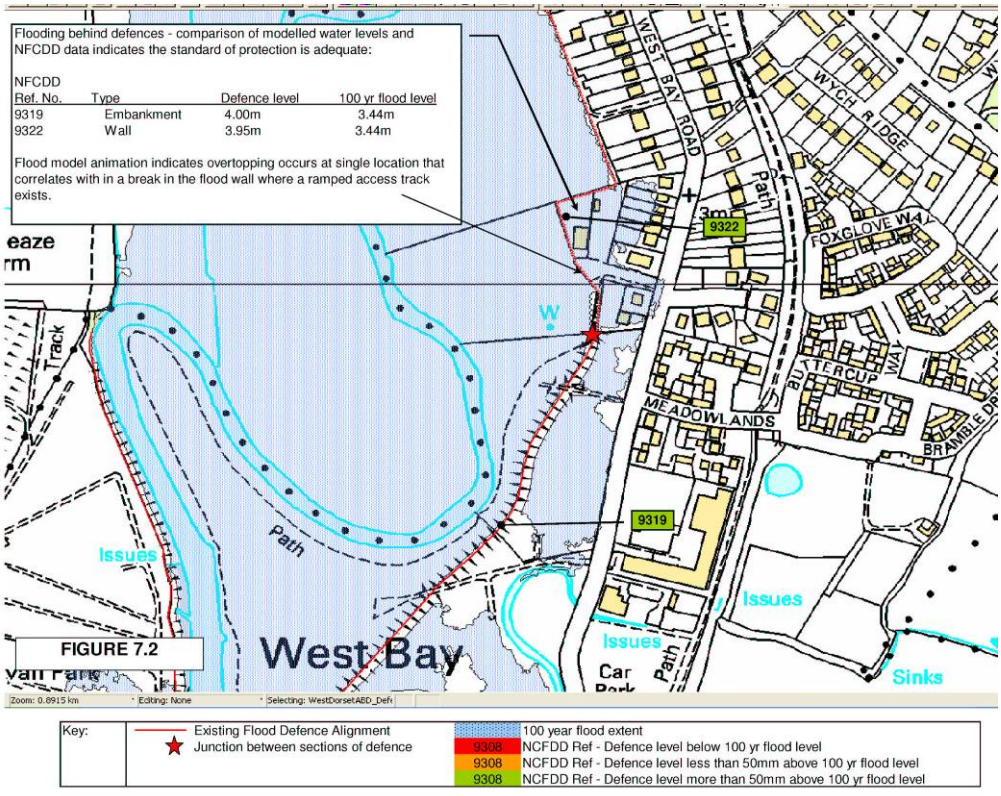


Figure 7.2 Location B - River Brit near Wych, adjacent to West Bay Road

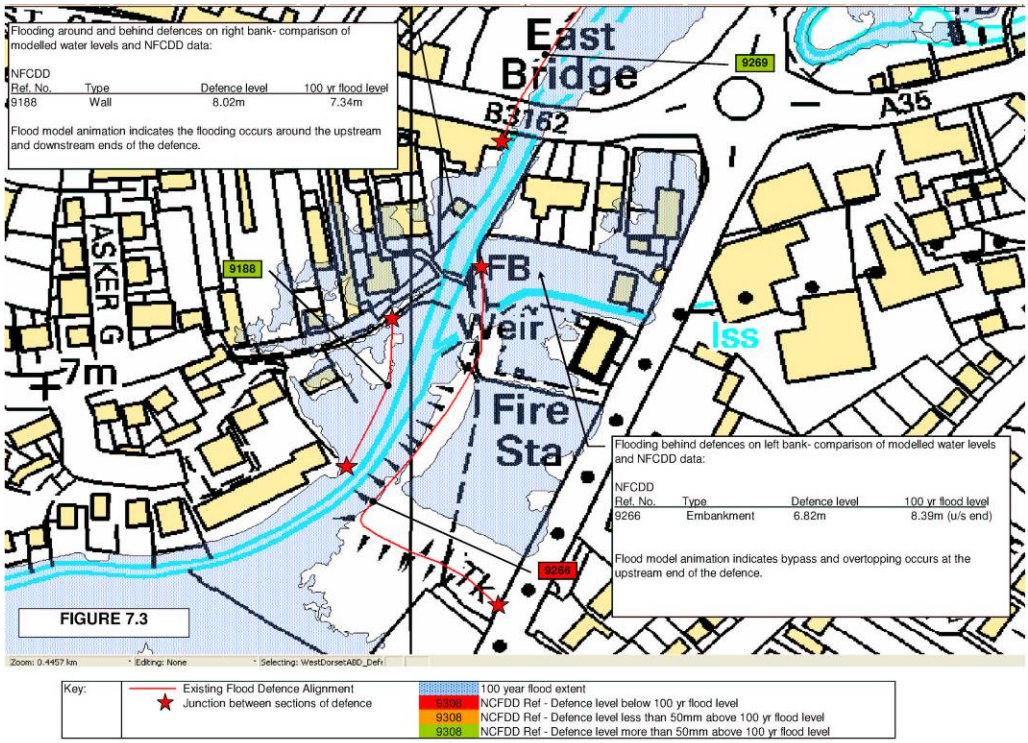


Figure 7.3 Location C - River Asker south of East Bridge

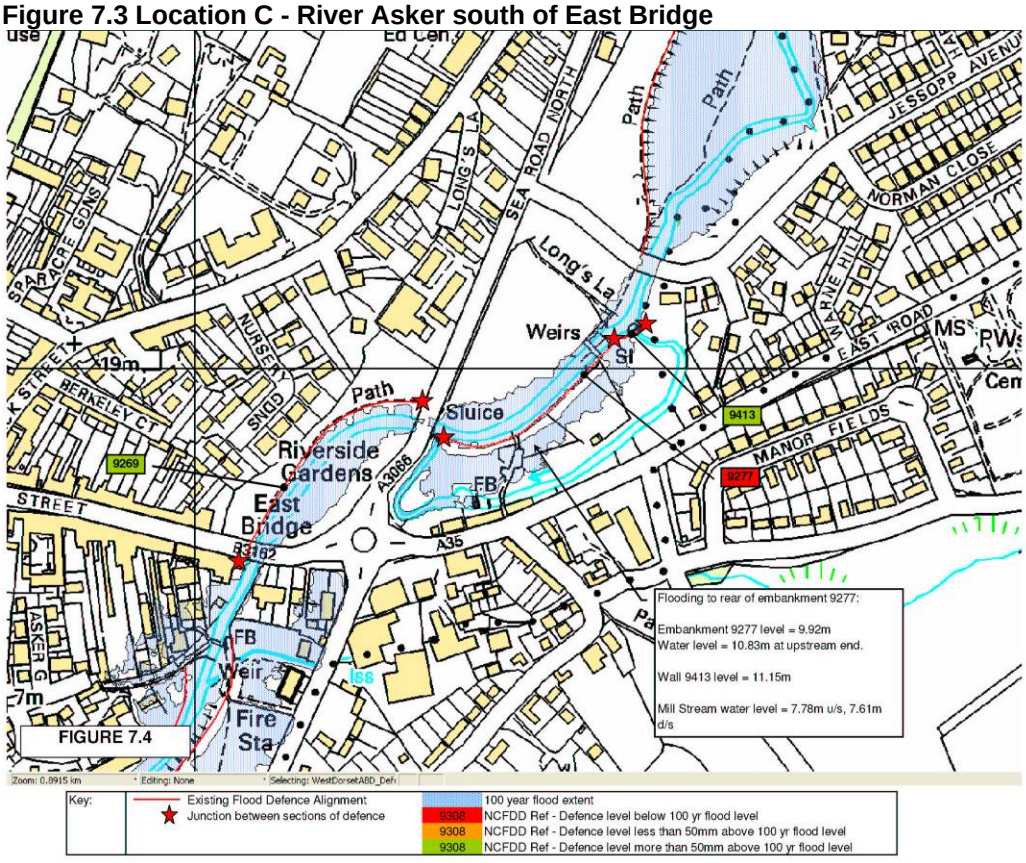


Figure 7.4 Location D - River Asker north of East Bridge

7.3.1 Location A – River Brit at West Bay

The Wych tributary joins the River Brit just upstream of the culverted outlet into Bridport Harbour. Flood defences exist continuously in this area along both river banks and across the headwall of the Brit culverts.

The 100 year flood extent indicated that flooding would occur behind the existing defences on both banks and at the headwall to Bridport Harbour. Analysis of the defence levels and modelled water levels found that one section of wall is below standard and two other sections of wall are within 20mm of the 100 year water levels.

The evidence reviewed indicates that three sections of masonry flood wall need to be raised by approximately 300mm in order to provide a Standard of Protection of 1%. Estimated costs for these improvements are presented in Section 7.4.

7.3.2 Location B – River Brit East bank near Wych

North of West Bay harbour, existing flood defences are located on the left bank of the flood plain, aligned with West Bay Road. The defences are continuous and comprise an earth embankment running upstream from West Bay harbour for a distance of 450m, at which point the form of defence transitions to a masonry wall (see photograph opposite).

The 100 year flood extent indicated that flooding would occur behind these existing defences, affecting approximately 10 properties adjacent to West Bay Road.

Initial examination of the defence levels and modelled water levels found that the defence level was generally higher than the 100 year flood level, implying that the standard of protection was adequate. Further examination of the digital animation of the flood model indicated that the defences overtop over a short section of the masonry wall, at the point where a ramped access track crosses the defence line.

Environment Agency staff who are familiar with the River Brit defences have advised that the defences are continuous in this location and that the defence level is not thought to be compromised by the access track crossing the flood wall.

It is recommended that the flooding mechanism that has been modelled is investigated further to confirm whether improvement works are required. For the purposes of this study it has been assumed that minor improvements are required to raise the defence level at the location of the overtopping and estimated costs are presented in Section 7.4.

7.3.3 Location C – River Asker Southwest of East Bridge Roundabout

The River Asker flows in a south-westerly direction along the eastern edge of Bridport and joins the River Brit just upstream of the A35 road to the south of the town. The existing defences on the River Asker are not continuous and include some structures that are not maintained as formal defences by the Environment Agency.

A weir is located on the river at the Environment Agency's East Bridge Flow Recorder Station. The section of river between the weir and the upstream B3162 road crossing at East Bridge has engineered banks (see photograph opposite).

The 100 year flood extent indicated that flooding would occur behind the existing defences on both banks. Analysis of the defence levels and modelled water levels found that the upstream end of the embankment on the left bank is approximately 1.5m below the 100 year water level. In addition the flood model animation indicated a flood flow route immediately upstream of the embankment. The defence level of the masonry wall on the right bank is 600mm above the 100 year water level, however the flood model animation demonstrated that flood flows emerge out-of-bank to the upstream and downstream ends of this wall.

It is recommended that the source and flow routes of flooding at this location are investigated further and that proposals are developed for new flood defences in order to provide a 1% Standard of Protection. For the purposes of this study it has been assumed that the upper third (70m length) of the existing embankment defence should be upgraded to meet the required SoP. This requires a significant increase in defence level of up to 1.5m and it is important to note that this improvement would only be worthwhile if combined with new defences to prevent flood bypass upstream. The estimated improvement costs are presented in Section 7.4.

7.3.4 Location D – River Asker Northeast of East Bridge Roundabout

To the north east of East Bridge an off-take from the left bank of the River Asker supplies a mill stream that then rejoins the river approximately 180m downstream, immediately upstream of the B3162 road crossing.

A flood embankment exists along the left bank of the main river between the inlet and outlet of the mill stream. A flood wall exists across the mill stream inlet.

The 100 year flood extent indicated that flooding would occur behind the existing defence on the left bank. Analysis of the defence levels and modelled water levels found that overtopping occurs to the upstream section of the embankment between a weir and the junction with the flood wall at the mill stream inlet. The floodwall has a defence level 300mm above the water level and is considered to meet the required SoP.

The area of flooding does not appear to affect any properties or significant infrastructure; however it is assumed that prevention of flooding in this location is desirable given that defences already exist. It is recommended that the need to prevent flooding at this location is confirmed and if required, that the upper section of the existing embankment (25m length between the weir and the floodwall) is raised by approximately 1 metre in order to meet the required SoP.

7.4 Cost of improvement works

The estimated costs of raising the existing defences to a SoP of 1% are presented in Table 7.1 below. The costs have been based upon the Environment Agency's flood risk management estimating guide (Unit Cost Database, 2007). In addition, a contingency sum is indicated at rate of 30%. Costs associated with landowner compensation and compensatory storage to offset 'lost' floodplain have not been included.

At locations C and D, the approximate costs for raising the existing embankment height have been estimated; however, it may not be technically or spatially feasible to construct earth banks to the required heights in these particular locations. For this reason, the approximate costs for the construction of a replacement flood wall (which tends to be more costly) are also given.

Table 7.1 Broad cost estimates for flood defence improvements

Location	Proposed works	Cost rate (£/m) or *(£/m^3)*	Length (m)	Volume (m^3)	Capital cost (£)	Contingency (£)
A	Raise walls by 300mm	300	217	-	65,100	19,530
B	Raise access ramp by 500mm	*100*	10	30	3,000	900
C	Raise embankment by 1.5m or;	*100*	70	630	63,000	18,900
	Replace embankment with retaining wall	2,000	70	-	140,000	42,000
	New defences to both banks – assume retaining walls up to 2.1m high.	1,750	100	-	175,000	52,500
D	Raise embankment by 1m or;	*100*	25	150	15,000	4,500
	Replace with retaining wall	2,000	25	-	50,000	15,000

8 Flood risk management policy considerations

8.1 Overview

This section provides recommendations for what should be included in the District Council's policy for flood risk management as well as providing guidance to developers on the preparation of site-specific FRAs. District 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 section are not exhaustive and it is therefore recommended that the District Council refers 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.
- **Catchment Flood Management Plans (Five separate plans: West Dorset, East Devon, Frome & Piddle, Dorset Stour and River Parrett), and Shoreline Management Plans (Durlston Head to Rame Head Shoreline Management Plan Review)** - 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 100 years.
- **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 is 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.

8.2 Policy considerations

A key aim of an SFRA is to define flood risk management objectives and identify key policy considerations. It should be noted that it is ultimately the responsibility of the District Council to formally formulate these policies and implement them.

It is recommended that the following flood risk objectives are taken into account during the policy making process and, where appropriate, used to strengthen or enhance the development control policies provided in Section 8.3. The objectives should also be taken into account when considering development applications either on allocated sites within Flood Zones 2 and 3 or windfall applications within urban areas that fall within these zones.

Flood Risk Objective 1: To Seek Flood Risk Reduction through Spatial Planning and Site Design:

- Use the Sequential Test to locate new development in least risky areas, giving highest priority to Flood Zone 1
- Use the Sequential Test within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an

effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits

- Build resilience into a site's design (e.g. flood resistant of resilient design, raised floor levels)
- Identify long-term opportunities to remove development from the floodplain through land swapping
- Ensure development is 'safe'. For developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. The Environment Agency states that dry pedestrian access/egress should be possible for the 1 in 100 year return period fluvial event and 1 in 200 tidal event when adjusted for the likely effects of climate change, and residual risk, i.e. the risks remaining after taking the sequential approach and taking mitigating actions, during the 1 in 1000 year event, should also be 'safe'.

Flood Risk Objective 2: To Reduce Surface Water Runoff from New Developments and Agricultural Land:

- SuDS required on all new development. Section 11.3 outlines appropriate SuDS techniques for the District. Infiltration systems should be the preferred means of surface water disposal, provided ground conditions are appropriate. Above ground attenuation, such as balancing ponds, should be considered in preference to below ground attenuation, due to the water quality and biodiversity benefits they offer.
- All sites require the following:

  - SuDS

  - Greenfield discharge rates

  - 1 in 100 year on-site attenuation taking into account climate change

- Space should be specifically set aside for SuDS and used to inform the overall site layout
- Promote environmental stewardship schemes to reduce water and soil runoff from agricultural land

Flood Risk Objective 3: To Enhance and Restore the River Corridor:

- An assessment of the condition of existing assets (e.g. bridges, culverts, river walls) should be made. Refurbishment or/and renewal should be made to ensure the lifetime is commensurate with lifetime of the development. Developer contributions should be sought for this purpose.
- Those proposing development should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, 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 de-culvert rivers for flood risk management and conservation benefit

- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip

Flood Risk Objective 4: To Protect and Promote Areas for Future Flood Alleviation Schemes

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset) and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones)
- Develop appropriate flood risk management policies for the Brownfield functional floodplain, focusing on risk reduction
- Use opportunities offered by new development to reduce causes and impacts of flooding, and to use designs which reduce flood risk to the development and elsewhere, as stated in PPS25's Key Planning Objectives and Owner / Developer Responsibilities
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas
- Seek opportunities to make space for water to accommodate climate change

Flood Risk Objective 5: To Improve Flood Awareness and Emergency Planning

- Seek to improve the emergency planning process using the outputs from the SFRA
- 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
- Ensure robust emergency (evacuation) plans are implemented for new developments where applicable

8.3 Development control policies

For the purposes of development control, detailed policies will need to be set out to ensure that flood risk is taken account of appropriately for both allocated and non-allocated 'windfall' sites. The following reflects the minimum requirements under PPS25 (reference should be made to Tables D.1-D.3 in PPS25).

Future Development within Flood Zone 1

In this zone, developers and local authorities should realise opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development. There is no significant flood risk constraint placed upon future developments within the Low Probability Flood Zone 1, although for sites greater than one hectare, the vulnerability from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.

Typically, a Drainage Impact Assessment will be required to demonstrate that runoff from the site is reduced, thereby reducing surface water flood risk. This will involve the use of SuDS techniques which should take into account the local geological and groundwater conditions (see Section 11 for SuDS guidance). The post development runoff volumes and peak flow rates should be attenuated to the Greenfield (pre-development) condition (see requirements set out in Section 11 which should be applied to Greenfield and brownfield sites alike).

Future Development within Flood Zone 2

Land use within Medium Probability Flood Zone 2 should be restricted to the 'water compatible', 'less vulnerable' and 'more vulnerable' category. Where other planning pressures dictate that 'highly vulnerable' land uses might proceed, it will be necessary to ensure that the requirements of the Exception Test are satisfied (see Section 1.5.2). The following should be considered in these exceptional circumstances:

- A detailed site-specific Flood Risk Assessment should be prepared in accordance with PPS25 and District Council Development Control policies
- Floor levels should be situated above the 100 year plus climate change predicted maximum level plus a minimum freeboard of 300mm (fluvial) or 600mm (tidal)
- The development should be safe, meaning that dry pedestrian access to and from the development should be possible above the 1 in 100 year plus climate change flood level and emergency vehicular access should be possible during times of extreme flood.
- SuDS should be implemented to ensure that runoff from the site (post development) is reduced. Post development runoff volumes and peak flow rates should be attenuated to the Greenfield (pre-development) condition for both Greenfield and brownfield sites. Space should be set-aside for SuDS.
- The proposed development should be set-back from the watercourse with a minimum 8m wide undeveloped buffer zone, to allow appropriate access for routine maintenance and emergency clearance.

Future development within High Probability Flood Zone 3a

Landuse within High Probability Flood Zone 3a should be restricted to the 'less vulnerable' uses to satisfy the requirements of the Sequential Test. For 'more vulnerable' uses it is necessary to ensure that the requirements of the Exception Test are satisfied. The following should be considered in these exceptional circumstances:

- The development should not increase flood risk elsewhere, and opportunities should be taken to decrease overall flood risk (such as use of SuDS and de-culverting). The can be achieved by developing land sequentially, with areas at risk of flooding favoured for green space.
- Floor levels should be situated above the 1% (100 year)/ 0.5% (200 year) plus climate change predicted maximum level plus a minimum freeboard of 300mm / 600mm. Within defended the areas the maximum water level should be assessed from a breach analysis.
- The development should allow dry pedestrian access to and from the development above the 1 in 100 year plus climate change flood level and emergency vehicular access should be possible during times of extreme flood. An evacuation plan should be prepared (see Section 6.5). With respect to new developments, those proposing the development should take advice from the emergency services, when producing an evacuation plan as part of a FRA. All access requirements should be discussed and agreed with the Environment Agency.
- Basements are not advisable in flood risk areas.

- SuDS should be implemented to ensure that runoff from the site (post development) is reduced. Post development runoff volumes and peak flow rates should be attenuated to the Greenfield (pre-development) condition for both Greenfield and brownfield sites.

- The proposed development should be set-back from the watercourse with a minimum 8m wide undeveloped buffer zone, to allow appropriate access for routine maintenance and emergency clearance.

Future development within Functional Floodplain Zone 3b

Development should be restricted to 'water-compatible uses' and 'essential infrastructure' that has to be there. 'Essential infrastructure' in this zone must pass the Exception Test and be designed and constructed to remain operational in times of flood and not impede water flow.

8.4 District Council specific policy issues

There may be specific policy issues within the District which need to be taken into account by the District Council.

8.5 Sensitive development locations

The existing site allocations proposed by the District Council are included on the 'Flooding from all sources' maps shown in Volume 2, Drawings B1 to B9. In addition to this, an assessment of the proposed site allocations has been made to identify whether they are within (or partially within) the Environment Agency's current Flood Zone maps.

Table 8.1 below identifies the proposed development locations at risk of flooding, as identified by the Environment Agency's Flood Zone Maps. With the exception of the site adjoining St Andrew's Road (reference F), all of the proposed development sites are within both Flood Zone 2 and Flood Zone 3.

Table 8.1 Proposed development sites at risk of flooding

Site description	Location	Proposed land use
West Bay Core Area	West Bay	Mixed use
Coach Station Square	Bridport	Mixed use
Rope Walks	Bridport	Mixed use
St Michael's Trading Estate	Bridport	Mixed use
Priory Mills	Bridport	Residential
Land off St Swithin's Road	Bridport	Residential
Site adjoining St Andrew's Road	Bridport	Employment
North Mills	Bridport	Employment
New Zealand	Bridport	Residential
Land north of Bridport	Bridport	Residential
Gasworks Hill	Sherborne	Employment
Site west of Beaminster	Beaminster	Employment
Dorchester sewerage works	Dorchester	Sewerage works extension

In general, throughout the study area, any development (including developments in Low Probability Flood Zone 1) which does not incorporate Sustainable Drainage Systems (SuDS) may increase the risk of surface and/or fluvial flooding both on-site and off-site (downstream). As such effective development control policies should be implemented in accordance with the SuDS recommendations provided in this report.

9 Guidance on the application of the Sequential Test

This section provides guidance on how to apply the Sequential Test. The approach should be applied to future sites but also to sites already allocated which have not undergone the Sequential Approach to ensure they are situated on land with the lowest possible flood risk. Environment Agency guidance on the application of PPS25 is available at: http://www.pipernetworking.com/floodrisk/ and at www.environment-agency.gov.uk.

9.1 Step One: Strategic overview of flood risk across all potential development areas

The recommended initial step is to determine the extents of potential land allocations on large scale maps showing the most up-to-date flood zones including climate change, in accordance with PPS25. Summary tables of flood risk issues should then be prepared for each location, indicating if the potential areas overlap Zones 2, 3, localised flooding areas or if there are records of previous flood incidents shown in the maps. It is then recommended that the summary tables and proposed locations are sent to the Environment Agency for verification. Particular care should be taken by identifying allocations that could increase flood risk elsewhere (flood incident points, localised flooding areas, flood zones) and lack of dry access.

9.2 Step Two: Flood risk issues in Zone 1

The next step should be to analyse all potential sites within Zone 1 by identifying those that have any flood risk issues (for example those affected by other sources of flooding or those that do not have dry access routes during flood events).

For the sites with flood risk issues, an assessment of likely significance of flood risk should then be carried out in terms of likely probability of flooding and potential consequences/flood damages (advice from a drainage specialist may be required, such as the SFRA consultant, the Environment Agency, a highways drainage engineer and/or the planning authority drainage specialist). The purpose is to identify sites with significant flood risk - high probability of flooding and significant flood damages with deep flooding and high velocities which could result in loss of property and potentially loss of life.

If a site with significant flood risk is identified within Zone 1, this would be considered as if it was in the High Probability Zone 3a, for further application of the Sequential Test in Zone 3a (see Section 9.3), bearing in mind that if a more vulnerable land use is required for the site, it will have to pass the Exception Test.

For those sites within localised flooding areas or with flood incident records where flood risk issues are not significant (for example shallow flooding and non-frequent blockages, etc), development should still be acceptable provided that adequate policies are in place for mitigating the risk (for example contributions may be required from the developer for the upgrade of the surface water system in the area).

It is important to note that most potential sites that pass the Sequential Test in Zone 1 will still require site-specific flood risk assessments. For development proposals on sites comprising one hectare or greater, the vulnerability to flooding from other sources (as well as from river flooding) and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, should be incorporated in an FRA. This need only be brief unless the factors above or other local considerations require particular attention. It is recommended

that FRAs are still produced for Zone 1 sites of less than one hectare, at locations where there are records of previous flood incidents.

9.3 Step Three: Sequential Test in Zones 2 and 3

The third step is to sequentially allocate sites as described in Section 1.5.1 and Appendix B and as part of a Sustainability Appraisal (SA). It is recommended that prior to incorporating the Sequential Test within the SA, the following actions take place:

a) Apply the measure of avoidance/prevention (see Section 5.1) by moving the boundaries of the potential sites away from Zones 2, 3a and 3b, for those cases where the loss of site area is acceptable. This is generally the case at locations where the loss in area is of the order of 10%.

b) Provisionally adopting land uses that are fully compatible with the vulnerability classification of PPS25, to try to avoid the need to apply the Exception Test where possible.

10 Guidance for developers

10.1 Introduction

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 (see general details about FRA requirements in Appendix E in PPS25). 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 the District Council 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 FRAs early on within the planning process. Consultation should be undertaken with the Environment Agency and the District Council to ensure that the District 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. The PPS25 Practice Guide (published in 2008) should be consulted by all parties to aid the practical implementation of the relevant policies, and in matters of contradiction or confusion should be considered to be the definitive information source.

11 Guidance for the application of Sustainable Drainage Systems

11.1 Introduction

PPS1: Delivering sustainable development and PPS25 requires that LPAs should promote SuDS. LPAs should therefore ensure policies encourage sustainable drainage practices in their LDDs. 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 of reducing future flood risk to both the site and its surroundings. Indeed, reducing the rate of discharge from urban sites to Greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the District.

11.2 Types of SuDS

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.

Any reduction in the amount of water that originates from any given site is likely to be small however if applied across the catchment, the cumulative affect from a number sites could 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. When designing surface water drainage systems, the Environment Agency states that climate change should be taken into account appropriate to the predicted lifetime of the development, and designed to account for the predicted increases in rainfall intensity.

The most commonly found components of a SuDS system are described below:

Pervious surfaces: Surfaces that allow inflow of rainwater into the underlying construction or soil.

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.

Swales: Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.

Basins: Ponds and wetlands areas that may be utilised for surface runoff storage.

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

Bioretention areas: Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground.

Pipes and accessories: A series of conduits and their accessories normally laid underground, that convey surface water to a suitable location for treatment and/or disposal (although sustainable, these techniques should be considered where other SuDS techniques are not practicable).

The Environment Agency asks that as a minimum for Brownfield sites, it should be demonstrated that at lease a 20% reduction in discharge rates will be achieved compared to the existing situation, to account for the effects of climate change.

An important aspect related to SuDS is consideration of ongoing maintenance requirements, without which the effectiveness of these systems over the longer term may be significantly reduced. In many cases as part of a proposed development, allowance should be made for a commuted sum for this purpose.

For more guidance on SuDS, the following documents and websites are recommended as a starting point:

PPS25

Practice Guide Companion to PPS25

The SuDS Manual – CIRIA C697 (2007) provides the best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems and facilitates their effective implementation within developments

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

www.ciria.org.uk/suds/

11.3 Application of SuDS for West Dorset District Council

There are a number of SuDS elements that could be used within development sites in the West Dorset area and the Environment Agency would expect that the initial stance of any drainage designer would be to consider infiltration, wherever geological conditions allow. As previously stated, West Dorset is underlain by relatively permeable sandstones and limestones in many areas and such infiltration-based systems are likely to be attractive to developers.

The provision of significant infiltration should be utilised wherever possible as a disposal option to reduce flows into watercourses. An indication of infiltration potential based upon underlying geological strata of the study area is provided in Appendix D. In general terms major aquifers have good

potential for infiltration, minor aquifers have moderate potential for infiltration and non-aquifers have poor potential.

Thus infiltration should be used unless ground investigation and in particular infiltration tests determine that it is not practicable. Investigations into the potential of infiltration drainage to increase the risk of groundwater flooding must also be undertaken.

It should also be noted that the Building Regulations Part H state that preferred option for the disposal of property runoff should be via a soakaway.

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

- **Swales** - 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** - provides 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 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.

12 Recommendations

A number of recommendations have been made throughout this report on the basis of the findings of the SFRA. These are summarised below.

12.1 Site allocation process

It is recommended that the outputs from this study are used as an evidence base from which to direct new development to areas of low flood risk (Flood Zone 1). Where development cannot be located in Flood Zone 1, each planning authority should use the flood maps to apply the Sequential Test to their 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 District Council has applied the Sequential Test. It is recommended that as soon 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.

12.2 District Council policy

It is recommended that the following core considerations should be included within the District Council's flood risk management policy documents:

- Protecting the functional floodplain from development
- Directing vulnerable development away from flood affected areas
- Ensuring all new development is 'Safe', meaning that dry pedestrian access to and from the development is possible, and emergency vehicular access is possible for extreme events
- Promoting the use of sustainable drainage systems in all flood zones to achieve Greenfield discharge rates on both Greenfield and Brownfield sites
- Supporting flood alleviation measures under consideration by the Environment Agency by safeguarding possible sites for flood storage and other channel works
- Seeking developer contributions (to be determined in consultation with the Environment Agency) via S106 planning obligations to fund (or part fund) strategic flood risk management facilities and bring benefit to the wider community.

12.3 Emergency planning

It is recommended that Dorset County Council's Emergency Response Plans are reviewed and updated in light of the findings of the SFRA to ensure that safe evacuation and access for emergency services is possible during times of flood.. It is further recommended that the District Council and Dorset County Council 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 Direct service.

12.4 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. It is recommended that outputs from the following studies are used to update future versions of the SFRA report and associated maps:

- Environment Agency Catchment Flood Management Plans
- Environment Agency Shoreline Management Plans
- Flood risk mapping studies

12.4.1 Missing or incomplete data

Data gaps have been assessed throughout the Level 1 SFRA data collection and review exercise. This has flagged the missing or incomplete data, which should be incorporated into the SFRA as it becomes available.

The following data were either not available for use with the SFRA or were incomplete. Receipt of the missing or incomplete data would have helped inform the SFRA process.

Data	Incomplete / missing	Description	Source
Flood Zone 3b (Functional floodplain)	Missing (these outlines are currently not mapped)	20 year return period (or similar) flood outlines for all rivers	Environment Agency
Historic flood outlines	Missing (historic event data have not yet been digitised into the historic flood outlines)	Flood outlines for historic events within the District	Environment Agency
Flood Zones for the future	Missing (these outlines are currently not mapped)	Flood Zone outlines accounting for climate change	Environment Agency
Beaminster ABD outputs	Missing (ABD study is not yet complete)	Information regarding the areas benefiting defences within Beaminster	Environment Agency
Geology maps	Incomplete	Solid and drift geology data have been provided for use with the maps, but there are some discrepancies between the source map boundaries	British Geological Society (via WDDC)
Soils maps	Missing	Maps showing the soil types	Environment Agency / WDDC

In addition to the above, it should be noted that the final versions of the CFMP reports were not available due to the CFMP studies being ongoing at the time of finalising the SFRA.

12.5 Level 2 SFRA

This Level 1 SFRA will allow the District Council to assess their current proposed site allocations using the sequential test. This will act as a 'sieving' process, allocating as many sites as possible to Flood Zone 1. Where it is found that some sites can only be placed in Flood Zones 2 and 3, the exception test will need to be applied. In order for developments to go ahead in such areas a number of criteria should be satisfied:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD 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

- 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

- A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall

A Level 2 SFRA should be viewed as rather more site specific than a Level 1 SFRA, addressing flood risk to potential development sites which have gone through the sequential test and have been located in Flood Zones 2 or 3.

The data required for a Level 2 SFRA within West Dorset will therefore depend upon which, if any, of the District Council's final list of preferred sites remain in Flood Zones 2 & 3 following application of the Sequential Test and hence where the Exception Test needs to be applied.

In instances where Flood Zone 3b does not exist (and therefore for the purposes of the sequential test Flood Zone 3b is deemed to be equal to 3a), and a 'more vulnerable' development has been allocated in Flood Zone 3a, it may be necessary to define Flood Zone 3b using flood mapping techniques. Halcrow is able to advise on further work required if this situation arises.

It is important that a Level 2 SFRA considers the variation of flood risk in a Flood Zone due to flood risk management measures i.e. flood defences. This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding). If development is to be located behind defences, it would be necessary to model constructional failure of the defence (breach) and water levels rising to exceed the level of the defence (overtopping). It is not necessary to carry out such scenarios behind all existing defences, if no new development is to be located behind these structures. In some instances improvements to existing flood defences may be required to manage residual flood risks. Here, the SFRA should include and appraisal of the extent of works to provide or raise the flood defence to appropriate standard. Should sites become allocated behind defences, Halcrow can advise on the cost of such work, and whether existing data is suitable for this purpose.

Level 2 SFRA outputs would include:

- An appraisal of the condition of flood defence infrastructure and likely future policy

- An appraisal of the probability and consequence of breach or overtopping of flood defence infrastructure
- Maps showing 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 the preparation of FRAs for sites with varying flood risk across the flood zone

13 References/Glossary

1) **AEP -** Annual Exceedance Probability, for example 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years).

2) **Core Strategy -** The Development Plan Document which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.

3) **Defra -** Department of Environment, Food and Rural Affairs Development.

4) **Development Plan Document (DPD) -** A spatial planning document within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.

5) **Dry pedestrian egress -** Routes to and from buildings that will remain dry and allow pedestrian/wheelchair evacuation to dry land in times of flood.

6) **Environment Agency -** The leading public body for protecting and improving the environment in England and Wales.

7) **Environment Agency Flood Map -** Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

8) **Environmental Stewardship** - Environmental Stewardship is a new agri-environment scheme which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. The scheme is intended to build on the recognised success of the Environmental Sensitive Areas scheme and the countryside Stewardship Scheme. Flood risk management is among its secondary objectives.

9) **Exception Test -** If, following application of the Sequential Test, it is not possible (consistent with wider sustainability objectives) 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, the Exception Test may apply. PPS25 sets out strict requirements for the application of the Test.

10) **Flood Estimation Handbook -** The latest hydrological approach for the estimate of flood flows in UK.

11) **Flood Risk Management Hierarchy -** PPS25 reaffirms the adoption of a risk-based approach to flooding by following stepped hierarchical measures at all stages in the planning process. Avoidance/prevention is the first measure, followed by substitution, control and then mitigation.

12) **Flood Risk Vulnerability -** PPS25 provides a vulnerability classification to assess which uses of land maybe appropriate in each flood risk zone.

13) **Formal Flood Defence -** A structure built and maintained specifically for flood defence purposes.

14) **Functional Floodplain Zone 3b -** Defined as areas at risk of flooding in the 5% AEP (20 year) design event.

15) **Habitable Room -** A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted.

16) **High probability Zone 3a -** Defined as areas at risk of flooding in the 1% AEP (100 year) design event.

17) **IDB –** Internal Drainage Board, responsible for non-main rivers and drainage within their boundary area.

18) **Informal Flood Defence -** A structure that provides a flood defence function however has not been built and/or maintained for this purpose (e.g. boundary wall).

19) **JFLOW -** A computer river model based on routeing a flood calculated by Flood Estimation Handbook methodology along a river corridor the levels of which are derived from a Side Aperture Radar (SAR) remote sensed Digital Terrain Model.

20) **Land Swapping** - looking for long term opportunities to remove development from areas that flood at present and relocate in lower risk locations which is essentially restoration of the floodplain.

21) **LiDAR -** Light Detection and Ranging (LiDAR) is an airborne terrain mapping technique which uses a laser to measure the distance between the aircraft and the ground.

22) **Local Development Framework -** The Local Development Framework (LDF) consists of a number of documents which together form the spatial strategy for development and the use of land.

23) **Low Probability Zone 1 -** Defined as areas outside Zone 2.

24) **Main River –** A section of watercourse (including the structures and devices on it used to regulate flow) which is maintained by the Environment Agency.

25) **'Making Space for Water' (Defra 2004) -** The Government's new evolving strategy to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches, so as: a) to reduce the threat to people and their property; b) to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles, c) to secure efficient and reliable funding mechanisms that deliver the levels of investment required.

26) **Medium probability Zone 2 -** Defined as areas at risk of flooding in events that are greater than the 1% AEP (100 year), and less than the 0.1% AEP (1000 year) design event.

27) **NFCDD –** National Flood and Coastal Defence Database, owned by the Environment Agency, containing details of the location, standard and condition of all Environment Agency maintained defences

28) **Ordinary Watercourse (non-main river)** – Any section of watercourse not designated as a main river.

29) **Planning Policy Statements -** The Government has updated its planning advice contained within Planning Policy Guidance Notes (PPGs) with the publication of new style Planning Policy Statements (PPSs).

30) **Planning Policy Statement 25 (PPS25): Development and Flood Risk -** PPS25 reflects the general direction set out in 'Making Space for Water'.

31) **Previously Developed (Brownfield) Land -** Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land.

32) **Residual Risk -** The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.

33) **Return Period –** The probability of a flood of a given magnitude occurring within any one year e.g. a 1 in 100 year event has a probability of occurring once over 100 years. However, a 1 in 100 year event could occur twice or more within 100 years, or not at all.

34) **Sequential Test -** Informed by a SFRA, 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.

35) **Strategic Flood Risk Assessment (SFRA) -** A Strategic Flood Risk Assessment is used as a tool by a planning authority to assess flood risk for spatial planning, producing development briefs, setting constraints, informing sustainability appraisals and identifying locations of emergency planning measures and requirements for flood risk assessments.

36) **Supplementary Planning Document (SPD) -** Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.

37) **Sustainability Appraisal (SA) -** Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.

38) **Sustainable Development -** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).

APPENDICES

Appendix A

Details of the Environment Agency Flood Zones

Introduction

A more detailed understanding of the Environment Agency Flood Zones and their limitations is important, as these are often used (unless more accurate flood outlines are available) for the production of SFRA flood maps.

Environment Agency flood maps

Data for Flood Zones 2 and 3 are derived from a number of sources. Most fluvial flood outlines are derived from the "JFLOW" generalised computer modelling, which is a 'coarse' modelling approach.

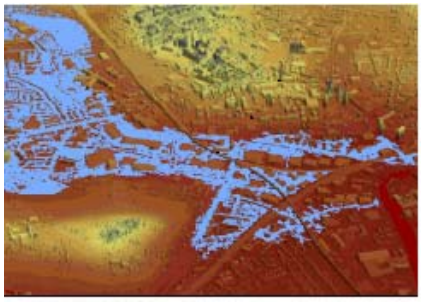
Caution should be used when looking at the data underlying JFLOW outlines, e.g. depth grids for the original national generalised JFLOW undertaken in 2004 which used SAR DTM. However, JFLOW re-runs, using LiDAR, are more accurate and have been passed fit for purpose.

The tidal elements of the Flood Zones in many of our coastal urban areas have been modelled using TuFlow, including fully dynamic modelling. In some cases, flood extents (behind defences) may have been derived from wave overtopping.

All Environment Agency Flood Zone Maps show the flood extent without the influences of defences.

Updates of the Environment Agency Flood Maps from modelling

In many places the results of detailed flood mapping studies have superseded the JFLOW model. Generally these studies included high quality hydrological research, surveyed river cross sections, and more precise computer hydraulic modelling such as ISIS, TuFlow and HecRas.



Output from a 2D TuFlow model

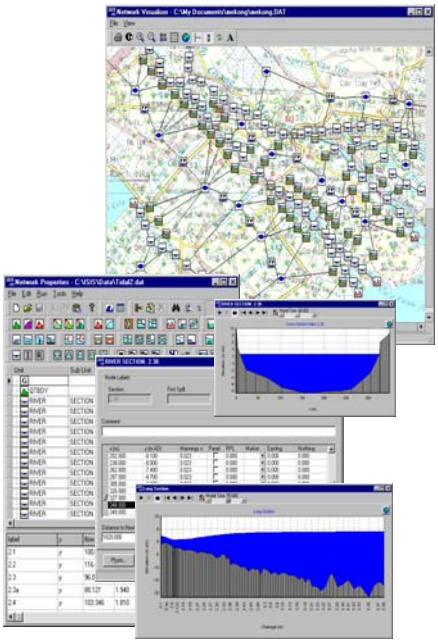
Although fluvial flooding is dependent on the standard of maintenance of watercourses and structures, this is not represented in the models. As a consequence, serious blockages occurring during a flood might produce much more flooding than shown..

Updates of the Environment Agency Flood Maps from recent events

Records of recent flood events can be used to modify the flood map. Flood Zone 2 is altered if the observed outline is greater than the modelled extent, however this is only done if there is substantiated evidence.

When evidence of flooding is based on aerial photographs, there is often uncertainty about a) whether the flooding has emanated from the river or is the result of other land drainage, b) the precise flood return period and c) whether the flooding was the result of blockage or some other maintenance factor. Occasionally therefore, Flood Zone modifications based on observed flooding are unreliable.

ISIS Software Graphic Interface



Non-main river flooding in the Environment Agency Flood Maps

Flood Zone maps show some non-main river watercourse flooding as well as main river watercourse flooding. Main rivers are principal watercourses defined by Section 93 of the Water Resources Act, 1991 and shown on a formal map held by the Environment Agency – the Environment Agency flood zones. Larger ordinary watercourses are shown on the background Ordnance Survey mapping.

All watercourses with a catchment area greater than 3km² have been modelled using JFLOW software or detailed modelling.

Climate Change effect on Flood Zones

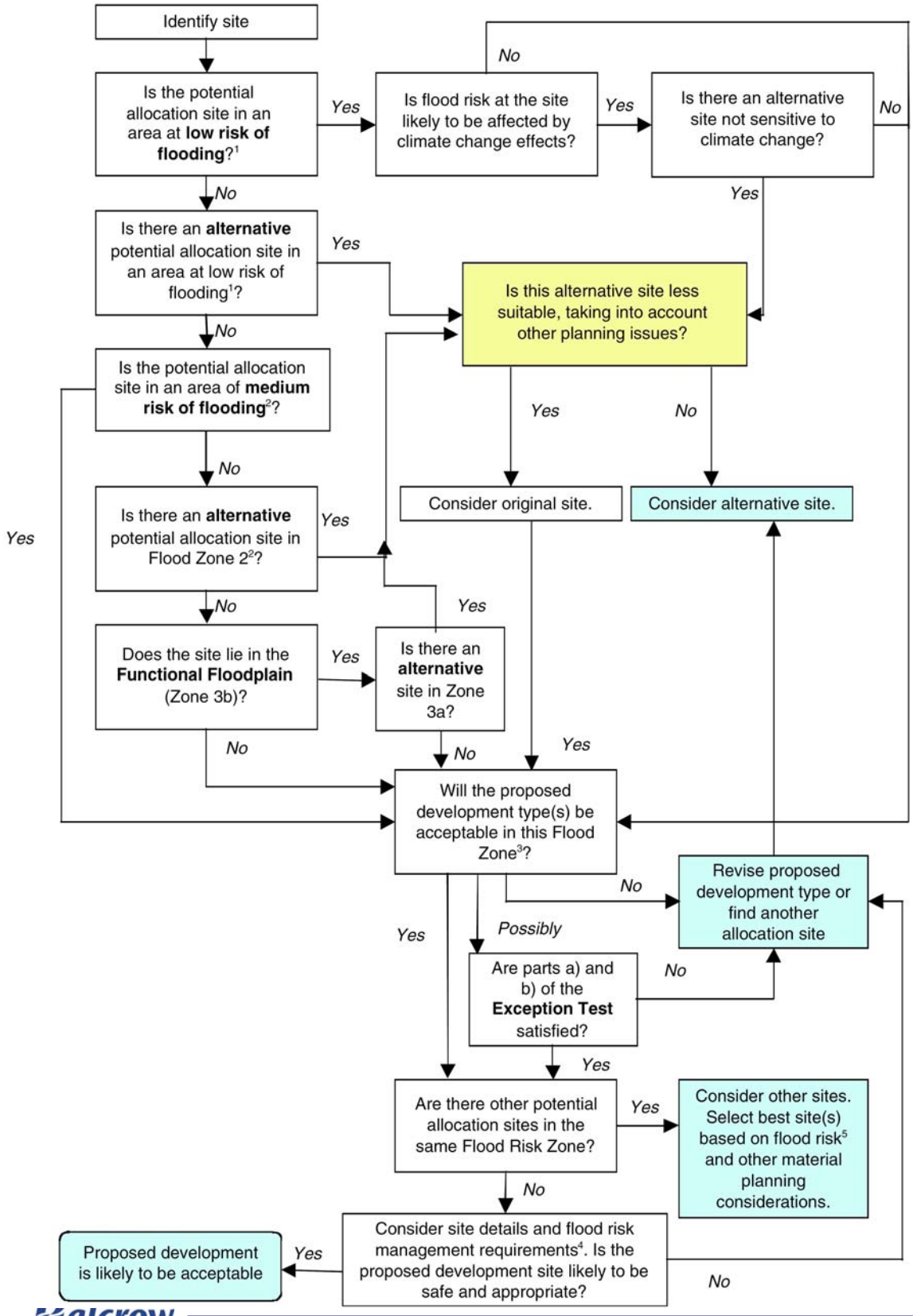
In the absence of better information, the current fluvial Flood Zone 2 can be considered an estimate of the extent of fluvial Flood Zone 3 within 100 years. Similarly, Flood Zone 3a can be considered an estimate of the extent of fluvial Flood Zone 3b within 100 years.

As noted, current Environment Agency formal flood maps generally do not take into account the effect of climate change on rainfall and tide levels.

Appendix B

Sequential Test Process

Environment Agency guidance on the application of PPS25 is available at: http://www.pipernetworking.com/floodrisk/ and from the Environment Agency webpage: www.environment-agency.gov.uk



Appendix C

Data log

Source	Electronic / hard-copy	Description of data	GIS-based?
Environment Agency	Electronic	Chetnole Flood Defence pre-feasibility study	N
Environment Agency	Electronic	Details of flooding in Piddletrenthide on 31/12/06	N
Environment Agency	Electronic	Details of flooding photographs	N
Environment Agency	Electronic	Dorchester Flood Defence Scheme Flood Risk Assessment Report	N
Environment Agency	Electronic	Draft and Final outputs for the River Brit ABD study	Y
Environment Agency	Electronic	Environment Agency Area boundaries	Y
Environment Agency	Electronic	Flood Alleviation Scheme details	N
Environment Agency	Electronic	Flood Defence Strategy information	N
Environment Agency	Electronic	Flood Risk Assessment (FRA) information	N
Environment Agency	Electronic	Flood Warning and Flood Watch areas	Y
Environment Agency	Electronic	Flood Zone data (May 2007)	Y
Environment Agency	Electronic	Formal reservoirs within West Dorset	N
Environment Agency	Electronic	FRIS (Flood Reconnaissance Information System) data	Y
Environment Agency	Electronic	Frome & Piddle CFMP Scoping Report	N
Environment Agency	Electronic	Location of raingauges and gauging stations within West Dorset	Y
Environment Agency	Electronic	NFCDD data	Y
Environment Agency	Electronic	Problems Identification Studies - details	N
Environment Agency	Electronic	Raingauge & gauge data	Y
Environment Agency	Electronic	River catchments	Y
Environment Agency	Electronic	River Frome Flood Risk Mapping Model	N
Environment Agency	Electronic	River locations	Y
Environment Agency	Electronic	Rivers	Y
Environment Agency	Electronic	West Dorset COWs Summary Sheets	N
West Dorset DC	Electronic	Adopted Local Plan 2007 map data	Y
West Dorset DC	Electronic	British Geological Survey data (Solid and Drift geology)	Y
West Dorset DC	Hard-copy	Castle Park Flood Study information	N
West Dorset DC	Hard-copy	Details of (i) priority sewage flooding sites, (ii) schemes approved and underway, (iii) priority internal flooding	N
West Dorset DC	Hard-copy	Details of priority flooding locations	N
West Dorset DC	Electronic	Flood Alleviation Scheme data	N
West Dorset DC	Hard-copy	Flooding investigations to March 1995	N
West Dorset DC	Electronic	GIS information	Y
West Dorset DC	Electronic (copied from hard-copy)	Land drainage incidents March 1994 onwards	N
West Dorset DC	Electronic (copied from hard-copy)	Land drainage inspections	N
West Dorset DC	Hard-copy	List of photos held within photo archive	N
West Dorset DC	Electronic	MIP information and example flood maps.	N
West Dorset DC	Electronic	OS base maps	Y
West Dorset DC	Both	Parish Council flooding information	N
West Dorset DC	Electronic	Proposed development sites	Y
West Dorset DC	Hard-copy	Work undertaken or required at priority flooding locations	N
Dorset CC	Electronic	Geology data	Y
Dorset Fire & Rescue	Electronic	Flood incidents attended between 01/04/02 - 30/06/07	N
Highways Agency	Electronic	Record of flooding incidents on the A35	N
South West Water	Electronic	SW Water sewer flooding problems within West Dorset	N
Wessex Water	Electronic	DG5 data (Sewer flooding)	Y

Appendix D

Geological strata (simplified) within the SFRA Study Area

Geology			Geological and Hydrogeological Properties	Aquifer Class *(Infiltration Drainage Potential)*	Distribution within Study Area	Groundwater Flooding Potential
Age	Group/ Formation	Unit				
Quaternary (Pleistocene and Recent)		Peat	Organic silt with plant remains	**Non-aquifer** *(Poor)*	In major river valleys, particularly Frome, Piddle and Yeo	Unlikely
		Alluvium	Primarily silt and clay, occasional sand and gravel. Poor permeability	**Non-aquifer** *(Poor)*	In major river valleys, particularly Frome, Piddle and Yeo	Possible - though likely related to fluvial/tidal events
		River Terrace Gravels	Coarse sands and gravels in river valleys – maybe several terraces	**Minor Aquifer** *(Good)*	In major river valleys, particularly Frome, Piddle and Yeo	Possible – though likely related to fluvial/tidal events
		Plateau/ Head Gravels	Coarse sands and gravels	**Minor Aquifer** *(Good)*	On plateau and in major river valleys	Possible – localised
		Clay with Flints (and head deposits	Solifluction deposits, flint rich clays. Impermeable. Head poorly sorted – depending on parent material	**Non-aquifer** *(Poor)*	Extreme west, central and east. Rivers Frome and Piddle	Unlikely
Tertiary	Barton		Fine sands with sporadic seams of pale pipe-clay and local beds of flint gravel	**Minor Aquifer** *(Moderate)*	Southeast. Frome and Piddle	Unlikely
	London Clay		Silty mudstone with sandy intercalations. Poor permeability	**Non-aquifer** *(Poor)*	Southeast. Frome and Piddle	Unlikely
	Lambeth		Dominantly clay with sand beds in the basal part. Poor to moderate permeability	**Non-aquifer** *(Poor)*	Southeast. Frome and Piddle	Unlikely
Upper Cretaceous	Chalk		White micritic limestone. Generally highly permeable	**Major Aquifer** *(Good)*	Extreme west, central and east. Rivers Frome and Piddle	Possible
Lower Cretaceous	Upper Greensand		Sand and sandstone. Moderately permeable	**Major Aquifer** *(Good)*	Extreme west, central and east. Rivers Frome and Piddle	Possible – localised
	Gault		Clays and sandy clays. Impermeable.	**Non-aquifer** *(Poor)*	Extreme west, central, east and north	Unlikely
Unconformity						
pper	Corallian		Interbedded clays, gritty sandstones and shelly and oolitic limestones	**Minor-aquifer** *(Moderate)*	Weymouth Lowlands and extreme southeast	Unlikely

Geology			**Geological and Hydrogeological Properties**	**Aquifer Class** *(Infiltration Drainage Potential)*	**Distribution within Study Area**	**Groundwater Flooding Potential**
Age	Group/ Formation	Unit				
Jurassic	Oxford Clay		Calcareous mudstones with silty mudstones and siltstones. Impermeable/ poor permeability	**Non-aquifer** *(Poor)*	South and north. Rivers Bride, Weymouth Lowlands and Wriggle/Yeo	Possible – localised
Middle Jurassic	Great Oolite	Cornbrash	Interbedded shelly limestone with sands and marl. Moderate permeability	**Minor Aquifer** *(Moderate)*	South and north. Rivers Bride, Weymouth Lowlands and Wriggle/Yeo	Possible – localised
		Forest Marble	Clays with thin sandstones and limestones. Moderate permeability.	**Minor Aquifer** *(Moderate)*	South and north. Rivers Bride, Weymouth Lowlands and Wriggle/Yeo	Unlikely
		Fullers Earth	Mudstone with thin limestone. Poor permeability	**Non-aquifer** *(Poor)*	South and north. Mangerton River, Rivers Bride, Weymouth Lowlands and Wriggle/Yeo	Possible – localised
	Inferior Oolite		Thin, fine grained oolitic. Generally highly permeable with fracture flow	**Major Aquifer** *(Good)*	South and north. Mangerton River and Wriggle/Yeo	Unlikely
Lower Jurassic	Upper Lias	Bridport and Yeovil Sands	Fine grained sand, sandstone and sandy limestone. Moderate to good permeability	**Major Aquifer** *(Good)*	South and north. Mangerton River and Wriggle/Yeo	Unlikely
	Middle Lias	Down Cliff and Thorncombe Sands	Silty, clayey sands. Moderate permeability	**Minor Aquifer** *(Moderate)*	South. Interfluves and upper-reaches of valleys of Rivers Brit and Simene	Unlikely
		Eype Clay	Mudstones. Poor permeability	**Non-aquifer** *(Poor)*	South. Valleys of Rivers Brit and Simene	Possible but localised
	Lower Lias	Charmouth Mudstone Formation	Mudstones and shales. Poor permeability	**Non-aquifer** *(Poor)*	Extreme west in catchment of River Char	Possible but localised
		Blue Lias formation	Thin, interbedded jointed limestone with interbedded mudstones	**Minor Aquifer** *(Moderate)*	Extreme west in catchment of River Lim	Possible but localised

Appendix E

List of Consultees

- Environment Agency
- West Dorset District Council
- Dorset County Council
- Highways Agency
- South West Water
- Wessex Water
- Dorset Fire & Rescue
- Allington Parish Council
- Bishops Caundle Parish Council
- Bradford Abbas Parish Council
- Broadmayne Parish Council
- Cerne Valley Parish Council
- Char Valley Parish Council
- Charmouth Parish Council
- Chetnole and Stockwood Parish Council
- Chickerell Town Council
- Corscombe, Halstock and District Parish Council
- Loders Parish Council
- Maiden Newton Parish Council
- Melcombe Horsey Parish Council
- Mosterton
- Osmington and Poxwell Parish Council
- Osmington Parish Council
- Parrett and Axe Parish Council
- Poyntington Parish Council
- Puddletown and District Parish Council
- Purse Caundle Parish Council
- Stinsford Parish Council
- Tincleton Parish Council
- Yeohead & Castleton Parish Council

Appendix F

List of the drawings and information shown on each

Drawing A: Watercourses

WDDC boundary

Main rivers

Minor watercourses

Modelled watercourses

Flood defences

Drawing set B: Flooding from all sources (9 drawings in total)

West Dorset District Council boundary

Main rivers

Flood Zone 2

Flood Zone 3

Dorset Fire & Rescue incidents

Highways Agency incidents

South West Water DG5 flooding information

Wessex Water DG5 flooding information

Environment Agency: Flood Reconnaissance Information System (FRIS) [flooding information]

WDDC: Properties at risk of flooding

WDDC: Recorded flooding

WDDC: Development areas

Parish Council flooding information

Drawing set C: Climate change (9 drawings in total)

WDDC boundary

Main rivers

Current Flood Zone 2, representing 100yr + climate change scenario

Drawing D (i): Geology - Solid

WDDC boundary

Solid geology

Strategic Flood Risk Assessment

West Dorset District Council

Drawing D (ii): Geology - Drift

WDDC boundary

Drift geology

Drawing E: Flood warning areas

WDDC boundary

Main rivers

Minor watercourses

Flood warning areas

Note: Ordnance Survey (OS) basemaps are included on each of the above drawings