West Dorset District Council

Strategic Flood Risk Assessment

Level 2 SFRA – Main Report

August 2010

Halcrow Group Limited

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Contents

1 Introduction 1

1.1 Background 1
1.2 Reasons for focus on Bridport area 2
1.3 WDDC SFRA Levels 1 and 2 3
1.4 SFRA User Guide 4
1.5 Future SFRA updates 6

2 Planning context 7

2.1 Overview 7
2.2 The SFRA in the planning context 7
2.3 Core Strategy & Local Development Framework 8
2.4 Planning horizons 8
2.5 Future development within West Dorset 9
2.6 Sequential Test 11
2.7 Exception Test 14

3 SFRA linkage to high level plans 16

3.1 Overview 16
3.2 Overall responsibilities for flood risk management 17
3.3 Draft South West Regional Spatial Strategy 18
3.4 Catchment Flood Management Plan 19
3.5 Shoreline Management Plan 23
3.6 Implementation of CFMP & SMP Policy 24
3.7 Surface Water Management Plans (SWMPs) 24
3.8 Water Cycle strategic studies 25

4 Defining the flood risks 26

4.1 Overview 26
4.2 Surface water flood risks 26
4.3 Fluvial / tidal flood risks - Flood Zones 27
4.4 Flood depths / velocities 28
4.5 Flood Hazard 28
4.6 Flood risks to the Bridport area 29

5 Fluvial / tidal flood risks – Bridport only 30

5.1 Overview 30
5.2 Flood defences – asset details, responsibilities, etc. 30
5.3 Policies for defended areas 31
5.4 Flood risk management improvements 31
5.5 Flood risk implications for areas of search 32
5.6 Flood risk implications for windfall sites 32

6 Surface water, sewer & groundwater flood risks 42
6.1 Overview 42
6.2 Flood risks 42
6.3 Mapping of surface water flood risk 42
6.4 Potential critical drainage areas 43
6.5 Groundwater flood risk areas 44

7 Flood risk management policy 45
7.1 Overview 45
7.2 Planning policy implications 45
7.3 Location specific development policies 45
7.4 Possible restricted development areas 45
7.5 Developable zones: appropriate mitigation 46
7.6 Areas for consideration of windfall applications 46
7.7 Developer contributions for flood defences 47

8 Advice for flood risk management 49
8.1 Overview 49
8.2 SuDS – appropriate locations and types 49
8.3 Appropriate resistance and resilience measures 53
8.4 Flood evacuation plans 54

9 Advice for site-specific flood risk assessments 56
9.1 Overview 56
9.2 Sequential approach using the SFRA 56
9.3 Using SFRA results to inform flood risk assessments 58
9.4 Site specific risk 61

10 Implications of Weymouth & Portland SFRA 62
10.1 Overview 62
10.2 Weymouth & Portland SFRA Level 2 62
10.3 Feasibility study for Southill watercourse 62
10.4 Flood risk implications 63
10.5 Recommended further study 65

11 Concluding remarks 66

Glossary 67

References 70

Appendices

Appendix A Sequential Test template
Appendix B Surface water flood risk maps: West Dorset
Appendix C Fluvial/tidal flood risk maps: defended scenario, Bridport
Appendix D Fluvial/tidal flood risk maps: defences breach scenario, Bridport
Appendix E Fluvial/tidal flood risk maps: undefended scenario, Bridport
Appendix F Fluvial/tidal flood risk maps: flooding onset & overland flow paths, Bridport
Appendix G Flood risk management options

Tables

Table 3.1 CFMP proposed actions
Table 4.1 Flood hazard classification
Table 5.1 Details of flood defence assets – Bridport
Table 5.2 Guide on how to use Flood Zones/hazards information
Table 5.3 Flood Zones/hazards - South west quadrant
Table 5.4 Flood Zones/hazards - Land off Saint Swithins Road
Table 5.5 Flood Zones/hazards - Land at Kisem, North Mills Road
Table 5.6 Flood Zones/hazards - Land East of Bredy Vet Centre, Sea Road North
Table 5.7 Flood Zones/hazards - Land adjacent to Jessop Avenue
Table 5.8 Flood Zones/hazards - Land around Vearse Farm
Table 5.9 Appropriate development for Bridport areas of search
Table 8.1 Flood risk assessment issues specific to Bridport

Figures

Figure 1.1 West Dorset District
Figure 1.2 SFRA user guide
Figure 2.1 Areas of search for potential development – Bridport
Figure 3.1 FCERM hierarchy
Figure 3.2 CFMP boundaries covering West Dorset
Figure 3.3 Extent of SMP2 study area
Figure 4.1 Flood Zone classification
Figure 5.1 Flood hazards in Bridport – future scenario
Figure 8.1 Diagram of how SuDS can be used at a local scale
Figure 8.2 Infiltration potential for SuDS in West Dorset
Figure 8.3 Examples of flood resistance and resilience measures
Figure 10.1 Areas with potential for additional development
Figure 10.2 Indicative flood limits for Chickerell / Southill sites

1 Introduction

1.1 Background

West Dorset District Council (WDDC) commissioned Halcrow to prepare this Level 2 Strategic Flood Risk Assessment (SFRA), with a focus on the nature and extent of flood hazards in the Bridport area due to known flood risks and development pressures. The West Dorset District boundary is shown in **Figure 1.1**.

This Level 2 SFRA is in accordance with Planning Policy Statement 25: Development and Flood Risk (PPS25) and its accompanying practice guide. The aim of PPS25 planning policy on development and flood risk is 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. WDDC and the Environment Agency specialists in flood risk and development have been consulted at all stages of the assessment.

This SFRA Level 2 report, together with the Level 1 report (2008), forms a part of the evidence base that will inform the development of policies in the emerging West Dorset Core Strategy: it does not in itself comprise planning policy. Specific development sites referred to in this report represent potential options being examined as part of the preparation of future planning policy, and will not necessarily be allocated for development in forthcoming Development Plan Documents (DPDs).

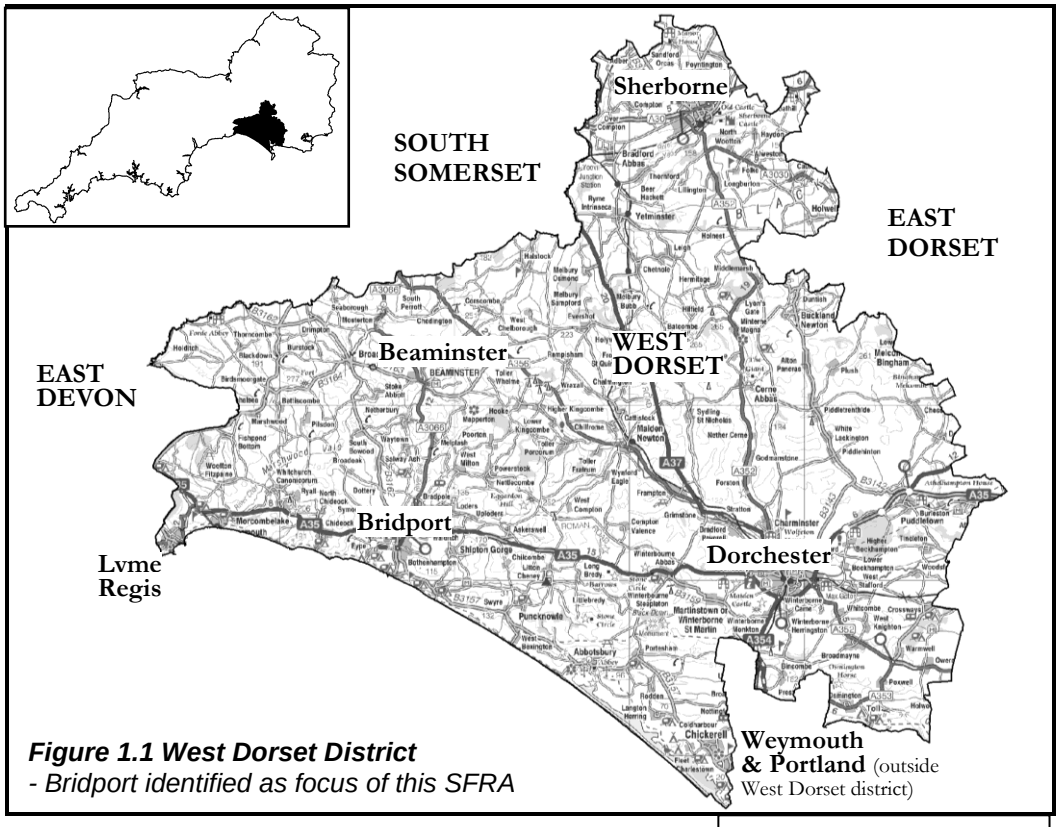


Figure 1.1 West Dorset District
- Bridport identified as focus of this SFRA

The PPS25 Practice Guide (Section 3.39 and 3.40) explains the need for SFRA:

"*…It provides the essential information on flood risk, taking climate change into account that allows the LPA* [Local Planning Authority] *to understand the risk across its area so that the Sequential Test can be properly applied… SFRAs should be a key part of the evidence base to help inform the allocation of development in a local plan area through the preparation of Local Development Documents (LDDs). It is unlikely that a LDD that was not supported by an adequate evidence base on flood risk would be found to be 'sound'. Unsound plans must be withdrawn under regulation…*".

The Level 1 and 2 SFRAs together form part of the evidence base for the Local Development Framework (LDF) and inform decisions regarding land allocation and policies. The information is being used to inform application of the Sequential Test and Exception Test, as described in PPS25 (Annex D), in the areas of search for potential development in Bridport.

This SFRA also allows WDDC to:

- Prepare appropriate policies for the management of flood risk.
- Inform the Sustainability Appraisal to take account of flood risk 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).
- Provide information to developers on flood risk and flood management issues for use in detailed site specific FRAs.
- Help inform the acceptability of flood risk in relation to emergency planning capability and by considering the beneficial effects of flood risk management infrastructure in generally reducing the extent and severity of flooding.
- Set out the strategic options for flood risk management.

1.2 Reasons for focus on Bridport area

The reasons for the focus on the Bridport area for detailed assessment by the SFRA are:

- Known flooding issues in the West Bay / Bridport area
- Extent of the existing built area that is within the Flood Zones (defined in Chapter 4)
- Benefit of more detailed flood risk information in making decisions about the extent of development that may be permitted in the area.

In other areas of the district it has been easier simply to avoid the Flood Zones in decisions about development, but this is more difficult at Bridport because of the extent of flood risk in and adjoining the built up area. This focus does not imply any particular planning status for the specific development sites located as areas for potential development or infer that identified sites within them will be granted planning permission for any use.

This SFRA Level 2 refines and builds upon the Level 1 SFRA. It provides more detailed information on fluvial/tidal flood risks in Bridport both now and in the future given the likely impacts of climate change. This has involved detailed hydraulic (2D) modelling to determine the flood hazard classifications based on flood extents, depths and flow velocities, and the rate of onset of flooding in animations. The flood risk modelling and mapping methodologies applied are consistent with Environment Agency requirements.

Other flood risks across West Dorset, including Bridport, are assessed from records of past flooding and the new surface water flood risk maps prepared by the Environment Agency. Thus the SFRA Level 2 provides an update of the surface water, groundwater and sewer flood risks across West Dorset.

1.3 WDDC SFRA Levels 1 and 2

PPS25 sets out government planning policy on development and flood risk, aiming to:

- Ensure that flood risk is taken into account at all stages of the planning process
- Avoid inappropriate development in areas at risk of flooding
- Direct development away from the areas of highest risk
  - by substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis.
  - by providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development
  - by mitigating the potential impacts of flooding through design and resilient construction.

To achieve the aim of PPS25 requires mapping of all forms of flood risk to provide an evidence base so that new development can be located primarily in low flood risk areas (Flood Zone 1). Where new development is necessary in flood risk areas (Flood Zones 2 and 3), under exceptional circumstances, the policy aims to make the development 'safe' through application of the Exception Test (refer to Section 2.7) without increasing flood risk elsewhere and, where possible, reducing flood risk overall.

The SFRA Level 1 (2008) mapped all sources of flood risk for West Dorset and thereby provided the evidence base to inform a risk-based sequential approach to flood risk (the Sequential Test). This approach helps ensure that development is located in areas of lowest possible risk of flooding.

The WDDC Local Plan allocates land for housing up to 2016, based on the annual requirement of 410 dwellings set out in the original draft South West Regional Spatial Strategy (RSS)[1]. This requirement has increased in the latest RSS, incorporating the Secretary of State's Proposed Changes (July 2008), which is not yet finalised. The RSS runs to 2026 and the emerging LDF will need to consider the distribution of development over this time period.

Accordingly, there may be a need for West Dorset to allocate significant additional land for housing (as well as employment and other uses) and planners are currently considering the options for making this provision. This SFRA Level 2 is intended to help with this process, and to form part of the evidence base to ensure that the most appropriate land is allocated for development.

`1 At time of publication, the new Government announced the intention to abolish the Regional Spatial Strategy. At this early stage no further information is available on housing requirements.

Six areas of search for potential development within Bridport that lie close to main rivers were identified by WDDC as requiring SFRA Level 2 (the six areas are detailed in Chapter 2) because of flood risk concerns. Specifically, this SFRA Level 2 demonstrates whether or not the flood risk will be 'acceptably safe' throughout the lifetime of the potential developments, taking account of climate change.

This SFRA Level 2 report provides flood risk information in more detail than the SFRA Level 1 report. The information will inform the allocation of sites that may require the Exception Test if identified as a requirement by the Sequential Test as part of the preparation of the LDF. This approach is in line with PPS25 that states:

'…*Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test* [based on SFRA Level 1]*, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA* [by carrying out this SFRA Level 2] *to provide the information necessary for application of the Exception Test. This should additionally, consider the beneficial effects of flood risk management infrastructure* [includes flood defences] *in generally reducing the extent and severity of flooding when compared to the Flood Zones on the Flood Map. The increased scope of the SFRA will enable the production of mapping showing flood outlines for different probabilities, impact, speed of onset, depth and velocity variance of flooding taking account of the presence and likely performance of flood risk management infrastructure*…'.

For development to be classified as 'acceptably safe' the site and the egress route from it to an area outside the flood plain should be classed as 'very low hazard', as defined by Defra (2005) R&D Technical report, FD2320/TR2.

This SFRA Level 2 report also provides policy information and advice on flood risk management, site-specific FRAs and implications for the Weymouth & Portland SFRA.

1.4 SFRA User Guide

The SFRA User Guide (Figure 1.2, next page) illustrates how the SFRA should be used by planners, drainage engineers, emergency planners and others in relation to planning and development control, site specific FRAs and emergency planning. The report structure is detailed below.

- **Chapter 2** considers the planning context to this SFRA as defined by PPS25
- **Chapter 3** explains the SFRA linkage to other high level plans
- **Chapter 4** defines the flood risks considered at strategic level
- **Chapter 5** assesses the fluvial / tidal flood risks and defences for Bridport only
- **Chapter 6** assesses the information for surface water / sewer flood risks for West Dorset
- **Chapter 7** recommends policies related to flood risk
- **Chapter 8** advises on flood risk management and Sustainable Drainage Systems (SuDS)
- **Chapter 9** advises on site-specific FRAs for planning applications
- **Chapter 10** reviews the Weymouth & Portland SFRA at Southill / Chickerell / Littlemoor
- **Chapter 11** summarises the conclusions of the SFRA

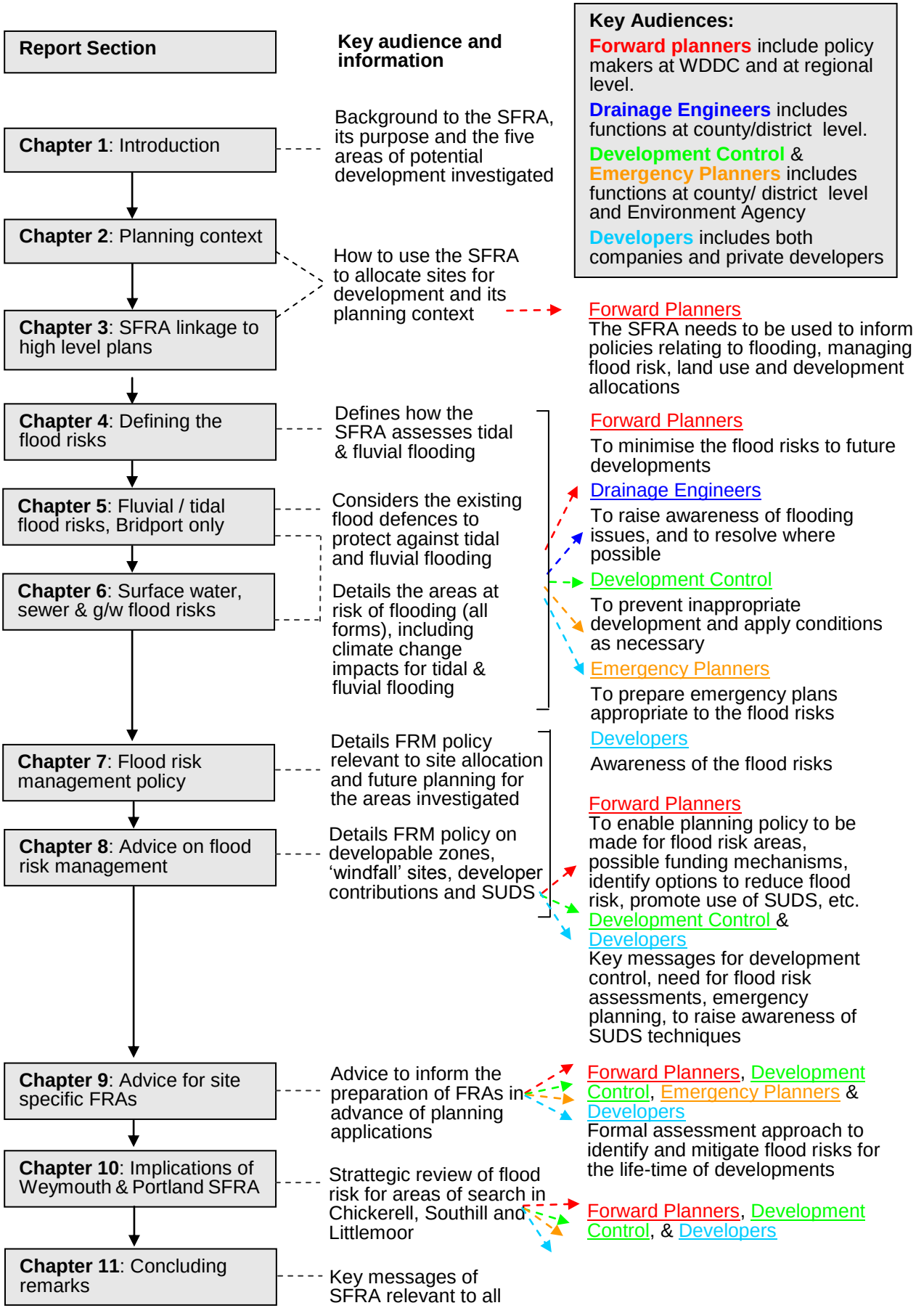


Figure 1.2 SFRA user guide

1.5 Future SFRA updates

This SFRA report is a 'live' document and as new information becomes available updates will be made to ensure that the latest information is used to guide the site selection process for future developments. For this reason users of this SFRA are recommended to check they are using the latest SFRA document and maps.

Over the coming years, further refinements may be undertaken (as part of the Environment Agency's flood risk mapping program), and any updates to Flood Zones 2 and 3a will be reflected in the latest Environment Agency Flood Map (updated quarterly). As such, it is recommended that WDDC remain abreast of any further refinements to these Flood Zones although significant changes are not anticipated.

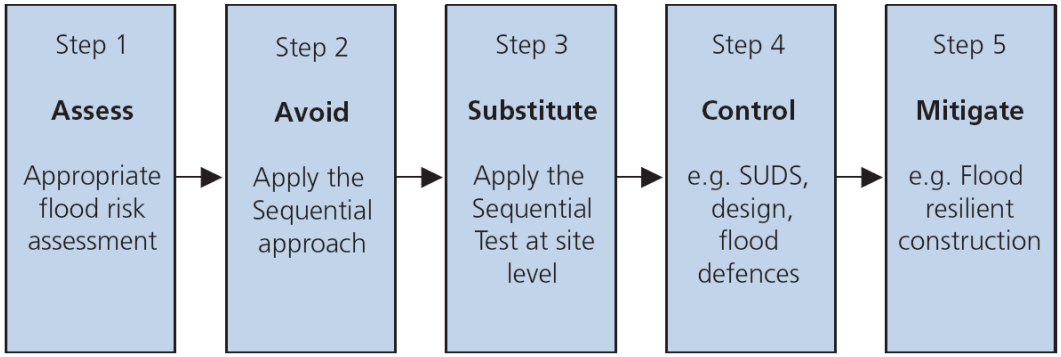
Generally, it is recommended that the fluvial/tidal model for Bridport should be reviewed every five years, but even then only minor revisions are envisaged, e.g. possibly to incorporate more recent data or to follow updates to climate change guidance (a priority will be to apply the guidance when available on published research in 2009 by the UK Climate Impacts Programme, UKCIP).

2 Planning context

2.1 Overview

National planning policy relating to flooding is set out in PPS25: Development and Flood Risk, taking account of current proposed amendments published for consultation in August 2009. This is referred to throughout this SFRA where appropriate and forms the main policy context. The practice guide to PPS25 explains how to implement the policies defined in PPS25 to deliver appropriate sustainable development in the right place while taking full account of flood risk.

The following extract from the PPS25 Practice Guide illustrates the flood risk management hierarchy for taking flood risk (all forms) into account in the planning process. It requires information on the nature of flood risk, the spatial distribution of flood risk, climate change impacts; and the degree of vulnerability of different types of development.



Extract: Flood Risk Management Hierarchy - PPS25 Practice Guide

This chapter describes the SFRA in the planning context, and its relevance to the Core Strategy and LDF for West Dorset. The future development sites being considered within West Dorset are introduced, including six areas of search for potential development in Bridport that are known to be at least partly at flood risk. Specific elements of PPS25 are also set out in detail in this Chapter, in particular the Sequential Test and the Exception Test.

At the regional level the planning policy context is set by the Draft South West Regional Spatial Strategy (RSS)[2], and there is linkage to other high level plans as considered in the next chapter (Chapter 3).

2.2 The SFRA in the planning context

This SFRA Level 2 will be used by WDDC in the application of the Sequential Test and the Exception Test as set out in PPS25, Annex D. The Sequential Test steers development to areas of lowest flood risk, and if it is found necessary to consider allocating development sites in flood risk areas (as indicated in Table D3 of PPS25) the Exception Test must be applied.

[2] At time of publication, the new Government announced the intention to abolish the Regional Spatial Strategy. At this early stage no further information is available on housing requirements.

Flood Zones (as mapped in the SFRA Level 1) only show the extent of flooding and not the variation in flood hazard. In order to apply the Exception Test it is necessary to consider the actual flood risk to the site, in terms of the frequency, impact, speed of onset, depth and velocity of flooding. This SFRA Level 2 provides this detailed information for the Bridport area, so that lower risk areas within a Flood Zone can be identified to inform suitable site layout, mitigate flood risk and make developments safe.

For Bridport this SFRA Level 2 takes into account the flood risk areas benefiting from defences, including the potential for flood defence failure such as breach of the defences. This means that the actual protection provided by flood defences can be considered for potential development areas. The SFRA Level 1 includes an appraisal of the condition of defences based on available information held by the Environment Agency (in their National Flood and Coastal Defence Database), as discussed further in Chapter 5.

2.3 Core Strategy & Local Development Framework

WDDC has started work on the Core Strategy, which will form part of the LDF. The Core Strategy will set out the general spatial vision and objectives for the LDF. All other Local Development Plan documents will have to conform to the Core Strategy.

The Core Strategy will:

- set out a vision for the future of West Dorset, spatial strategy and a series of development management policies to be used in making decisions on planning applications
- include the number of homes needed in West Dorset to 2026
- outline the broad strategy for the location of new housing, employment and community facilities
- set out policies for the protection of the district's environmental assets
- include policies for the provision of affordable housing, infrastructure and community facilities with new development.

The Core Strategy must generally conform to the South West Regional Spatial Strategy (RSS)[3], prepared by the South West Regional Assembly. It is also important that the Core Strategy is closely linked to the West Dorset Community Plan.

The next stage of consultation will be on preferred options for the Core Strategy in 2010.

The SFRA forms part of the evidence base for the LDF and will inform many of the documents which comprise the LDF. In particular, it has informed the spatial strategy for the district by identifying those areas most at risk of flooding and has influenced choices regarding the location and scale of growth.

2.4 Planning horizons

The minimum design life for non-residential development is taken as 60 years (although at application stage, the LPAs or applicant may need to specify an alternative lifetime for specific developments). The design life for a residential development should be taken as a minimum of 100 years.

[3] At time of publication, the new Government announced the intention to abolish the Regional Spatial Strategy. At this early stage no further information is available on housing requirements.

The emerging LDF is expected to run until 2026. To correspond with this planning horizon, the impact of climate change on the risk of fluvial and tidal flooding has been assessed for 60 and 100 years beyond 2026, i.e. in year 2086 and year 2126 (using the assumptions of a 20% increase in peak river flows and sea level rise, as detailed in Annex B of PPS25). This approach ensures that WDDC is planning in line with the LDF and beyond the life of the RSS.

2.5 Future development within West Dorset

A number of the sites which have been considered by WDDC for possible housing and for other forms of development are within Flood Zones 2 and 3 and may be subject to other risks from surface water. WDDC has been guided by emerging SFRA work in preparing its Strategic Housing Land Availability Assessment and will draw on this SFRA Level 2 report to assess further the potential sites to be included in its forthcoming Core Strategy and Site Specific Allocation DPDs.

A number of areas of search for potential development in Bridport are known to be at least partly at risk, as identified in Figure 2.1. The base mapping in this figure shows the Flood Zones (FZ2 dark blue and FZ3 light blue, as defined in Chapter 4) published by the Environment Agency. Each area is further assessed (Chapter 6) to determine appropriate policies related to flood risk.

A short description of each area located follows:

1. South west quadrant – three existing local plan allocations WA3 (Coach Station Square), WA4 (Rope Walks Car Park) and WA6 (St. Michaels Trading Estate) located in the centre of Bridport, just to the south of West Street and either side of St Michael's Lane. with combined area over approximately 5ha.
2. Land off St. Swithins Road - existing local plan allocation WA15 located on the current allotments between St Swithen's Road and North Allington, over approximately 1ha.
3. Land at Kisem, North Mills Road - SHLAA* site (no.1/016/0175 part included Appendix C and part excluded Appendix D) located in the crook of North Mills Road just behind Victoria Grove over approximately 1ha.
4. Land East of Bredy Vet Centre, Sea Road North - SHLAA* site (no. 1/016/0181) located almost parallel to Sea Road North, in the vicinity of its junction with Jessops Avenue and just to the south west of the current superstore, over approximately 2ha.
5. Land adjacent to Jessop Avenue - SHLAA* site (no. 1/015/0164) located behind the properties on Jessop Avenue and adjacent to the River Asker to the north-easterly extreme of Bridport, over approximately 2ha.
6. Land around Vearse Farm - excluded SHLAA* site (no. 1/015/0164 in Appendix D) located to the West of Bridport, on farmland bounded by the B3162 to the North, the A35 to the West and Broad Lane to the South, over approximately 70 ha. There are two minor watercourses running through its north and north-easterly extent.

*SHLAA - Strategic Housing Land Availability Assessment

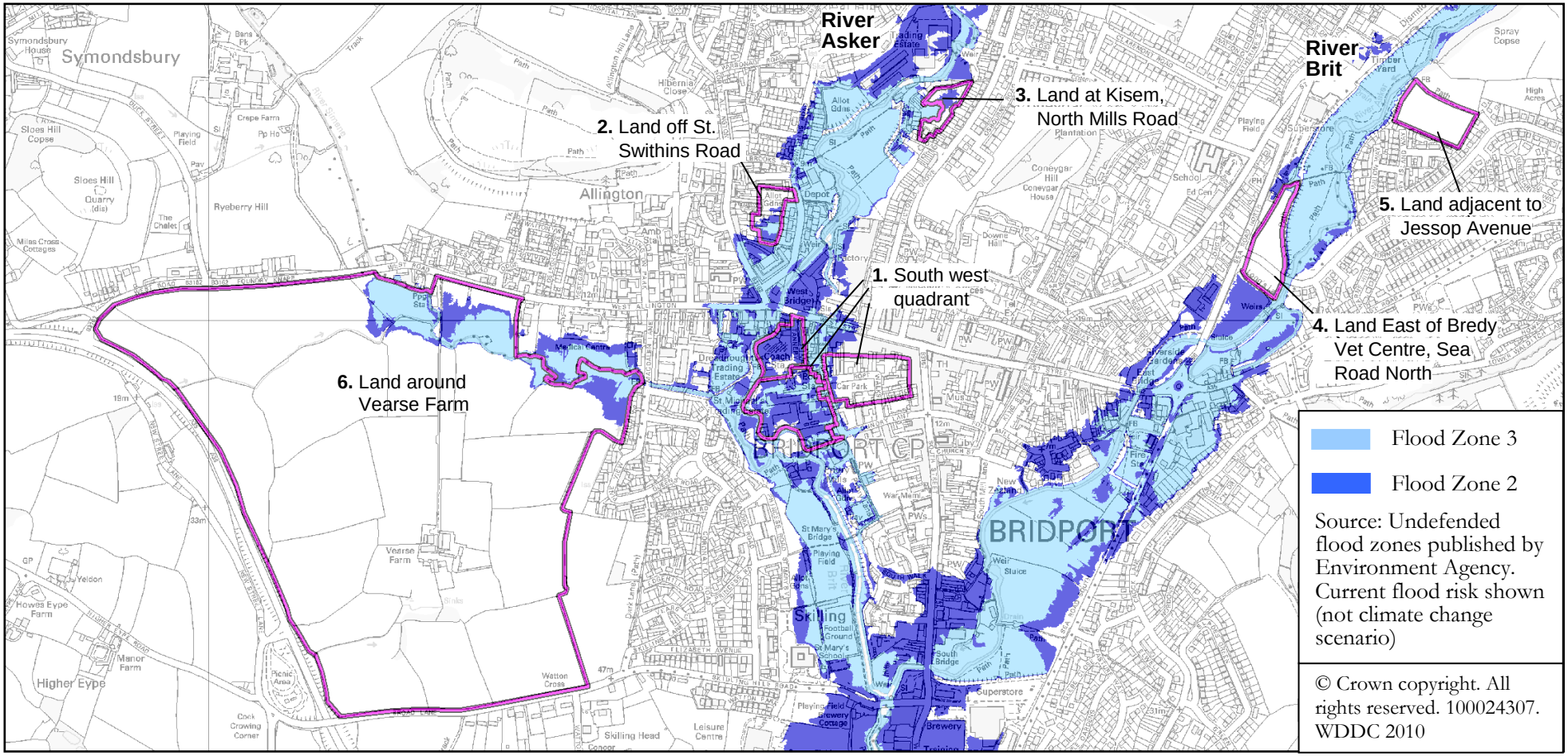


Figure 2.1 Areas of search for potential development – Bridport

2.6 *Sequential Test*

The Sequential Test is used to direct all new development (through the site allocation process) to locations at least risk of flooding, giving highest priority to Flood Zone 1. Before the sites being considered in this SFRA can be allocated for development, WDDC must complete the Sequential Test to determine whether these sites are appropriate as strategic allocations given the flood risks associated with them.

The output from the Strategic Housing Land Availability Assessment (SHLAA) will be critical evidence in this process. If these sites do not pass the Sequential Test they should not be allocated and alternative sites should be brought forward. Where the Sequential Test alone cannot deliver acceptable sites, the Exception Test will need to be applied.

The Sequential Test should be applied using the climate change Flood Zone (FZ3) maps using the best available information. WDDC's approach to strategic planning and the Sequential Test using these maps is explained in the text box below.

Prior to this SFRA Level 2 report, WDDC used the SFRA Level 1 flood maps (2008) to assess areas of search for development. These flood maps, consistent with the level of detail required by PPS25, derived from the Environment Agency (undefended) Flood Zone maps as follows (where 1% AEP – Annual Exceedance Probability – is equivalent to FZ3):

"…*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) … 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*…"

The SFRA Level 1 flood maps still apply to West Dorset except that this SFRA Level 2 (reported herein) has produced more detailed FZ3 information based on modelling defended, undefended, breach and climate change scenarios for the Bridport area, and this should be used to inform further Sequential Test work. The reasons for the focus on Bridport are explained in Section 1.2.

The Environment Agency recommends that the following approach is used by LPAs to apply the Sequential Test to planning applications located in Flood Zones 2 or 3. The same approach should also be used for the LDF site selection process, which is undertaken at the larger district scale. A pro forma template, based on the process below, is provided in Appendix A. There are three stages, as follows:

- Stage 1 – Strategic application & development vulnerability
- Stage 2 – Defining the evidence base
- Stage 3 – Applying the Sequential Test

Stage 1 – Strategic application & development vulnerability

The Sequential Test can be considered adequately demonstrated if **both** of the following criteria are met:

- The Sequential Test has already been carried out for the site (for the same development type) at the strategic level (development plan) in line with paragraphs D5 and D6 of PPS25; and
- The development vulnerability is appropriate to the Flood Zone (see table D1 of PPS25)

1.A Has the Sequential Test already been carried out for this development at the development plan level? If yes, reference should be provided to the site allocation and Development Plan Document (DPD) in question.

1.B Is the flood risk vulnerability classification of the proposal appropriate to the Flood Zone in which the site is located according to Tables D1 and D3 of PPS25? The vulnerability of the development should be clearly stated.

Finish here if the answer is 'Yes' to both questions 1.A. and 1.B.

Only complete Stages 2 and 3 if the answer to either questions 1.A and 1.B is 'No'.

Stage 2 – Defining the evidence base

2.A State the geographical area over which the test is to be applied.

2.B If greater or less than the district boundary justify why the geographical area for applying the test has been chosen.

Identify the geographical area of search over which the test is to be applied – this will usually be over the whole of the district but may be reduced where justified by the functional arrangements of the development (e.g. catchment area for a school or doctors surgery) or relevant objectives in the RSS or LDF. Equally, in some circumstances it may be appropriate to expand the search area beyond the district for uses that have a sub-regional, regional or national market.

2.C Identify the source of reasonable available sites, either:

- Background / evidence base documents (state which), or if not available
- Other sites known to WDDC that meet the functional requirements of the application

Identify the source of 'reasonably available' alternative sites – these sites will usually be drawn from the evidence base / background documents that have been produced to inform the emerging LDF. For example, an important source of information from housing sites and employment land will be provided by the Strategic Housing Land Availability Assessment and the Employment Land Review (ELR).

Until the SHLAA is complete, or in the absence of background documents, 'reasonably available' sites would include any sites that are known to the WDDC and that meet the functional requirements of the application in question, and where necessary, meet the LDF Policy criterion for windfall development (see below).

In general there will be a presumption against the grant of planning permission in flood risk areas where the SHLAA has demonstrated that there is an adequate supply of sites within West Dorset District Council area that are at a lower flood risk.

Windfall sites – further detail on windfall sites is included in Sections 5.6 and 7.6

Windfall sites are those which have not been specifically identified as available in the Development Planning Process. They comprise previously-developed (brownfield) sites that have unexpectedly become available. Government policy in PPS3 para. 59 advises that LPAs should not normally rely on windfall sites to meet housing needs.

The Environment Agency recommend that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms. Evidence on this position should be provided as support to the soundness of the Core Strategy. Guidance on determining the housing potential of windfall (where justified) for broad locations can be found in paras 50-52 of Strategic Housing Land Availability Assessments, Practice Guide to PPS3.

In the absence of flood risk windfall policy, it may be possible (where data are sufficiently robust) for the LPA to apply the Sequential Test taking into account historic windfall rates and their distribution across the district relative to Flood Zones. Where historic and future trends evidence indicate that housing need in the district through windfall can be met largely/entirely by development outside high flood risk areas, this may provide grounds for factoring this into the consideration of 'reasonably available' alternative sites at the planning application stage.

2.D State the method used for comparing the flood risk between sites, whether it is this SFRA or an alternative (e.g. Environment Agency flood map, site specific FRA) as new information becomes available.

Stage 3 – Applying the Sequential Test

Compare the reasonably available sites identified under stage 2 with the application site. Sites should be compared in relation to flood risk; development plan status; capacity; and constraints to delivery including availability, policy restrictions, physical problems or limitations, potential impacts of the development, and future environmental conditions that would be experienced by the inhabitants of the development.

3.A State the name and location of the reasonably available site options being compared to the application site

3.B Indicate whether flood risk on the reasonable available options is higher or lower than the application site. State the Flood Zone or SFRA classification for each site.

3.C State whether the reasonably available options being considered are allocated in the Development Plan. Confirm the status of the plan.

3.D State the approximate capacity of each reasonably available site being considered. This should be based on:

- the density policy within a Local Development Document (LDD)
- the current Strategic Housing Land Availability Assessment for the district
- past performance

3.E Detail any constraints to the delivery of identified reasonably available options; for example, availability within a given time period or lack of appropriate infrastructure i.e. flood defences which protect the site through its design lifetime. This part of the test should include recommendations on how these constraints should be overcome and when.

Sequential Test conclusion

Are there any reasonably available sites in areas with a lower probability of flooding, which would be appropriate to the type of development or land use proposed?

Next step

Exception Test – Where necessary, the Exception Test should now be applied in the circumstances set out by table D.1 and D.3 of PPS25.

Applying the Sequential Approach* at the site level –PPS25 sets out the requirements for developers to apply the sequential approach (see para. 14 and D8) to locating development within the site.

The following questions should be considered:

- Can risk be avoided through substituting less vulnerable uses or by amending the site lay-out?
- Has the applicant demonstrated that less vulnerable uses for the site have been considered and reasonably discounted?
- Can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

*Sequential Test versus Sequential Approach: The Sequential Test is used to direct all new development (through the site allocation process) to locations at least risk of flooding, giving highest priority to Flood Zone 1. The Sequential Approach is used to plan the development layout in these locations so that the most vulnerable uses are placed at least risk of flooding.

2.7 Exception Test

The Exception Test should be applied by decision-makers only after the Sequential Test has been applied and in the circumstances shown in Table D.1 of PPS25 when 'more vulnerable' development and 'essential infrastructure' cannot be located in Zones 1 or 2 and 'highly vulnerable' development cannot be located in Zone 1.

The flood risk information of a Level 2 SFRA facilitates the application of the Exception Test. The test is applied when there are 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.

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 (Figure 4 of PPS12: LDFs) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal.

b) The development should be on brownfield land (developable previously-developed land) or, if it is not on brownfiield land, that there are no reasonable alternative sites on brownfield land.

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

WDDC may need to apply the Exception Test as one potential development site intersects with Flood Zone 3a, although this is not possible to determine until the Sequential Test process is complete. WDDC must then demonstrate in a transparent means that the positive contribution to the community of development on the site is so great that they firmly outweigh the concerns about the risk of flooding and safety.

The Emergency Services (Fire & Rescue) should be formally consulted for their consideration on whether they will be able to rescue people from the development for all flood events up to an annual probability of 0.1%. The emergency planners should also be consulted to confirm that evacuation plans and rest centres will be available to assist people displaced during a major flood event. Their involvement will also be at the subsequent planning application stage when detailed layouts are available.

3 SFRA linkage to high level plans

3.1 Overview

There are a number of existing and ongoing plans available for West Dorset and wider regional area. Figure 3.1 below shows the hierarchy of national, regional/sub-regional and local plans published in the recent 'Appraisal of Flood and Coastal Erosion Risk Management: A Defra Policy Statement'. This chapter introduces the high level plans and their linkage with the SFRA.

The highest level of FCERM relevant to this SFRA is represented by the Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs), with the RSS linked to national planning policy at a similar level. It is important to understand the linkage of the SFRA with these high level plans, in particular the CFMPs and SMPs that recommend the flood risk management policy for West Dorset.

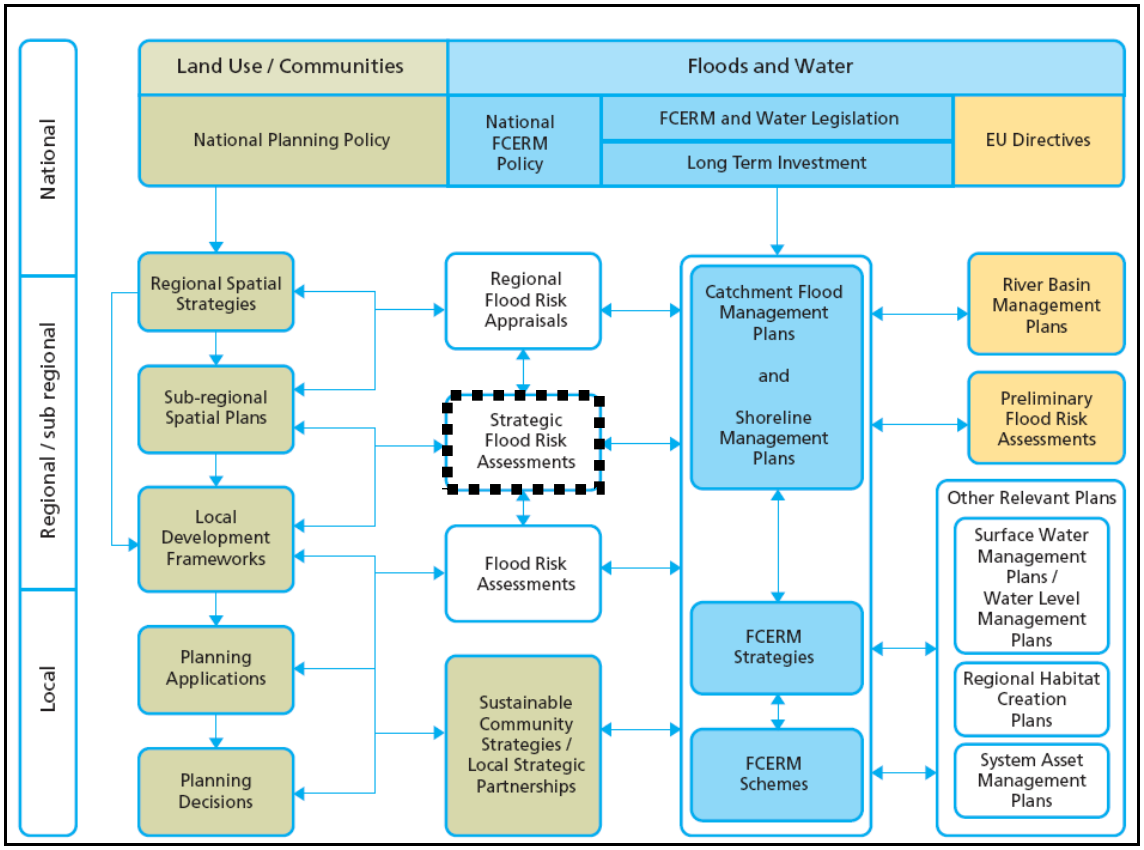


Figure 3.1 FCERM hierarchy
(*Appraisal of Flood & Coastal Erosion Risk Management, Defra Policy statement - Figure 3.1, 2009*)

3.2 Overall responsibilities for flood risk management

The Department for the Environment, Food and Rural Affairs (Defra) has overall responsibility for flood risk management in England. Their aim is to reduce flood risk by:

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

The Government's Foresight Programme has produced a report called Future Flooding (2004), which warns that the risk of flooding will increase between 2 and 20 fold over the next 75 years. The report produced by the Office of Science and Technology has a long-term vision for the future (2030 – 2100), helping to ensure effective strategies are developed now. Sir David King, the Chief Scientific Advisor to the Government concluded:

"*continuing with existing policies is not an option – in virtually every scenario considered (for climate change), the risks grow to unacceptable levels. Secondly, the risk needs to be tackled across a broad front. However, this is unlikely to be sufficient in itself. Hard choices need to be taken – we must either invest in more sustainable approaches to flood and coastal management or learn to live with increasing flooding*".

In response to this, Defra is leading the development of a new strategy for flood and coastal erosion for the next 20 years. This programme, called 'Making Space for Water', is helping define and set the agenda for the Government's future strategic approach to flood risk.

The strategic approach is being delivered through a strong and continuing commitment to CFMPs and SMPs within a broader planning matrix which will include River Basin Management Plans (RBMPs) prepared under the Water Framework Directive and Integrated Coastal Zone Management.

The Government's policy in flood and coastal erosion management has a key role to contribute to mitigation and adaptation to climate change. Increases in sea level and changing river flows (more floods / droughts) will impact on coastal and catchment areas:

- It is expected that larger numbers of people could in the future be at risk from flooding and coastal erosion, particularly from exceptional events, and if severe events occur beyond the current design standards of flood defences across the UK.
- To reduce these risks means investing significant sums each year to do so, and increased flood and coastal defence activities are part of the adaptation strategy to protect the UK economy from the full effects of climate change.

The EC Water Framework Directive (WFD) (2000/60/EC) came into force in 2000 and has set out a timetable for inclusion into the laws of Member States and then for their implementation through RBMP. It requires all inland and coastal waters to reach a "good status" by 2015.

Article 4(3) of the WFD allows Member States to designate surface water bodies, which have been physically altered by human activity, as artificial or heavily modified, subject to a number of provisions. Good ecological potential is the environmental objective for these water bodies.

The EC directive on the assessment and management of flood risk (the Floods Directive) aims to reduce the risk to human health, the environment and economic activity associated with floods. This directive will require the preparation of Flood Risk Management Plans (FRMPs) that will sit alongside the RBMPs prepared under the Water Framework Directive. The FRMPs to be prepared in the future will build on CFMPs and SMPs.

The summer floods of 2007 and 2008 highlighted a wide range of challenges that we face in relation to flooding. Sir Michael Pitt undertook a comprehensive review of the lessons to be learned. He clearly identified the need for changes to primary legislation and called for a single unifying act.

The Government's Floods and Water Bill (consultation draft published April 2009) will take forward the outcomes of the Pitt Review. The content of the Bill related to flooding is likely to include: measures in relation to surface water management, transposition of the Floods Directive requirements, SuDS adoption and maintenance measures, sewer micro-connections, critical infrastructure, information sharing, disaster recovery, flood event management and potential amendments to the Civil Contingencies Act.

3.3 Draft South West Regional Spatial Strategy

The South West Regional Spatial Strategy (RSS)[4] provides a framework for the future planning of the South West to 2026, by setting out policies for the location and scale of development for the region. The LDFs of local authorities must be in general conformity with RSS policy. RSS also provides a spatial context for plans, programmes and investment of other agencies and organisations in the region.

The RSS is currently published in the form of the Secretary of State's Proposed Changes July 2008, with the final version delayed since June 2009 following a High Court judgement that the published East of England Regional Spatial Strategy failed to meet certain requirements of the EU Strategic Environmental Assessment Directive. As a result of this judgement a new sustainability appraisal of the RSS is currently being carried out.

The RSS includes the policy statement: "*defend[ing] existing properties and, where possible, locate[ing] new development in places with little or no risk of flooding*" and "*use[ing] development to reduce the risk of flooding through location, development and design*" (Policy F1).

[4] At time of publication, the new Government announced the intention to abolish the Regional Spatial Strategy. At this early stage no further information is available, however new planning policy will be formulated in the light of the most up to date guidance.

3.4 Catchment Flood Management Plan

The District is covered by five separate CFMP areas, as shown in Figure 3.2. The CFMPs are high-level strategic documents through which the Environment Agency work with other stakeholders to identify and agree policies for long-term flood risk management over the next 50 to 100 years.

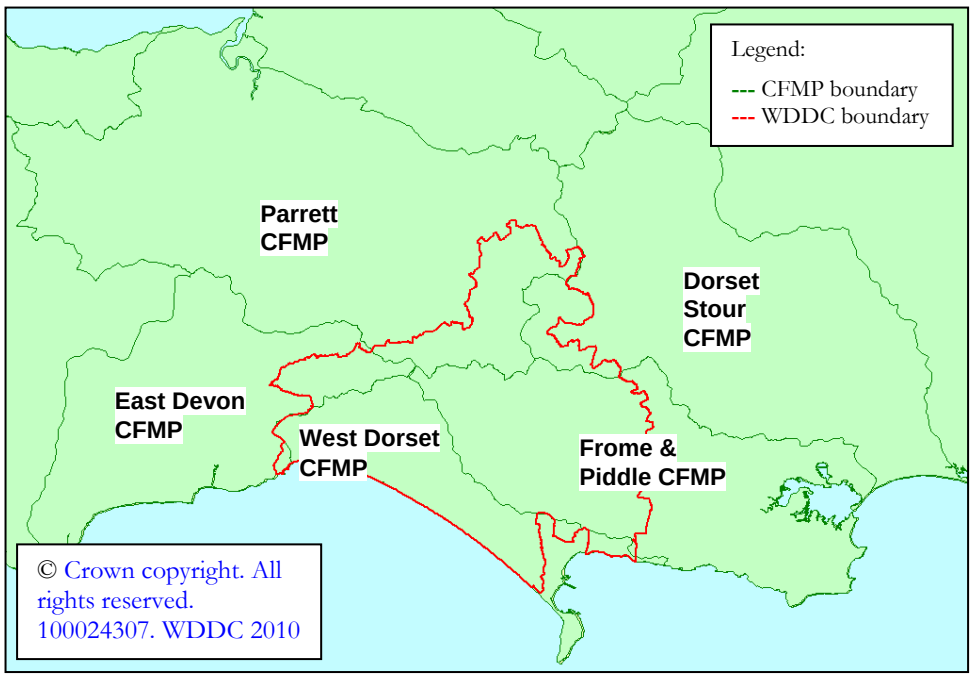


Figure 3.2 CFMP boundaries covering West Dorset

The key messages of the CFMPs are:

- Flood defences cannot be built to protect everything.
- Climate change will be the major cause of increased flood risk in the future.
- The floodplain is our most important asset in managing flood risk.
- Development and urban regeneration provide a crucial opportunity to manage flood risks.
- If current flood risk management activities continue, estimated average annual damages are set to significantly increase due to increased tide levels and flood flows predicted to result from climate change.
- Further action for West Dorset should be taken to reduce flood risk to safeguard social, economic and environmental welfare.

It is important to note that the policies and stated aims to come out of the CFMP process do not necessarily confer responsibility for these to any particular body or agency.

The CFMPs recommends for parts of the SFRA area a long term reduction in flood risk should be achieved primarily through a number of measures to be determined in further flood risk, asset management and integrated urban drainage studies. These studies will need to look at the combined fluvial, tidal and urban drainage flood risks. The CFMPs also recommend some possible strategic solutions to manage flood risk, such as upstream storage for the Frome headwaters (Frome & Piddle CFMP).

The CFMPs recommend the following policy options for the SFRA area:

- Policy 1: Areas of little or no flood risk where the Environment Agency will continue to monitor and advise, which reflects a commitment to work with the natural flood processes as far as possible. This policy option applies to the major rural part and Isle of Portland of the West Dorset CFMP, and coastline of the Frome and Piddle CFMP.
- Policy 2: Areas of low to moderate flood risk where existing flood risk management actions can generally be reduced. This policy option applies to the rural mid and lower catchment of the Dorset CFMP.
- Policy 3: Areas of low to moderate flood risk where existing flood risk is generally being managed effectively. This policy option applies to Burton Bradstock and Charmouth (West Dorset CFMP) and Upper Yeo and Cary (Parrett CFMP).
- Policy 4: Areas of low, moderate or high flood risk where flood risk is already being managed effectively but where further action may need to be taken to keep pace with climate change. This policy option applies to Bridport, Beaminster and the Weymouth urban area (West Dorset CFMP), Dorchester (Frome and Piddle CFMP) and Lyme Regis (East Devon CFMP).
- Policy 5: Areas of moderate to high flood risk where further action to reduce flood risk can generally be taken. There are no parts of the SFRA area where this policy option applies.
- Policy 6: Areas of low to moderate flood risk where action will be taken to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits. This policy option applies to the headwaters and chalklands (Frome and Piddle CFMP), Upper Otter and Axe (East Devon CFMP) and Upper Stour and Blackmore Vale (Dorset Stour CFMP).

Table 3.1 summarises the proposed actions for the SFRA area drawn from the individual CFMP summary reports. It is important to consider carefully these actions and their implications for development control.

Table 3.1 CFMP proposed actions

CFMP	Sub-area	Proposed actions to implement the preferred policy
West Dorset CFMP	Bridport (Policy 4)	▪ Improve flood forecasting / warning / awareness, flood incident management and emergency response. ▪ Identify areas where surface water run-off issues are causing problems for this Rapid Response Catchment. ▪ Ensure spatial planning and development does not increase flood risk (PPS25). ▪ Review licences and investigate possible relocation of caravan/camping sites currently at risk, e.g. on west side of lower Brit. ▪ Investigate whether critical infrastructure currently at risk can be relocated over the longer term. ▪ Determine the link between soils and run-off in the catchment, with one aim to reduce river maintenance removal of silts. ▪ Investigate opportunities to restore former wetland; increase floodplain connectivity; modify/improve lower Asker flood defences ▪ Investigate if there are any feasible options for smaller on-line storage options for the River Brit and tributaries.
	Weymouth urban areas, incl. Southill, Chickerell and Littlemore (Policy 4)	▪ Ensure spatial planning and development does not increase flood risk (PPS25). ▪ Review surface water drainage and solutions; identify / retrofit SuDS; incorporate SuDS in new Weymouth Relief Road. ▪ Investigate relocating of any inappropriate development in Wey floodplain and critical infrastructure in medium/long term. ▪ Siltation study for Wey catchment (RSPB as one partner) to inform site and flood risk management at Radipole Lake. ▪ Use study results to review drainage issues at Radipole Lake and options to reduce flood risk to properties in Radipole village. ▪ Investigate opportunity to create floodplain grazing marsh for flood risk management benefit.
	Beaminster (Policy 4)	▪ Continue ongoing development of System Asset Management Plans (SAMPs) - improve understanding of flood defences. ▪ Standard of flood protection study, and how to manage flood risk, e.g. e.g. opening up of culverted sections. ▪ Surface Water Management Plan (SWMP) study. ▪ Review current flood forecasting and flood warning procedures for this Rapid Response Catchment.
	Burton Bradstock (Policy 3)	▪ Drainage study to assess realigning channel back to original and regulating flows in main river/mill stream to reduce flood risk. ▪ Review licences and possible relocation of caravan / camping sites that are currently at risk. ▪ Investigate land use and land management changes in the Bride catchment to reduce surface water flood risk from rural areas. ▪ Depending on outcome of Rapid Response Catchments project, take further action if deemed appropriate.
	Charmouth (Policy 3)	▪ Review licences and possible relocation of the caravan / camping / holiday sites that are currently at risk. ▪ Continue to provide a flood warning service. ▪ Depending on the outcome of the Rapid Response Catchments project, take further action if deemed appropriate.
	West Dorset rural areas (Policy 1)	▪ Continue to monitor and advise (by Environment Agency).
	The Isle of Portland (Policy 4)	▪ No proposed actions relating to fluvial, surface water or sewer flooding. ▪ South Devon and Dorset SMP includes actions relating to tidal/coastal flood risk (e.g. at Chiswell).

CFMP	Sub-area	Proposed actions to implement the preferred policy
Frome and Piddle CFMP	Headwaters & The Chalklands (Policy 6)	▪ Opportunities arising from the Catchment Sensitive Farming Initiative and Environmental Stewardship schemes. ▪ Potential benefits of the AONB tree and woodland planting programme and wetland habitat creation. ▪ Schemes to restore rivers/floodplains to reduce conveyance where appropriate, e.g. reduce tree clearance.
	Dorchester (Policy 4)	▪ Identify locations for channel maintenance ensure adequate conveyance and revise maintenance regime where appropriate. ▪ Identify and survey infrastructure at risk and take measures to increase flood resilience. ▪ Improve the flood warning service and use awareness campaigns to increase the service uptake. ▪ Study past surface water flooding events and set up systems to measure and record future events to provide baseline data. ▪ Develop an Integrated Urban Drainage strategy and implement actions.
Parrett CFMP	Upper Yeo and Cary (Policy 3)	▪ Work with communities to increase flood awareness, pre-flood planning and promote flood warning. ▪ Review maintenance activities to ensure best value for money. ▪ Investigate ways to support flood resistance/resilience methods to individual properties where other options are not practical.
East Devon CFMP	Upper Otter and Axe (Policy 6)	▪ System Asset Management Plans (SAMPS) to reduce level of maintenance and utilise floodplains more effectively. ▪ Measures for increased floodplain storage, wetland habitat creation, natural river bank restoration - contributes to WFD targets. ▪ Investigate land use and land management changes to reduce flood risk and 'muddy' floods (Otter, Axe, Yerty, Wolf, Tale). ▪ Planners can support policy by designating floodplain/wetland areas as functional floodplain to support attenuation/biodiversity.
	Sidmouth and Lyme Regis (Policy 4)	▪ System Asset Management Plans (SAMPS) to sustain the current scale of flood risk. ▪ Investigate flood risk in Lyme Regis, particularly for extreme floods and making use of Rapid Response Catchments Project. ▪ Develop a strategy for managing weirs to improve flood risk management and provide environmental benefits. ▪ Develop our programme for Flood Hazard Mapping to determine direction and velocity of flow. ▪ Investigate ways of improving flood warning and promote self-help opportunities for flood protection in specific locations. ▪ Ensure all new developments conform with PPS25, and encourage opening up floodplains and culverts through development. ▪ Investigate ways to move people and infrastructure out of flood risk areas, e.g. as poor housing stock deteriorates longer term.
	Rural Mid and Lower catchment (Policy 2)	▪ System Asset Management Plans (SAMPS) to reduce level of maintenance. ▪ Identify locations with the potential to improve land management and land use to benefit flood risk management. ▪ Consider ways of reconnecting the rivers with their floodplains to utilise flood storage and reduce risk downstream.
Dorset Stour CFMP	Upper Stour and Blackmore Vale (Policy 6)	▪ Improve awareness / resilience and advice on self help for properties at risk. ▪ Keep main routes open. ▪ Encourage appropriate land-use to reduce runoff.

3.5 *Shoreline Management Plan*

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; refer to Figure 3.3.

The Durlston Head to Rame Head SMP2, which will set out coastal policies described above, is due to be adopted by coastal authorities from June 2010 through democratic committee processes. Adoption by WDDC is scheduled in June 2010 (this will vary for other authorities).

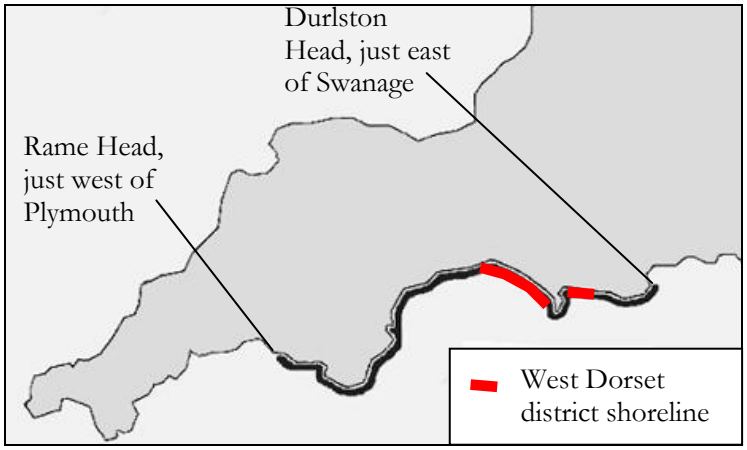


Figure 3.3 Extent of SMP2 area

The emerging SMP2 recommends the following overall policies for West Dorset district:

- White Nothe to Redcliff Point: Mainly cliffed section of undefended (apart from Ringstead Bay) coast that experiences episodic landslide events making management of this coastline difficult. To continue the natural erosion process is in line with the World Heritage and SSSI status of the cliffs, and therefore the long term aim is to return this coastline to its natural stage. As this will impact on a number of cliff top assets a transition period is proposed to manage this change.
- Redcliffe to Portland Bill: Incorporates Weymouth and the Isle of Portland, with a key driver of policy in this area the continued protection of commercial and social assets, which require the continued defence of the shoreline for much of this area.
- Portland Bill to Thorncombe Beacon: This stretch of coast is dominated by Chesil Beach that provides an important defence role. The shingle barrier is undergoing a natural change as it rolls landwards in response to sea level rise and experiences natural reduction in sediment inputs from the west. Conflicts arise for small settlements, such as West Bexington and Burton Bradstock, which are important for tourism. A key driver of policy is maintaining the natural status of Chesil Beach and taking measures to ensure its future sustainability; therefore for most of this stretch a policy of continued no active intervention is proposed.
- Thorncombe Beacon to Beer Head: This section of coast is characterised by dramatic, geologically important cliffs that are subject to large-scale complex landsliding, making management of this shoreline difficult. A key driver of policy is continuation of natural coastline evolution of this stretch, which is largely undefended, whilst managing the risk of erosion and flooding to key settlements including Lyme Regis.

3.6 Implementation of CFMP & SMP Policy

CFMP & SMP policies reflect preferred options. While the CFMP and SMP provide the framework for future decisions, the implementation of the policy relies on the availability of funding.

While it is appropriate for a SFRA to consider the policies set out in a CFMP or SMP to ensure that proposals do not conflict with high level policy. No reliance should be made within a SFRA that the policy identified in the CFMP or SMP will be resourced out of central funding or implemented unless works have already been committed.

In general where the Sequential Test and Exception Test demonstrate an allocation is appropriate, the Environment Agency would support a Local Authority who wishes to fully fund works envisaged within a SMP or CFMP via an infrastructure levy as part of their LDF.

3.7 Surface Water Management Plans (SWMPs)

Intense rainfall events can occur anywhere as was highlighted by the summer 2007 floods that affected areas of Northern Ireland, north east England, the Midlands and Wales. The occurrence of such events needs all stakeholders to work in partnership to improve understanding and the management of flood risk in urban areas so that they are better prepared for future events.

A SWMP is a framework through which key local partners with responsibility for surface water in their area work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk. The purpose is to make sustainable urban surface water management decisions that are evidence based, risk based, future proofed and inclusive of stakeholder views and preferences (Defra, 2009).

The Pitt Review Recommendation 18: "Local Surface Water Management Plans, as set out in PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk."

PPS25: "Surface Water Management Plans (SWMPs) are referred to in Planning Policy Statement 25 (PPS25) as a tool to manage surface water flood risk on a local basis by improving and optimising coordination between relevant stakeholders. SWMPs will build on SFRAs and provide the vehicle for local organisations to develop a shared understanding of local flood risk, including setting out priorities for action, maintenance needs and links into local development frameworks and emergency plans."

Source: Defra (2009) Surface Water Management Plan guidance

The Pitt Review (2008) recommends SWMPs be adopted where surface water flood risk is high. Defra provide funding for SWMP studies, and Dorset County Council recently sourced funding for the Dorset area (excluding Poole & Bournemouth Borough Councils) and will seek funding for other SWMPs including Bridport and Dorchester in the West Dorset area.

3.8 Water Cycle strategic studies

Water Cycle strategic studies seek to ensure that where new homes are built that they can be adequately supplied with clean water and that dirty water can be adequately disposed of, within the limits of environment responsibility. To achieve this, such studies:

- bring together all water and planning evidence under a single framework
- understand the environmental and physical constraints to development
- work alongside green infrastructure planning to identify more sustainable planning
- consider the opportunity for SuDS (discussed further in Section 8.2)
- identify water cycle planning policies and a water cycle strategy

The Environment Agency encourages the use of Water Cycle strategic studies to address a range of water and environmental planning issues, including flood risk management, water resources and waste water planning processes, in areas where significant development is planned.

A Water Cycle study can be recommended if there is a requirement for a SWMP and it is uncertain whether the environmental capacity of the water cycle to cope with future proposed development is adequate.

At this stage there is no specific requirement for a Water Cycle study in West Dorset, but the Environment Agency have indicated a requirement for the foul drainage and water supply capacity to be assessed for any potential growth areas. As part of their evidence base, WDDC may decide to commission a Water Cycle study for some of the settlements where strategic growth is proposed (e.g. Dorchester).

4 Defining the flood risks

4.1 Overview

The aim of the hydraulic modelling undertaken is to improve the Flood Zone information for the Bridport area being considered for future development and to assess the flood hazards posed. This chapter defines the fluvial/tidal flood risks to each of the six areas of search for potential development identified (Figure 2.1).

The SFRA Level 1 (2008) mapped all sources of flood risk and thereby provided the evidence base to inform a risk-based sequential approach to flood risk (the Sequential Test). This approach helps ensure that development is located in areas of lowest possible risk of flooding. The evidence base included flood risks relating to all sources of flooding, i.e. tidal, fluvial, surface water, sewers, groundwater and impounded waters (such as reservoir, canal, etc).

Areas of search for potential development within Bridport (Figure 2.1) were identified by WDDC as requiring a Level 2 SFRA. A SFRA Level 2 is necessary as WDDC may consider these areas, known to be partly affected by Flood Zones (FZ3) based on the SFRA Level 1 evidence base, for future development.

Additional flood risk information provided by the SFRA Level 2 may be required to carry out the Exception Test in accordance with Table D3 of PPS25. This information derives from detailed modelling to assess the effects of the defences through Bridport, and modelling 'worse-case scenario' breaches in the areas of search. This gives an indication of the residual risk to developments sited behind defences.

The Flood Zones (undefended) published by the Environment Agency are the first consideration for planning purposes, even where further modelling has been undertaken. It is important to note that the Environment Agency revises the Flood Zones on a regular basis and it is important to ensure that the most up to date versions are being used.

WDDC considered the Flood Zones (undefended) provided as part of the SFRA Level 1 in their strategic planning work. In this way WDDC identified the need for this SFRA Level 2 to focus on the Bridport area in view of known flooding issues for the existing built area and the areas of search for potential development.

The more detailed modelling results for Bridport provided as part of this SFRA Level 2, incorporating the effects of defences and breaches, provide a more detailed picture of flood risk at the very local scale for use within the Sequential and Exception Tests, and in development control for windfall sites and Brownfield sites.

4.2 Surface water flood risks

As part of the SFRA Level 1 a series of consultations were undertaken to identify and map known surface water flooding including local drainage issues. These maps are updated for the SFRA Level 2 based on the latest records provided by Wessex Water and new surface water flood risk modelling results produced by the Environment Agency.

Recommendation: Updated surface water flooding records should be obtained after any significant flooding incidents, to ensure that the best available information is used to inform site allocations and windfall sites.

It is reiterated in this Level 2 SFRA that the surface water flooding records collated are not considered an exhaustive assessment of surface water flooding since the data are based on historical events rather than predictive modelling. This means that very rare events will not be represented and, hence, the full extent of surface water flooding mechanisms is unlikely to have been captured.

The surface water flood risks are further considered in Chapter 6.

4.3 Fluvial / tidal flood risks - Flood Zones

Detailed hydraulic modelling has been undertaken, refining the assessment of the fluvial/ tidal flood risks within Bridport as presented in the SFRA Level 1, by modelling the effects of the defences through Bridport and 'worse-case scenario' breaches. This provides additional flood risk information for the Bridport area to guide decisions about the acceptability of development, including the six potential sites identified in Figure 2.1 and windfall development.

The SFRA Flood Zones (Figure 4.1) are defined as:

- Flood 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%).
- Flood 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.

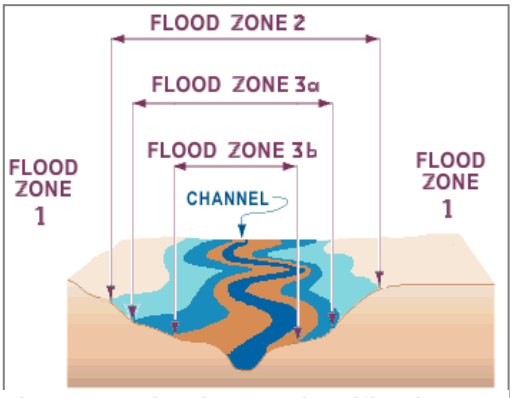


Figure 4.1 Flood Zone classification

- Flood Zone 3a (High probability) – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b (Functional Floodplain) – This zone comprises land where water has to flow or be stored in times of flood (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, including water conveyance routes).

It should be noted, however, that flooding from sources including sewers, surface water, groundwater and impounded water bodies (reservoirs), can occur in any zone.

For the Flood Zone 3 and Flood Zone 3 adjusted for climate change scenarios, both the 1% Annual Exceedance Probability (AEP) fluvial event and the 0.5% AEP tidal event were modelled and the worst case was adopted: i.e. the event with greater depths and velocities.

The assumptions used to model the impacts of climate change are based on the following precautionary predictions (to the end of this century) as advised by Annex B of PPS25:

- Increase in fluvial flows by 20%
- Increase in tide levels by 1.26m to 2126

These values are applicable to the planning horizon as discussed previously (Section 2.4).

The 0.1% AEP event was selected as an indicator of an extreme situation.

It should be noted that in this SFRA Level 2 report, the future scenarios have been independently modelled. This improves on the SFRA Level 1 report, which presents the future Flood Zone 3 extent simply assumed as equivalent to the current Flood Zone 2.

4.4 Flood depths / velocities

Within a Flood Zone the depth and velocity of flood water can vary significantly. As a result, the modelled depths and velocities for each flood zone have been mapped separately to help inform the safest locations within the five areas. However, it is often the different combinations of depths and velocities that are critical, such that:

'*…six inches (0.15m) of fast flowing water can knock someone off their feet and two feet (0.61m) of water is enough to float a car…*' (Pitt Review, 2008)

The following section therefore considers the combination of depths and velocities together with an appropriate debris factor in order to provide useful guidance of the dangers to people likely to be caused by individual flood events.

4.5 Flood Hazard

In addition to TUFLOW model output of flood depth and velocity, flood hazard can also be calculated. The output includes a grid of Flood Hazard derived from the flood depth and velocity outputs and a debris factor. The methodology for these calculations is given below. Flood Hazard is calculated using the following equation from Defra (2006) R&D outputs: Flood Risks to People Phase Two Draft (FD2321/TR2).

Hazard = d x (v + 0.5) + DF

where **d** = depth (m)
v = velocity (m/s)
DF = Debris Factor

A conservative DF of 1.0 for urban areas has been applied to all depths greater that 0.25m for this study, as advised by Defra (2006). The value obtained for the Hazard is then used to assign a hazard category. Based on the value of the Hazard for a given area, a Hazard Classification is then assigned.

The Flood Hazard classifications are as shown in Table 4.1 and are divided into four categories. The Environment Agency (Development control) have advised that where the flood hazard for a site (for the lifetime of the development), is not classified as 'low' they will look to object to the development.

Table 4.1 Flood Hazard Classification (Source: Supplementary note on flood hazard ratings and thresholds for development and planning control purpose – Clarification of Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1, May 2008)

Flood Hazard Rating	Degree of flood hazard	Description
< 0.75	Low	Caution – flood zone with shallow flowing water or deep standing water
0.75 – 1.25	Moderate	Danger for some – Flood Zone with deep or fast flowing water that presents a hazard for some people (i.e. children, the elderly and the infirm)
1.25 – 2.0	Significant	Danger for most – Flood Zone with deep or fast flowing water that presents a hazard for most people
> 2.0	Extreme	Flood Zone with deep or fast flowing water that presents a hazard for all people.

4.6 Flood risks to the Bridport area

The flood defences and flood risks to the Bridport area being considered for future development are considered in Chapter 5. When allocating sites for future development the current flood risks and potential impacts of climate change on the Flood Zones must be considered.

For the purpose of this SFRA Level 2, a linked 1D-2D model (using TUFLOW software) has been developed for the Bridport area using floodplain digital terrain models (DTM) derived from aerial (LiDAR) survey data, and surveys of flood defences as part of the National Fluvial and Coastal Defence Database (NFCDD) programme.

The model computes the 'defended' flood extent, depth and velocity of floodplain flows, and the 1D in-channel component of the models determines the locations where flow exceeds channel capacity leading to out-of-bank flow – this is not shown in the flood maps. As the models include the flood defences they differ from the Environment Agency published 'undefended' Flood Zones (included in the SFRA Level 1).

5 Fluvial / tidal flood risks – Bridport only

5.1 Overview

Several areas of Bridport and West Bay are protected from fluvial / tidal flooding by raised defences. This chapter identifies the flood defences, assesses their condition and considers options for improvement consistent with CFMP policy.

The flood risks within Bridport are evaluated using the results of 2D modelling together with commentary on the flood risk implications for the six areas of search for potential development identified by WDDC (Figure 2.1). A sequential approach within each area must be applied to avoid any flood hazard with 'significant' rating (Table 4.1). However, very limited 'significant' hazard is identified, even from the breach analysis.

The surface water flood risks for West Dorset, including Bridport, are considered in Chapter 6.

5.2 Flood defences – asset details, responsibilities, etc.

All the rivers within Bridport are protected by the raised defences and associated assets.

The flood defences are predominantly a mix of flood walls and earth embankments. There are some sections of steel sheet piled walls, flood gate, ramped vehicular accesses, and a number of gated drainage outfalls.

Based on SFRA Level 1 analysis (Table 5.1) the Standard of Protection (SoP) they provide is generally above 1% annual exceedance probability (1 in 100-year) standard, although there are a limited number of locations in Bridport and West Bay where the SoP is lower:

- River Brit at West Bay – affecting the caravan park, Quayside and George Street
- River Brit East bank, near Wych – affecting land / property adjacent to West Bay Road
- River Asker at East Bridge – affecting land / property south-west of the roundabout
- River Asker at East Bridge – affection land north-east of the roundabout

The SoP provided by a defence can be reduced if a defence is in poor condition. No formal inspection was conducted for the SFRA except during a walkover assessment (restricted to the areas of search) that found the defences condition to be generally fair or better.

Table 5.1 Details of flood defence assets – Bridport (source: SFRA Level 1 report)

Details	Maintenance responsibility	Standard of protection
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*	1% AEP (1:100-year)
Raised defences (walls & embankments) on the River Brit, protecting Bridport	Environment Agency*	1% AEP (1:100-year)

* Partial responsibility for these defences also rests with other organisations

5.3 *Policies for defended areas*

Flood defences are located within Bridport. All these existing defences should be maintained to a high standard, where they currently protect development or will be relied upon to protect future development (although reliance on defences to protect new development is not supported by PPS25 or the Environment Agency), with an allowance for climate change.

Sites protected from flooding by a flood defence may be at risk of rapid inundation. Therefore, new development should be sited away from existing flood defences except in exceptional circumstances, where a FRA shows how the building and its users will be made safe for the lifetime of the development.

> "Flooding is a natural process – we can never stop it happening altogether. So tackling flooding is more than just defending against floods. It means understanding the complex causes of flooding and taking co-ordinated action on every front to reduce flood risk. This calls for long-term planning and truly 'joined-up' action from the full spectrum of partners, from policy makers to vulnerable communities. To help make this step change in the way we tackle flooding ….."
>
> Extract: Environment Agency Strategy for Flood Risk Management 2003-08

Any area behind a defence that is being considered for residential development should make reference to the breach and overtopping assessments investigated as part of this SFRA to allow any development to be designed appropriately.

5.4 *Flood risk management improvements*

The capital cost of improvement works for raising the existing defences to 1% SoP at the four locations referenced above was estimated at £670k including contingency (SFRA Level 1 appraisal).

This scheme cost breaks down as £90k River Brit and £580k River Asker. To modify the lower Asker flood defences would be in line with one action recommended by the CFMP.

No scheme benefit-cost appraisal has been undertaken at this stage, except to note that more than 50 properties would need to benefit for such a scheme to be justified (i.e. benefits of flood damage avoidance above capital / maintenance costs).

Increasing flood risk is predicted as a result of climate change and the option to simply raise the existing defences may not prove a sustainable or economically justifiable approach. There are actions recommended by the CFMP that could potentially offset this increasing flood risk, including land management, wetland creation, increasing floodplain connectivity and upstream storage options. Other options include (retro-fit) flood resistance / resilience measures (Chapter 9).

The full range of options for flood risk management is detailed in Appendix G.

5.5 *Flood risk implications for areas of search*

In line with PPS25, any development must be safe, without increasing flood risk elsewhere, and where possible reduce flood risk overall. This must be assessed over the lifetime of the development and therefore account for the impacts of climate change. Access and egress routes also need to take account of climate change. A failure or breach of flood defences is a scenario that must be considered. Flood mitigation measures may be appropriate.

The SFRA Level 2 has evaluated the fluvial / tidal flood risk implications for the six areas of search for potential development (Figure 2.1) identified by WDDC. The results are presented in Tables 5.3 to 5.8 that consider the Flood Zones (undefended and defended conditions), and flood hazards (current defences) for current, future and breach scenarios and potential for development. The preceding Table 5.2 provides a basic guide on how to use Tables 5.3 to 5.8. Table 5.9 summarises for each area the appropriate development that can be considered.

Tables 5.3-5.8 provide Flood Zones/hazards information for the six areas of search for potential development. In line with PPS25 the assessments of flood risk are based on the defended scenario information, not the Flood Zones (undefended). The modelling for this scenario takes into account the beneficial effects of flood defences in generally reducing the extent and severity of flooding when compared to the Flood Zones, and provides mapping of flood outlines for different probabilities, impact, speed of onset, depth and velocity variance of flooding.

No further studies are recommended at strategic level, as development in the majority of the areas of search within Bridport is considered viable (in flood risk terms) and flood risk can be sustainably managed. There is still a need for site-specific FRAs (Chapter 10).

5.6 *Flood risk implications for windfall sites*

The Environment Agency has recommended that should the Strategic Housing Land Availability Assessment (SHLAA) demonstrate that it is necessary for the Bridport area to develop windfall sites within the future flood zones (with allowances made for climate change), that this be limited to those areas where the flood hazard rating is less than 0.75 (defined in Table 4.1) based on defended 2126 flood hazard maps, and in most cases this will preclude sites where the flood depth is 0.25m or greater.

Figure 5.1 shows the defended 2126 flood hazard map for the Bridport area to identify the extent of the hazard rating of 0.75 and above where windfall sites are not recommended. This map is based on the future flood risk (assumes +20% increase in flows due to climate change and with no change in flood risk predicted in the Bridport area due to sea level rise).

It is considered unlikely that it will be practical to raise ground levels outside the site to provide dry access. Defra document FD2320 states that: *"…A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services or others. A route can only be completely safe in flood risk terms if it is dry at all times. However, this is not always practicable. Therefore, a more detailed analysis is sometimes required…".*

Table 5.2: Guide on how to use Flood Zones/hazards information *(presented in subsequent tables)*

Areas of search for development	• Information for South west quadrant in Table 5.3 • Information for land off Saint Swithins Road in Table 5.4 • Information for land at Kisem, North Mills Road in Table 5.5 • Information for land east of Bredy Vet Centre, Sea North Road in Table 5.5 • Information for land adjacent to Jessop Avenue in Table 5.6 • Information for land around Vearse Farm in Table 5.7
Information provided	Tables 5.2 to 5.8 provide only summary information on Flood Zones/hazards focussed on the above areas of search, based on the more detailed and comprehensive flood map information provided in appendices to this report. The summary information includes the following figures for each area: • Flood risks for the defended scenario, based on modelling for this SFRA Level 2 • Flood risks for the undefended scenario, as published by the Environment Agency • Flood hazard for 1% AEP defended scenario • Flood hazard for 1% AEP breach scenario (assumes critical section of defence fails) • Flood hazard for 1% AEP climate change scenario (assumes 20% increase in flows) The flood maps in appendices to this report show information for the whole Bridport area, including flood depth, velocity and hazard maps the for 5%, 1%, 0.1% and 1% climate change AEP events for the defended (12 flood maps in Appendix C) and undefended scenarios (12 flood maps in Appendix E). Flood maps for the 1% AEP event are also included for the defences breach scenarios at 5 separate breach locations (15 flood maps in Appendix D).
How to use the information to inform planning decisions	The latest Flood Zone/hazard information presented updates that previously provided in the SFRA Level 1. It is intended for use to ensure that any development will be safe for its occupants, and would not increase flood risk. **Flood Zones - defended scenario**: Figures shown for 0.1% AEP (equivalent to FZ2), 1% AEP (FZ3a) and 4% AEP (FZ3b) for each of the areas of search locate the different levels of flood risk in order to determine the types of appropriate development for each area. **Flood Zones - undefended scenario**: Figures shown for FZ3a and FZ3a climate change (both 1% AEP) for comparison with the defended scenario only to illustrate areas benefitting from defences. This information is unchanged from the SFRA Level 1, as already used by WDDC for strategic planning (including the Sequential Test) in line with PPS25. **Flood hazards - defended**: Figures for FZ3a and the critical defences breach scenario and future FZ3a climate change (all 1% AEP) to illustrate the hazards that are relevant in terms of siting development and assessing safe access and escape routes and the safe management of any residual risk. The tables include summary text to help interpret the figures (defended scenario): • Current flood risk • Future flood risk • Flood hazard rating • Access / egress • Potential for development (see also Table 5.9) • Types of development (see also Table 5.9) This information is needed to meet the requirements of the Exception Test (part c) as discussed in Section 2.7, which requires that a FRA (considered in Section 9) must demonstrate that where there are flood risks the development will be safe, without increasing flood risk, and where possible, will reduce flood risk overall. This must be assessed over the lifetime of the development, i.e. to account for climate change.
Types of appropriate development	Table 5.9 indicates the appropriate development for Flood Zones as classified in PPS25: • Essential Infrastructure, e.g. for transport and utilities • Water Compatible Development, e.g. water based recreation • Highly Vulnerable, e.g. police, ambulance and fire stations • More Vulnerable, e.g. hospitals, residential care homes, dwelling houses • Less Vulnerable, e.g. shops, restaurants and cafes Table 5.9 also makes reference to other flood risks.(surface water, groundwater, sewer)

Table 5.3: Flood Zones/hazards - South west quadrant

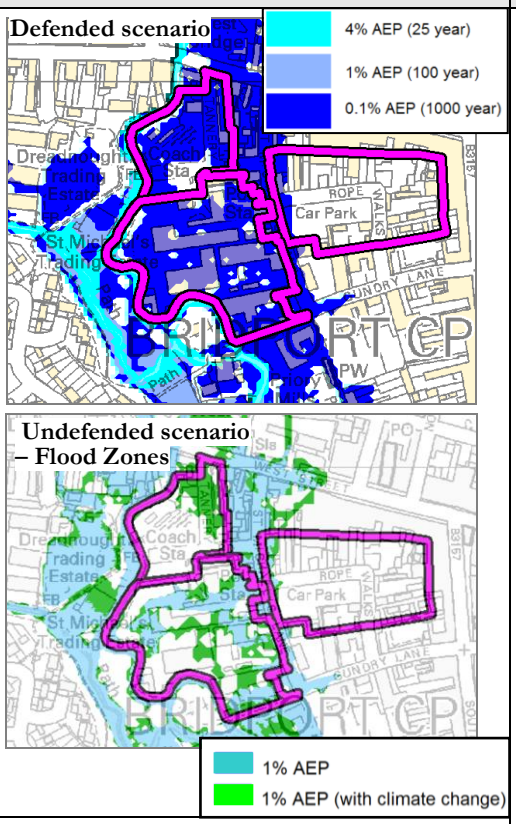
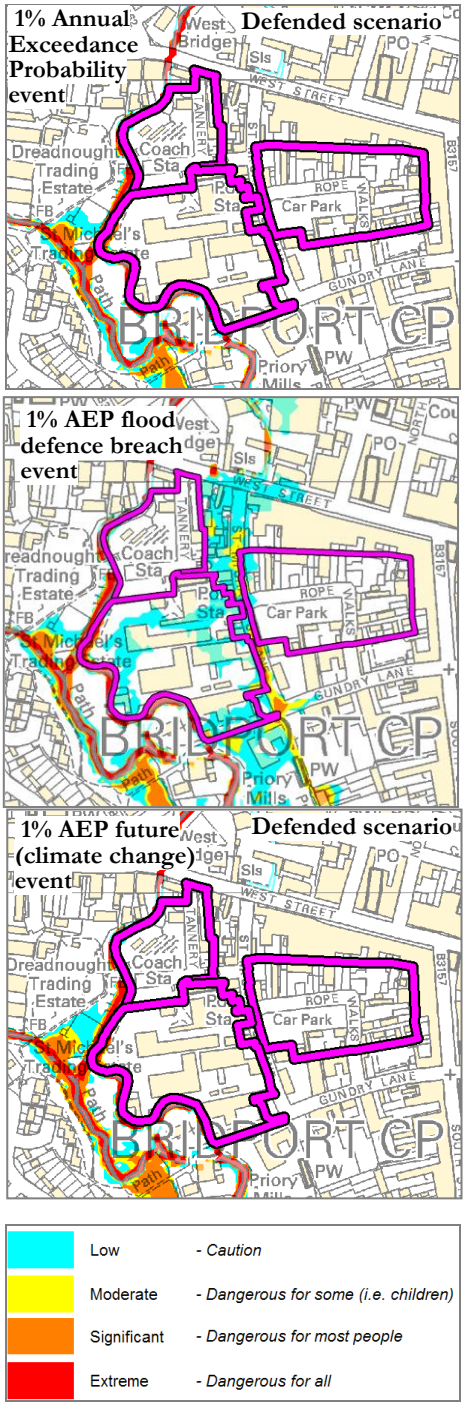
	South west quadrant – three existing local plan allocations WA3 (Coach Station Square), WA4 (Rope Walks Car Park) and WA6 (St. Michaels Trading Estate) located in the centre of Bridport, just to the south of West Street and either side of St Michael's Lane. with combined area over approximately 5ha.	
Flood maps	Flood Risk – defended / undefended	Flood Hazard (defended) – 2010, breach, future
For full set of SFRA flood maps refer to Appendix C-F 		
Current flood risk	Low risk of flooding, with majority of site in defended FZ2 (0.1% AEP) and no FZ3 (1% AEP). For breach scenario part of site at risk (1% AEP) and must factor this into any site development (e.g. design finished floor levels above flood levels).	
Future flood risk	Low flood risk as FZ2 (0.1% AEP), and no future FZ3. Note: future scenario (with climate change) not tested for breach.	
Flood hazard rating	No flood hazard for current / future scenarios except in breach scenario with flood hazard rating classified as low (minimal flood depth/velocity).	
Access / egress	No flooding for current / future scenarios except in a breach scenario, and for this reason no access/egress issues.	
Potential for development	In FZ1 no restrictions on development other than managing surface water runoff. Restrictions apply in FZ2 subject to Sequential Test and possibly Exception Test (Chapter 2). Development to accommodate breach areas as above (finished floor levels).	
Types of development	Appropriate development in FZ2 includes essential infrastructure, water compatible development and highly/ more/ less vulnerable development, some of which is subject to a specific warning and evacuation plan – see PPS25 Table D.2.	

Table 5.4: Flood Zones/hazards - Land off Saint Swithins Road

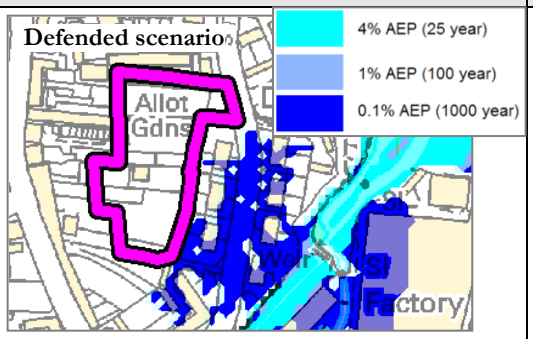
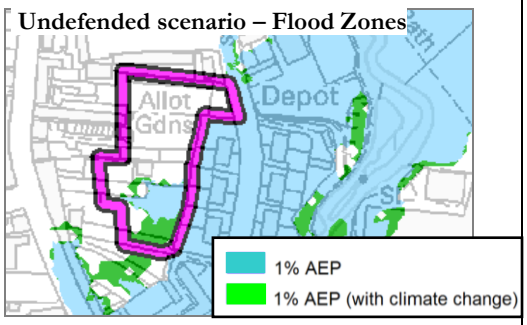
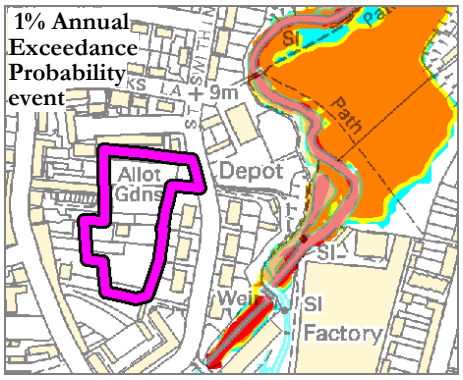
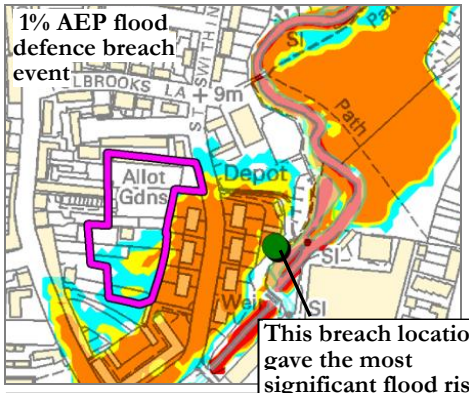
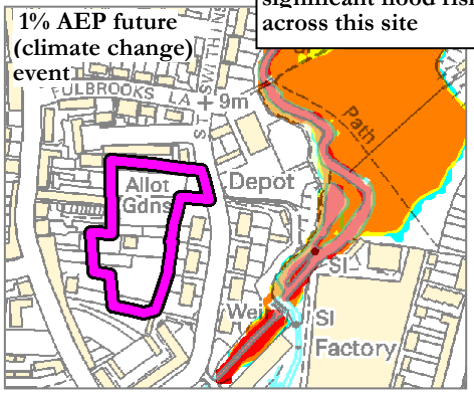
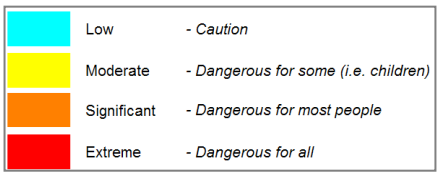
	Land off Saint Swithins Road - existing local plan allocation WA15 located on the current allotments between St Swithen's Road and North Allington, over approx. 1ha.	
Flood maps	Flood Risk – defended / undefended	Flood Hazard (defended) – 2010, breach, future
For full set of SFRA flood maps refer to Appendix C-F 	 	   
Current flood risk (including defences)	Low risk of flooding, with site wholly in FZ1 (<0.1% AEP). For breach scenario, southern part of site at risk (1% AEP) and must factor this into any site development (e.g. design finished floor levels above flood levels).	
Future flood risk (including defences)	Low flood risk as FZ1 (0.1% AEP). Note: future scenario not tested for breach.	
Hazard rating (including defences)	No flood hazard for current / future scenarios except in breach scenario with flood hazard rating classified as mainly low and limited moderate / significant.	
Access (including defences)	No flooding for current / future scenarios except in a breach scenario, and for this reason no access/egress issues. Nearest FZ2 extends outside south-east corner.	
Potential for development (including defences)	In FZ1 no restrictions on development other than managing surface water runoff. Development to accommodate breach areas as above (finished floor levels).	
Types of development	No restrictions.	

Table 5.5: Flood Zones/hazards - Land at Kisem, North Mills Road

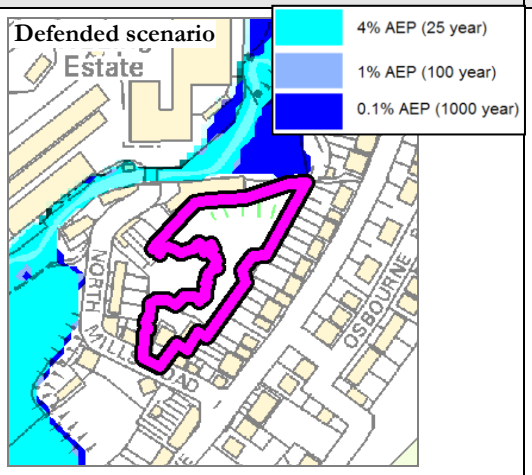
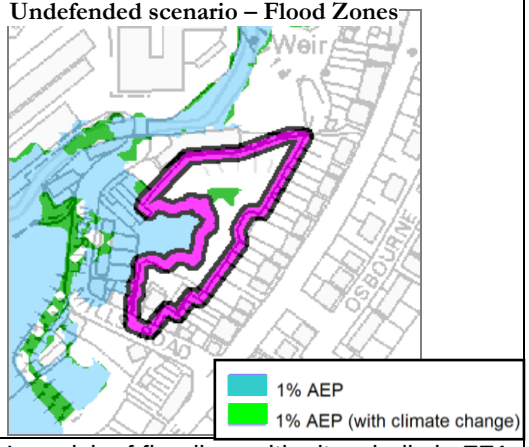
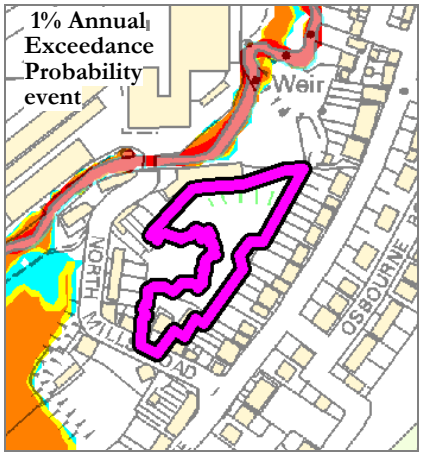
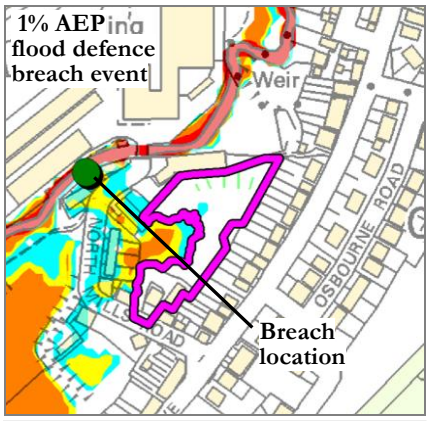
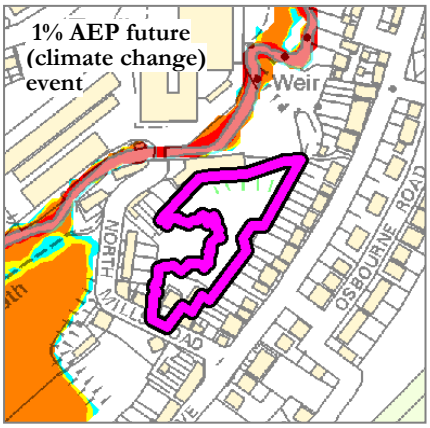
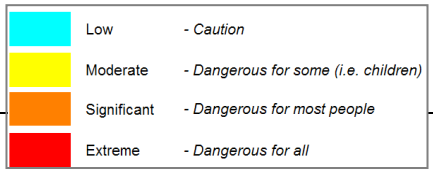
	Land at Kisem, North Mills Road - SHLAA site (no.1/016/0175 part included Appendix C and part excluded Appendix D) located in the crook of North Mills Road just behind Victoria Grove over approximately 1ha.	
Flood maps	Flood Risk – defended / undefended	Flood Hazard (defended) – 2010, breach, future
For full set of SFRA flood maps refer to Appendix C-F 	 	   
Current flood risk (including influence of defences)	Low risk of flooding, with site wholly in FZ1 (<0.1% AEP). For breach scenario, minimal area at risk (1% AEP) and must factor this into any site development (e.g. design finished floor levels above flood levels).	
Future flood risk (including defences)	Low flood risk as FZ1 (<0.1% AEP). Note: future scenario not tested for breach.	
Hazard rating (including defences)	No flood hazard for current / future scenarios except in breach scenario with flood hazard rating classified as mainly low and limited moderate / significant.	
Access / egress (including defences)	No flooding for current / future scenarios except in a breach scenario, and for this reason no access/egress issues.	
Potential for development (including defences)	In FZ1 no restrictions on development other than managing surface water runoff. Development to accommodate breach areas as above (finished floor levels).	
Types of development	No restrictions.	

Table 5.6: Flood Zones/hazards - Land East of Bredy Vet Centre, Sea Road North

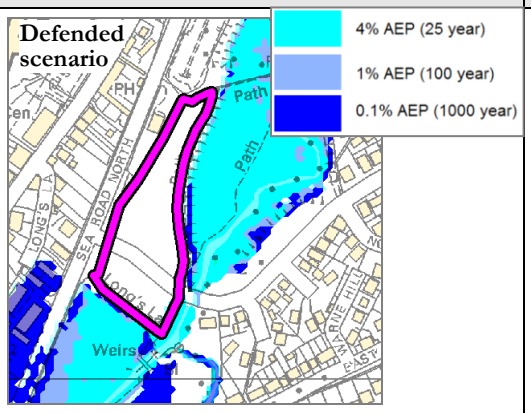
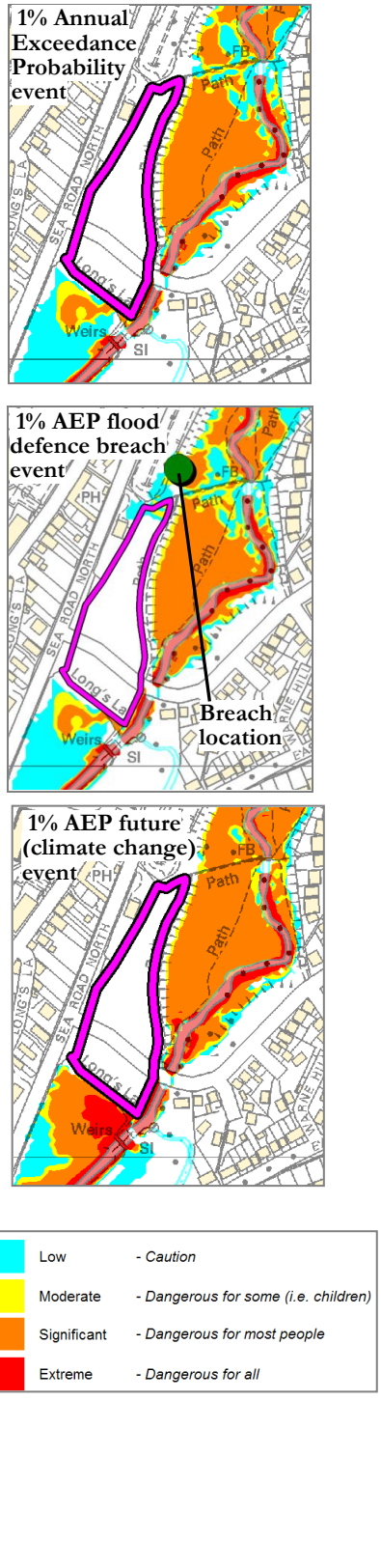
Area of search for potential development	Land East of Bredy Vet Centre, Sea Road North - SHLAA site (no. 1/016/0181) located almost parallel to Sea Road North, in the vicinity of its junction with Jessops Avenue and just to the south west of the current superstore, over approximately 2ha.	
Flood maps	Flood Risk – defended / undefended	Flood Hazard (defended) – 2010, breach, future
For full set of SFRA flood maps refer to Appendix C-F 		
Current flood risk (including defences)	Low risk of flooding, with site wholly in FZ1 (<0.1% AEP). For breach scenario, minimal area at risk (1% AEP) at north end and must factor this into any site development (e.g. design finished floor levels above flood levels).	
Future flood risk (including defences)	Low flood risk as FZ1 (<0.1% AEP). Note: future scenario not tested for breach.	
Hazard rating (including defences)	No flood hazard for current / future scenarios except in breach scenario with flood hazard rating classified as mainly low and limited moderate / significant.	
Access (including defences)	No flooding for current / future scenarios except in a breach scenario, and for this reason no access/egress issues. Functional floodplain extends to meet east and southwest boundaries.	
Potential for development (including defences)	In FZ1 no restrictions on development other than managing surface water runoff. Development to accommodate breach areas as above (finished floor levels).	
Types of development	No restrictions.	

Table 5.7: Flood Zones/hazards - Land adjacent to Jessop Avenue

<table>
<tr><td>Area of search for potential development</td><td colspan="2">Land adjacent to Jessop Avenue - SHLAA site (no. 1/015/0164) located behind the properties on Jessop Avenue and adjacent to the River Asker to the north-easterly extreme of Bridport, over approximately 2ha.</td></tr>
<tr><td>Flood maps</td><td>Flood Risk – defended / undefended</td><td>Flood Hazard (defended) – 2010, breach, future</td></tr>
<tr><td>For full set of SFRA flood maps refer to Appendix C-F

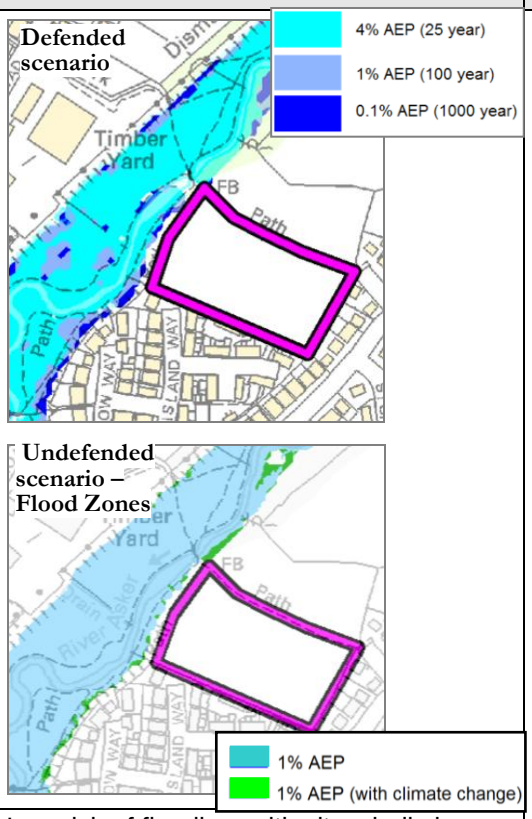
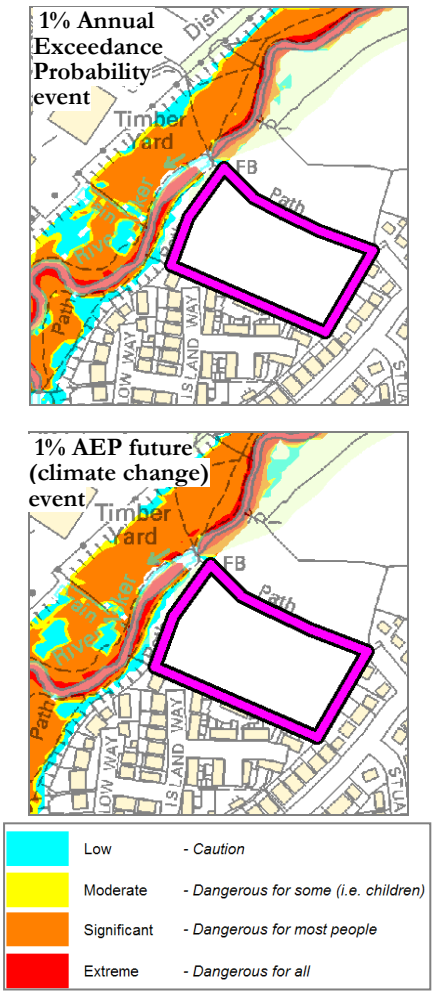
© Crown copyright. All rights reserved. 100024307. WDDC 2010</td><td> 
</td><td> 
</td></tr>
<tr><td>Current flood risk (including defences)</td><td>Low risk of flooding, with site wholly in defended FZ1 (<0.1% AEP).</td><td rowspan="4">No breach scenario tested as no flood risk to site would result</td></tr>
<tr><td>Future flood risk (including defences)</td><td>Low flood risk as FZ1 (<0.1% AEP).</td></tr>
<tr><td>Hazard rating (including defences)</td><td>No flood hazard for current / future scenarios. Breach scenario not tested as no flood defences along this river reach.</td></tr>
<tr><td>Access (including defences)</td><td>No flooding for current / future scenarios.</td></tr>
<tr><td>Potential for development (including defences)</td><td colspan="2">In FZ1 no restrictions on development other than managing surface water runoff.</td></tr>
<tr><td>Types of development</td><td colspan="2">No restrictions.</td></tr>
</table>

Table 5.8: Flood Zones/hazards - Land around Vearse Farm

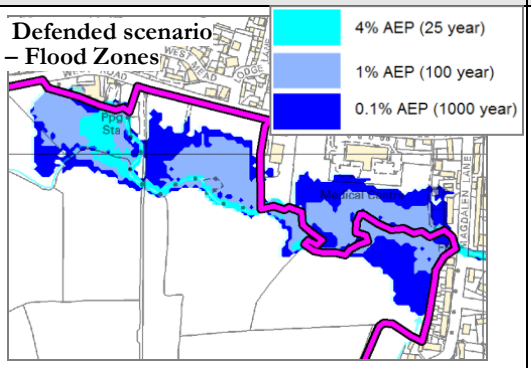
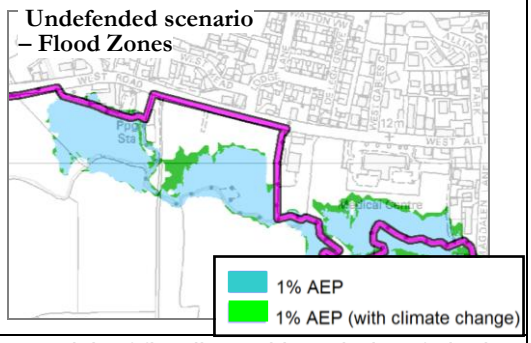
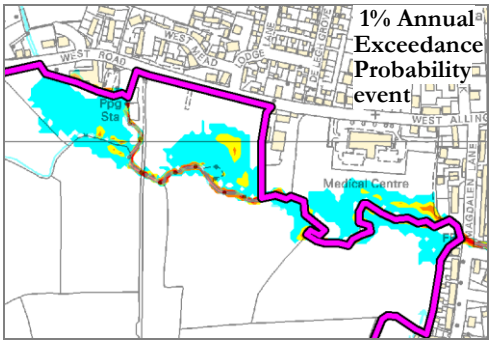
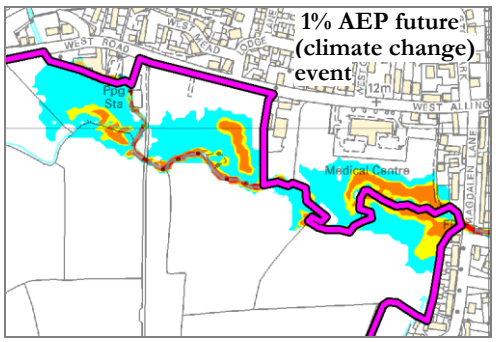
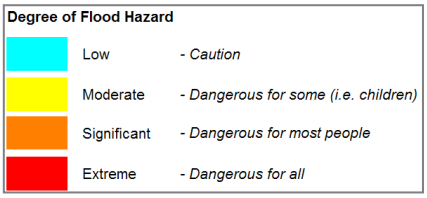
Area of search for potential development	Land around Vearse Farm - excluded SHLAA site (no. 1/015/0164 in Appendix D) located to the West of Bridport, on farmland bounded by the B3162 to the North, the A35 to the West and Broad Lane to the South, over approximately 70 ha. There are two minor watercourses running through its north and north-easterly extent.	
Flood maps	Flood Risk – defended / undefended	Flood Hazard (defended) – 2010, breach, future
For full set of SFRA flood maps refer to Appendix C-F 	 	   **No breach scenario tested as not defended over river reach investigated**
Current flood risk (including defences)	Low risk of flooding, with majority of site in FZ1 (<0.1% AEP), except along river corridor FZ3b Functional Floodplain, FZ3a (1% AEP) and FZ2 (0.1% AEP) along northern boundary (as mapped above).	
Future flood risk (including defences)	As for current flood risk with more extensive FZ areas mapped.	
Hazard rating (including defences)	Within FZ3a mainly low hazard, and with some parts classified as moderate / significant, more extensive in future (climate change) scenario.	
Access (including defences)	Avoid any access/egress along river corridor in FZ3b, FZ3a and FZ2 (except if any essential transport infrastructure).	
Potential for development (including defences)	In FZ1 no restrictions on development other than managing surface water runoff. Restrictions apply in FZ areas subject to Sequential Test and possibly Exception Test (Chapter 2).	
Types of development	Appropriate development in FZ2 includes essential infrastructure, water compatible development and highly/ more/ less vulnerable development, some of which is subject to a specific warning and evacuation plan – see PPS25 Table D.2. Appropriate development is further limited in FZ3b and FZ3a to water compatible and less vulnerable development.	

Table 5.9 Appropriate development for Bridport areas of search *(Flood Zones based on modelling the defended condition)*

Source of Flooding	Description of flood risk	Essential Infrastructure	Water Compatible Development	Highly Vulnerable	More Vulnerable	Less Vulnerable
		Permitted Development				
Flood Zone 1	Majority of areas	**No restrictions on development other than managing surface water runoff**				
Flood Zone 2	Identified for: ➢ South west quadrant, covers majority of site. ➢ Land around Vearse Farm, along river corridor near northern boundary)	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.	Flood control infrastructure; water transmission infrastructure and pumping stations; sewage transmission infrastructure and pumping stations; sand and gravel workings; docks marinas and wharves; navigation facilities; MOD defence installations; ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; water-based recreation (excluding sleeping accommodation); lifeguard and coastguard stations; amenity open space, nature conservation and biodiversity; outdoor sports and recreation and essential facilities such as changing rooms; essential ancillary sleeping or residential accommodation for staff required by uses in this category **subject to a specific warning and evacuation plan**.	Police stations, Ambulance stations, Fire stations, Command Centres and telecoms installations required to be operational during flooding; emergency dispersal points; basement dwellings; caravans mobile homes and park homes intended for permanent residential use, installations requiring hazardous substances consent.	Hospitals; residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels; buildings used for: dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels; non-residential uses for health services, nurseries and educational establishments; landfill and sites used for waste management facilities for hazardous waste; sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.	Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in 'more vulnerable', assembly and leisure; land and buildings used for agriculture and forestry, waste treatment (except landfill and hazardous waste facilities); minerals working and processing (except sand and gravel processing); water treatment plants; sewage treatment plants (if adequate pollution control measures are in place).
Flood Zone 3a	Identified for: ➢ Land around Vearse Farm, along river corridor near northern boundary)	**Development should be avoided.**		**Development should not be permitted**	**Development should be avoided**	
Flood Zone 3b					**Development should not be permitted**	**Development should not be permitted**
Breach flood hazard	Part site affected: ➢ Land off Saint Swithins Road ➢ Land adjacent to Jessop Avenue	Minimal low hazard identified for: ➢ South West Quadrant ➢ Land at Kisem, North Mills Road		No breach hazard: ➢ Land East of Bredy Vet Centre, Sea Road North ➢ Land around Vearse Farm		
Other: canals, reservoirs	No flood risks arising from artificial sources identified for Bridport area					
Tidal Flooding	Assessed as part of the Flood Zones defined above – downstream boundary of modelling at West Bay set as tidal boundary.					
Surface water flooding	Part site affected (modelled risk): ➢ Land around Vearse Farm ➢ South West Quadrant	Historic events (also modelled risk): ➢ Land East of Bredy Vet Centre, Sea Road North ➢ Land off Saint Swithins Road ➢ Land at Kisem, North Mills Road		No surface water hazard: ➢ Land adjacent to Jessop Avenue		
Groundwater flooding	No groundwater flooding incident records identified for any areas of search					
Sewer flooding	No sewer flooding incident records identified for any areas of search					

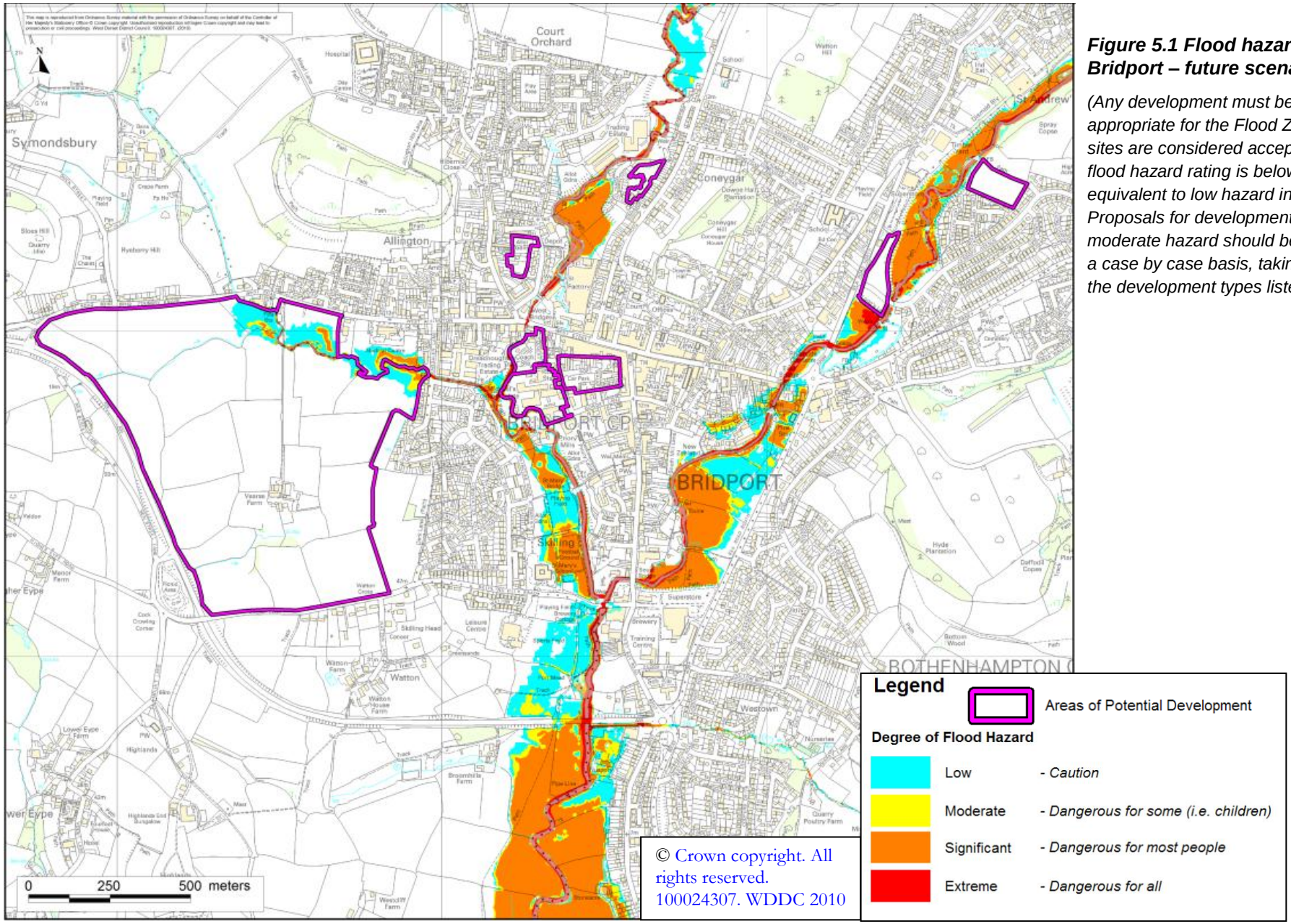


Figure 5.1 Flood hazards in Bridport – future scenario

(Any development must be safe and appropriate for the Flood Zone. Windfall sites are considered acceptable if the flood hazard rating is below 0.75, equivalent to low hazard in legend. Proposals for development in areas of moderate hazard should be considered on a case by case basis, taking into account the development types listed in Table 5.9.

6 Surface water, sewer & groundwater flood risks

6.1 Overview

This chapter considers the surface and sewer flood risks in West Dorset and the recent surface water management plan guidance. The approach to mapping of surface water flood risks is explained, and potential critical drainage areas and groundwater flood risk areas are identified.

Surface water flooding was regarded as the main cause of flooding in the summer of 2007 in England (source: The Pitt Review of the Summer 2007 Floods, Cabinet Office), and contributed to many flood events in the summer of 2008.Urban surface water (or pluvial) flooding is distinct from river flooding in that it occurs *before* runoff enters the watercourse.

Urban surface water flooding tends to occur shortly after intense rainfall and is the result of the drainage system being unable to convey all surface water runoff; either because the drainage system is full or the water cannot find its way into the drainage system due to the high rate of runoff or localised issues such as culvert or road gully blockage.

One factor to highlight is that underground drainage systems are traditionally designed for 1:30-year return period flows, whereas for planning purposes a 1:100-year climate change scenario must be considered.

6.2 Flood risks

As part of the Level 1 SFRA (2008) a series of consultations were undertaken to identify known local drainage issues resulting in surface water flooding. These incidents have been added to the current Level 1 SFRA maps. Details of sites affected by surface water flooding can be obtained by referring to the Level 1 GIS database.

The PPS25 Practice Guide requires that Level 2 SFRAs should identify the location of critical drainage areas and the need for Surface Water Management Plans (SWMPs). Critical drainage areas are locations where surface water flooding is known to be a concern, either through prior incidents being recorded or indicative mapping highlighting potential areas at risk.

Information provided by the Environment Agency (December 2009) and Wessex Water (January 2010) has been used to indicate areas that could be regarded as having critical drainage issues for detailed study in the forthcoming SWMP.

Developers should check for updated surface water flooding records after any significant flooding incidents, to ensure that the best available information is used to inform site allocations and windfall sites.

6.3 Mapping of surface water flood risk

The set of figures in Appendix B show areas of potential surface water flood risk, derived from two sources: the Environment Agency indicative surface water flooding maps and Wessex Water DG5 property flooding records. In interpreting these maps it is important to appreciate the source and derivation of the information shown.

Areas susceptible to surface water flooding. These Environment Agency maps were produced using a simplified method that excludes underground sewerage and drainage systems, smaller over ground drainage systems and buildings. They provide a general indication of areas which may be more likely to suffer from surface water flooding.

The maps indicate three degrees of surface water flood risk, categorised qualitatively as 'more', 'intermediate', and 'less'. In the flood maps (Appendix B) the areas representative of 'more', 'intermediate' and 'less' surface water flood risk are reproduced.

The risk areas, shown as 'less' risk, 'intermediate' risk and 'more' risk, have been derived through simplistic modelling techniques that 'spread' water over depressions in the land surface. Therefore, they are not necessarily representative of historic surface water flooding, but are useful combined with DG5 records to focus attention on areas likely to be regarded as critical drainage areas.

The maps (Appendix B) include the following information from Wessex Water:

- DG5: properties at risk of flooding from sewers due to hydraulic overload
- Known External flooding – these have been verified as being caused by inadequate hydraulic capacity of sewers
- Externals awaiting HLA's – these are awaiting the cause of flooding to be verified through the HLA.

DG5 incident locations: highlight properties where Wessex Water is aware of external flooding up to 1 in 30 year (3.3% AEP) flood magnitude. As such, they are not necessarily representative of flood risk at higher return periods. They are also indicative of historic flooding, and therefore may not be representative of future flood risk. Nevertheless, they do represent useful information, which, when combined with other information, can aid the identification of critical drainage areas.

Updated records provided by Wessex Water for the SFRA Level 2 are included in Appendix C.

6.4 Potential critical drainage areas

The planned SWMPs will focus on surface water flooding problems in Bridport and Dorchester. There are however many other urban areas susceptible to surface water flooding in West Dorset (refer to flood maps in Appendix B). Based on SFRA Level 1 analysis of actual flood incident records the following areas were identified where surface water was the principal flooding mechanism.

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

Chickerell has recorded nearly 40 incidents of flooding attributed to surface water, Piddlehinton close to 30 incidents and the remainder between 10 and 20 recorded incidents. Dorchester, Sherborne and Lyme Regis do not feature in this list based on the records available.

6.5 Groundwater flood risk areas

Again based on SFRA Level 1 analysis the following areas are identified where groundwater flooding was the principal flooding mechanism (* indicates several records).

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

Groundwater flooding is often difficult to differentiate from other forms of flooding, although the Environment Agency do record this information and will be seeking to develop groundwater flood risk mapping in the future. There are currently no specific Environment Agency policies that cover groundwater flood risk (a groundwater flood forecasting and warning policy is to be introduced later in 2010). As groundwater flooding is often localised, response to and management of that risk will depend upon the specific characteristics of the flood event.

7 Flood risk management policy

7.1 Overview

Policy recommendations for the planning system related to development are presented in this chapter, including location, possible restriction, appropriate mitigation, windfall sites and developer contributions. This is mainly general guidance of relevance to West Dorset.

7.2 Planning policy implications

The complex range of issues that result from this Level 2 SFRA have wide ranging implications for future planning in West Dorset. The emerging LDF will require detailed policies to ensure development takes place in safe and sustainable locations, while making the best use of the district's scarce developable land.

Policies are likely to be too detailed for inclusion in the Core Strategy alone and one way of addressing these would be to prepare a Supplementary Planning Document on the subject of flood risk.

The Core Strategy provides the strategic policy basis for directing development away from areas at risk of flooding and ensuring that where development is at risk, it incorporates appropriate flood resistance and resilience measures. The Supplementary Planning Document could provide additional detail to clarify how the LPA and developers should deliver the Core Strategy policies.

Such a Supplementary Planning Document on flood risk should be published in advance of delivery of any site specific allocation identified in the LDF that wholly or partly lies within future flood risk areas identified in this report. This would allow site-specific and/or area-wide flood mitigation measures to be assessed as part of the planning process.

7.3 Location specific development policies

In allocating sites for development WDDC is required to adopt the climate change fluvial and tidal flood zone maps for the lifetime of the proposed development, as detailed below, in addition to any other sources of flooding (surface water, groundwater and sewer). Location specific development policies detailed in Table 9.1 are recommended for these areas.

When considering the layout of new developments, information about flood depths and velocities should be used to minimise any flood risk or ensure the level of risk is appropriate to the type of development being proposed. For any sites situated behind defences the defended flood zones should also be considered, together with information about flood depths and velocities.

7.4 Possible restricted development areas

Possible restricted development areas are areas of greatest risk, beyond mitigation. When development pressures means that it is necessary to consider development in areas that are at medium or high flood risk and there are no other suitable alternative sites for development after applying the Sequential Test the nature of the flood hazard should be considered. This will allow a sequential approach to site allocation to be adopted in each flood zone.

When allocating sites for development and designing safe access and exit routes, the combinations of depth and velocity on the routes should correspond to the category of 'very low hazard – caution'. The Environment Agency will look to object to development where the flood hazard is at least 'danger for some'. Residential development should be avoided in all areas where the flood hazard is categorised as 'danger for some' or greater or where the egress route from the site to safe areas outside the floodplain involve crossing such flooded areas.

Refer to the flood maps (in appendices) to identify the areas of greatest hazard.

7.5 Developable zones: appropriate mitigation

Development should not be located in flood risk areas unless the Sequential Test, and where necessary, the Exception Test have shown that it is necessary. Where this is the case, a mitigation strategy to deal with flood risk is required to ensure any development will be safe.

Wherever possible the construction of new defences to protect new development should be avoided, since there is a residual risk that the defence may breach or be overtopped. Possible strategic solutions to manage flood risks within Bridport are identified later (Chapter 11).

Any development that requires the construction of new defences will need to show that other options (e.g. flood storage areas) have been considered and are not feasible and that the defences are compatible with the long-term flood risk management policies for West Dorset as detailed in the CFMP and SMP (Chapter 3).

Opportunities may exist to reduce overall flood risk through the redevelopment of existing uses, through innovative design, drainage or other forms of flood mitigation. The merits of such schemes will need to be clearly demonstrated by the applicants and supported by a FRA and drainage impact assessment.

7.6 Areas for consideration of windfall applications

Windfall sites are those sites which become available unexpectedly and therefore have not necessarily been considered as part of the forward planning site allocation process. WDDC should consider windfall applications for sites with an equal or lower risk of flooding as those sites that have already been allocated.

For the purpose of development control, policies may need to be included for unallocated windfall sites that will set out broad locations and quantities of windfall development that will be acceptable. Windfall sites should be subject to the same consideration of flood risk as other allocated sites.

The Sequential Test (as discussed in Section 2.6) should be applied to windfall sites, unless the area in which they occur has been sequentially tested on the basis of this SFRA. Where the Sequential Test has not been applied to the site or area, proposals will need to be dealt with on an individual site basis and the developer will need to provide evidence to WDDC that they have adequately considered other reasonably available sites, both allocated and unallocated.

A change of use to a higher flood risk Vulnerability Classification as set out in Table D2 of PPS25 will generally not be subject to the Sequential Test however the application will still be subject to the Exception Test where applicable and in all cases a FRA will be required to demonstrate that the development is safe.

It is likely that applications for windfall sites would only be passed subject to appropriate mitigation measures being put in place, for example the building's structure being designed to withstand the hydrostatic pressure of flood water.

7.7 Developer contributions for flood defences

Defra has national policy responsibility for FRM and provides funding (through 'grant in aid') to the Environment Agency, which also administers grant for capital projects to local authorities and internal drainage boards. The Environment Agency is the principal FRM operating authority, and generally supervises all matters relating to flood defence including:

- building and maintaining defences and other management measures on designated Main Rivers
- flood forecasting and warning
- improving public awareness of flood risk

The Government has previously announced that under the Environment Agency's new strategic overview role in England for all sources of flood risk, local authorities (County or Unitary, where these exist) will take responsibility for surface water management, including Surface Water Management Plans.

Local authorities, working through local and regional resilience forums, lead in:

- planning for emergencies, including flooding events
- dealing with the consequences of flooding such as humanitarian assistance, emergency housing and clear up operations
- building and maintaining defences on ordinary watercourses.

PPS25 (Appendix G) sets out the circumstances under which it may be necessary to permit development that requires the provision of FRM including flood defence and mitigation works. This is a key consideration to ensure that development is 'safe' against flood risks over its lifetime. PPS25 states the following about contributions that developers should make:

- developers cannot normally call on public resources to provide defences and other measures for their proposed developments where they are not already programmed for the protection of existing development;
- where previously programmed defences and other measures have already been provided at public expense to protect existing development, these may also provide opportunities for new development, provided this does not itself add to flood risk at other locations;
- for some previously developed land, public investment in land remediation and infrastructure may include an element of flood defence and mitigation investment as a means of bringing such land into beneficial use;

- where the two preceding considerations do not apply but where other material considerations outweigh the risk of flooding, any necessary flood risk management, including defences or flood alleviation works required because of the development or which form a part of that development should normally be fully funded by the developer;
- where such works would provide a wider benefit, the funding provided by developers may be proportional to the benefits to them. For instance, the development might fund the provision of the defences or other measures which would then be vested in and maintained by the operating authority (which authority depends on classification of watercourse).

To continue to protect existing areas at risk there is a need for continued investment in flood risk management, particularly in light of the climate change flood risks predicted. Any developer contributions to programmed offsite FRM solutions can be expected to be required on a proportionate basis i.e. the number planned units divided by the number of existing units benefiting from the flood defence scheme. On-site provision of FRM measures will be funded by developers.

8 Advice for flood risk management

8.1 Overview

Advice for flood risk management considers Sustainable Drainage Systems (SuDS), appropriate flood avoidance, site layout, resistance and resilience measures, and flood evacuation plans, and how these might be relevant to West Dorset District.

Best practice guidance (CIRIA C635) for piped systems and SuDS considers the design and management of urban sewerage and drainage systems to reduce the impacts that arise when flows occur that exceed their capacity. It includes information on the effective design of both underground systems and overland flood conveyance. It also provides risk assessment procedures and planning to reduce the impacts that extreme events may have on people and property within the surrounding area.

8.2 SuDS – appropriate locations and types

Surface water drainage systems developed in line with the ideals of sustainable development are collectively referred to as Sustainable Urban Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement.

SuDS objectives are to minimise the impacts from the development on the quantity and quality of the runoff, and maximise amenity and biodiversity opportunities. FRA's must investigate the feasibility of all SuDS techniques within their development boundary. To achieve the SuDS objectives during development, emphasis must be drawn towards incorporating a SuDS management train which aims to mimic natural catchment processes. This management train comprises a hierarchical (sequential) series of measures comprising;

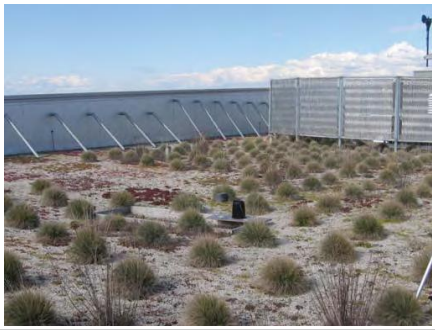
Prevention	these measures include rainwater re-use and harvesting and pollution prevention - e.g the use of water butts and other rainfall storage.
Source Control	these measures attenuate runoff at source – including green roofs, local soakaways and pervious paving.
Site Control	where greater attenuation volumes are required (in addition to source control measures), site or area drainage may be routed to site controls, - e.g. filter strips, swales, pervious paving, attenuation crates, infiltration basins and devices, detention basins, ponds and wetlands.
Region Control	these measures include the management of run-off from several sites integrated into a regional system- typical controls are as for site controls above.

PPS25 requires that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development (PPS25 Annex F paragraph F10) for storm events up to and including those with a 1 in 100 year return period. The Environment Agency will normally require that the redeveloped site runoff is to provide a degree of betterment on the existing site runoff whilst allowing for climate change.

Any betterment rates or conditions on the redeveloped sites runoff should be agreed during planning stages. This ensures that the effect of the proposed development on downstream water courses and areas is minimal, even when climate change occurs. As a result, SuDS can have a potential positive effect by reducing flood risk at all sites. This report recommends that SuDS should be a requirement for all new development. Space should be specifically set-aside for SuDS and used to inform the overall site layout.

The selection of SuDS within a development is specific to the site conditions and criteria to be met. The SuDS manual – CIRIA C697 published by the Construction Industry Research and Information Association (CIRIA) provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems to facilitate their effective implementation within developments.

The selection of SuDS to be implemented within the developments will be specific to the site conditions, required attenuation volumes, permitted outflow rates and allowable SuDS techniques. Local authorities may preclude the use of some SuDS due to relevant maintenance and adoption issues.

Wetland	**Pond**	**Dry Basin (in foreground)**
		
Swale	**Permeable paving**	**Filter drain/ strips**
		
Attenuation tank	**Green Roof**[1]	**Rainwater harvester**
		

(Source: Dti 2009**)**

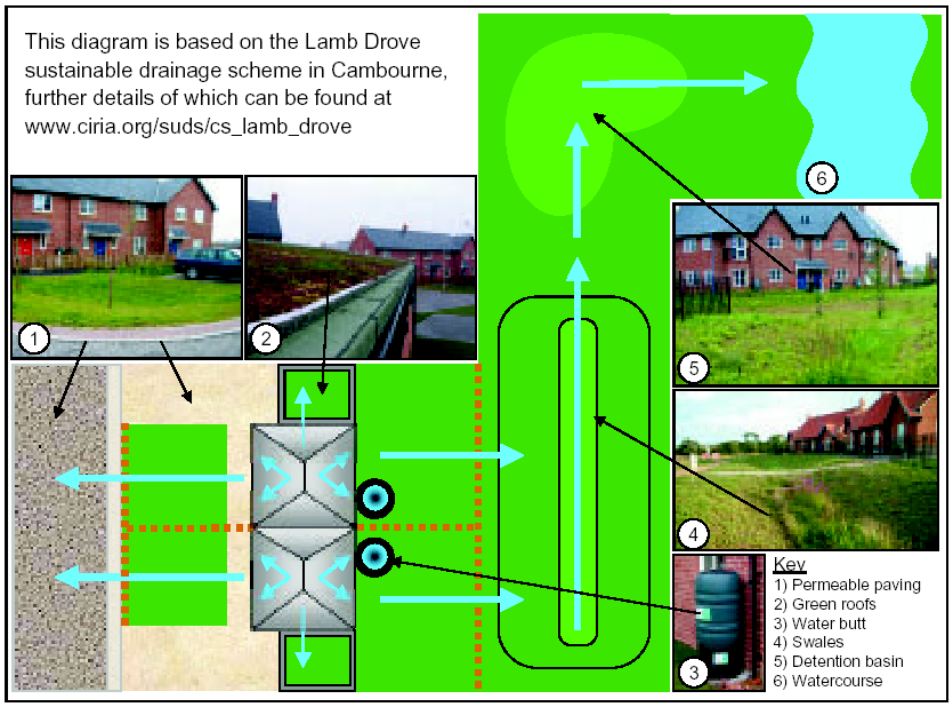


Figure 8.1 Diagram of how SUDS can be used at a local scale
(Source: The Pitt Review, 2007. Learning Lessons from the 2007 floods, Cabinet Office)

Figure 8.1 shows examples of SuDS techniques. Where the soils are predominantly impermeable (e.g. clayey) the use of infiltration techniques will be limited. Appropriate SuDS will need to be established through a site specific drainage assessment of local geological and groundwater conditions, including specific site investigations to assess the capabilities of infiltration techniques.

Figure 8.2 (next page) illustrates the infiltration potential for SuDS across West Dorset, based on a simple low / medium / high rating determined from the underlying solid geology classifications (solid geology map included in the SFRA Level 1 report). This figure is intended to be indicative only. It shows the high potential for infiltration SuDS techniques mainly in the central and south-eastern part of West Dorset. As noted above, infiltration potential should be assessed in specific site investigations.

The key loss of benefit from not utilising infiltration is that these SuDS systems attenuate peak flows but do not significantly reduce flood volumes. Discharging attenuated site runoff directly to watercourses should be used instead of routing flows through the sewer network. However the Environment Agency would expect that the initial assumption of any drainage designer would be to include infiltration where possible.

Large increases in impermeable areas contribute to significant increases in surface runoff volumes and peak flows and could increase flood risk elsewhere unless adequate SuDS techniques are implemented. It is relatively simple to avoid the increase in peak flows by providing attenuation or detention storage that temporarily store the required amounts of runoff within the site boundary. The use of water recycling and permeable paving can allow trans-evaporation of up to 20% of the water attenuated.

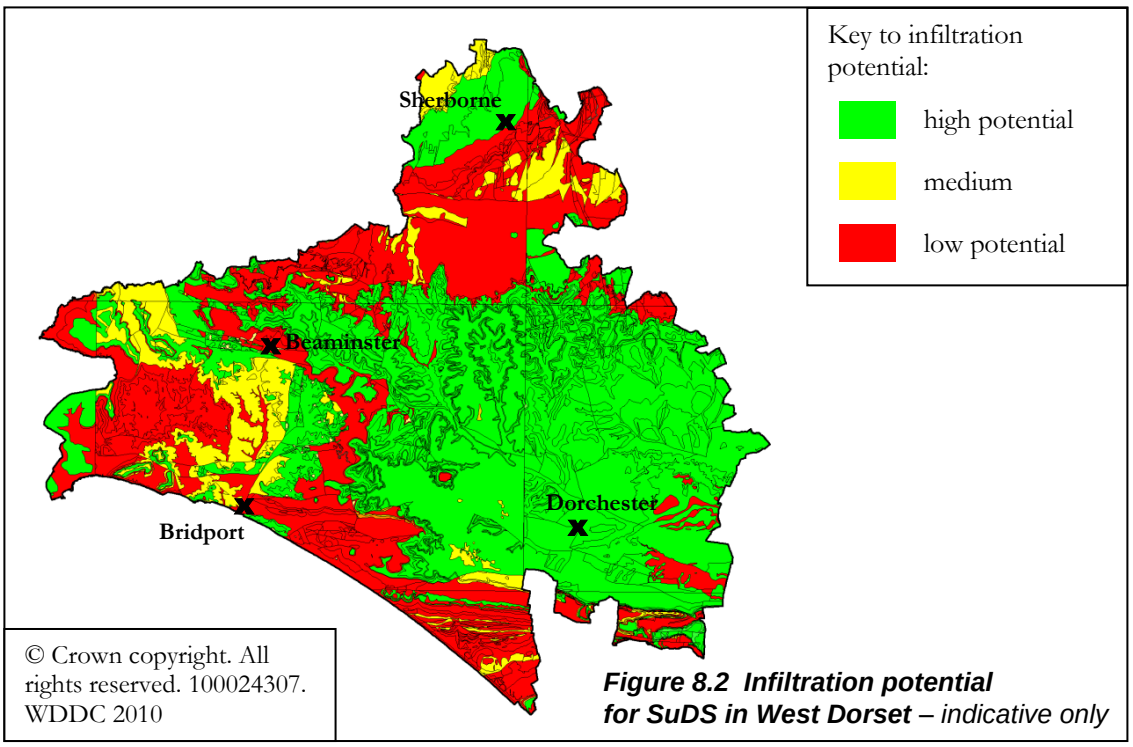


***Figure 8.2 Infiltration potential for SuDS in West Dorset** – indicative only*

Specific attenuation could comprise of:

- Swales that can be constructed alongside roads and within green areas to transfer runoff to storage facilities, and also provide limited storage. Infiltration swales are preferred as they keep dry between rainfall events and so avoid becoming marshy, and allow as much infiltration as the surrounding ground can accommodate.
- Pond / dry basin to provide the majority of the volume required to attenuate the surface water runoff.
- Permeable/porous paving may be used within development areas, subject to consideration of the adoption issues with the highway department, to attenuate runoff at source as it will collect the rainfall below the surface and discharge it after a significant delay.

In October 2008, the Government changed the General Permitted Development Order making (inter alia) the hard surfacing of more than five square metres of residential front gardens only permitted where a permeable surface is used (CLG and Environment Agency, 2008). The purpose of this policy change is to slow any increase in the loss of natural drainage storage and the incidence of surface water flooding.

8.3 Appropriate resistance and resilience measures

The best way to avoid flood risk is to locate the development outside areas of flood risk i.e. Flood Zone 1. Where there are no suitable sites in lower flood risk areas, the Sequential Approach should be applied within the development site to locate the most vulnerable elements of a development in the lowest risk areas.

Site layouts should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with more flood-compatible development (managed public parking, open space etc.) in the highest risk areas. The acceptability of parking use will be dependant on the depth and the ability to manage parking during potential flood events.

Where development is considered necessary and it is not possible to minimise flood risks to an acceptable level through the use of defence structures, flood storage areas or other alternatives, the less desirable resort is to minimise the impact of flooding through individual building design by raising finished floor levels and providing safe access routes.

Other resistance and resilience measures (see Figure 8.2) are likely to be considered as unacceptable on their own for new development since the hazard posed by flood waters still remains, particularly for access, egress and the supply of utilities. Indeed, on their own these measures are unlikely to be suitable as the only mitigation measure implemented, but may be appropriate where land is being used for water-compatible or change of use to less-vulnerable building types (see Table D.2 of PPS25) where there is not an inappropriate risk to people or assets.

Further requirements to enable development may include appropriate flood warning, raised floor level and raised ground levels that allow safe access and egress, i.e. dry pedestrian egress should be possible above the 1% fluvial or 0.5% tidal flood level plus climate change. Should this not be possible an egress route which has a flood hazard rating of less than 0.75 and considered to have a low degree of flood hazard, as identified in Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2320/TR1, shall be provided. Emergency vehicles should be able to access the site during an extreme event (an event with an annual probability of 0.1%).

Advice from the Local Authorities emergency planning officer and the emergency services should be sought on whether they will be able to provide emergency evacuation from the development during exceedance events (events in excess of a design event, i.e. with an annual probability of between 0.5% and 0.1% for tidal events or 1% and 0.1% for fluvial events).

Individual property protection can be divided into two main types (Figure 8.3):

- Flood resistance measures (also known as dry proofing) are those put in place to prevent flood water entering a building. These measures may be acceptable for a change of use. For new development elevating finished floor levels above future flood levels would be more appropriate.
- Flood resilience measures (also known as wet proofing) accept that water will enter the building but through careful design will minimise damage and allow the re-occupancy of the building quickly.

As resilience measures still allow water to enter a building, these should not normally be considered for new developments.

Making a building flood resistant aims to prevent flood water entering the building. This approach relies on flood barriers and the building structure. The flood barriers are placed across doors and air vents and may include non-return valves on drains. It is difficult to effectively block all flooding routes, e.g. where services enter the building.

These types of flood resistant measures are most effective for short duration flooding with simple measures estimated to be effective for several hours and more complex measures effective for several days (Scottish Executive, 2004).

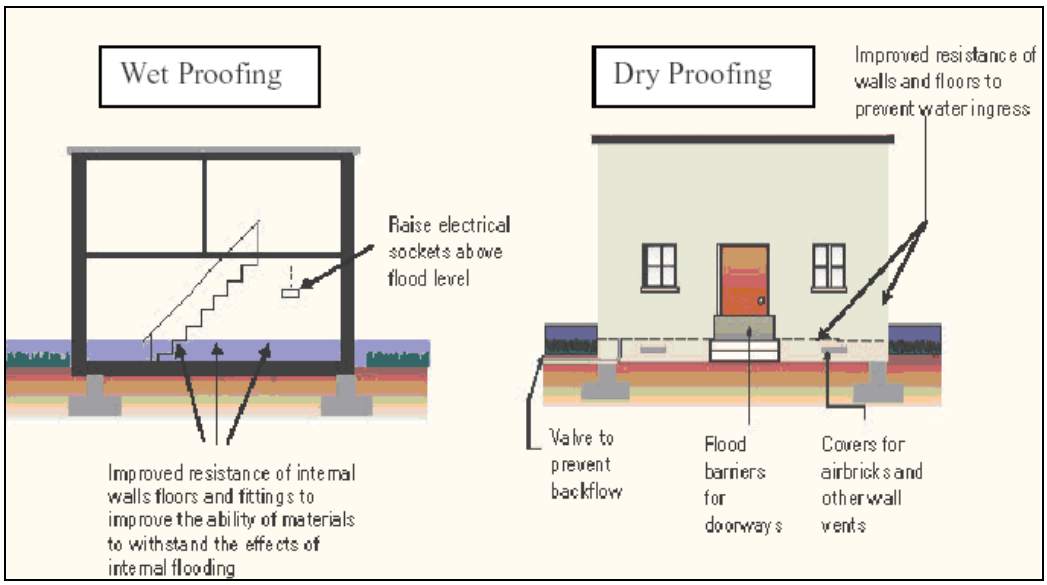


Figure 8.3 Examples of flood resistance and resilience measures
(Source: Adapted from Scottish Executive, 2004)

Making a building flood resilient involves a number of measures to make the building able to cope with being inundated with flood water. Work may include the raising of the services, in particular the service meters and electrical wiring above the flood level. Some examples of flood resilience measures include:

- replacing floors with concrete;
- removing carpet and replacing with clay tiles;
- replacing open cell insulation with closed cell insulation.

Since any flood management measures only manage the risk of flooding rather than remove it, flood resistance and flood resilience may need to be incorporated into the design of buildings and other infrastructure behind flood defence systems. If a defence does fail, the area behind the defence may be rapidly inundated with high velocity flood water. As such, buildings should be structurally designed to withstand the expected water pressures, potential debris impacts and erosion which may occur during a flood event.

8.4 Flood evacuation plans

Experiences during the 2007 floods in the UK and the subsequent report by Sir Michael Pitt to Government recognised that it is not just the emergency services that have roles in flooding emergencies. Those who plan developments and then those who live and work in areas, which could be flooded, have personal roles to ensure that they are prepared and can respond when warned that flooding is imminent.

Flood evacuation plans should be used to manage residual flood risks. Key considerations to ensure that any new development is safe are:

- whether adequate flood warnings will be available and that people using the development will act on them;
- that safe access routes located above design flood levels (i.e. 1:100-year fluvial or 1:200-year tidal flood level plus climate change) are available and that individuals will be able to use these routes unaided to retreat to safe ground beyond the flooded area;
- that emergency vehicles can access the site in an extreme flood event (1:1000 year) and are able to evacuate individuals to safe locations.

For sites at risk of flooding, developers will be required to prepare a Flood Evacuation Plan as part of their FRA. PPS25 considers it best practice that developers take advice from the emergency services when producing an evacuation plan. The emergency route shall not require people to enter into flood water which is considered to be a danger for some, as identified in the Defra (2005) R&D Technical report, FD2320/TR2.

The Flood Evacuation Plan must be a 'live' document capable of use in a flood emergency; owned and understood by those with responsibilities for Health & Safety; by staff or employees who have roles within the plan or those who live in the development. Factors to be considered will vary according to the nature of the development proposed and the potential severity of flooding, and may include:

- The availability of flood warning systems - individual properties and wider sites can be registered with the Environment Agency's warning service 'Floodline' that provides information on the current and future flood danger.
- Occupants' awareness of the likely frequency and duration of flood events. Particular attention should be given to communicating warnings to vulnerable people, e.g. those with restricted mobility or impaired hearing or sight.
- Responsibility for owning / managing the plan that must be reviewed at least annually and those who have a role within it must be aware of its content by training/briefings as well as any exercise to test its capability.
- Evacuation routes / plans and warnings will be of particular importance where premises are used by transient occupants. It should be assumed that occupiers will not have local knowledge and will need to be guided to a safe route/location.
- The availability and knowledge of staff to respond to a flood warning including preparing for evacuation, deploying flood barriers and other relevant equipment or procedures.
- If critical workers are to remain on site; have risk assessments been made? How will they communicate to and with management or emergency services? Etc.
- The possible need for emergency services to rescue vulnerable occupants and the feasibility of doing so, and to liaise with neighbouring site(s) in preparing plans.
- Measures to re-establish normal use, following a flood event.
- Plans should indicate the safest routes to leave as early evacuation before floodwaters affect those routes is one option. If routes are affected then ensuring there is a safe location to stay within the building, rather than evacuating.

9 Advice for site-specific flood risk assessments

9.1 Overview

This chapter provides advice for planners and potential developers for site specific FRAs. The following recommendations are in accordance with PPS25 and the broad objectives of the CFMP and SMP. To help understand requirements for FRAs, reference should be made to the flood risk information in previous chapters.

Summary information from previous chapters is presented in Table 9.1 (next page), which considers the potential development in Bridport, flood risks in terms of surface water and sewer flood risks (Chapter 6), flood depths, velocity and hazard and potential solutions to reduce the risks (Chapter 5) and need for an emergency evacuation plan (Chapter 8).

9.2 Sequential approach using the SFRA

Future development within all areas will require application of the sequential approach at the site level (sequential design) to ensure that the more vulnerable development (e.g. residential housing) is located within an area of the site at least risk of flooding (i.e. Flood Zone 1).

Areas at higher risk of flooding should ideally be set-aside as open space for amenity and potential environmental enhancements to satisfy requirements of the Sequential Test (see Table D.3. of PPS25 for other uses). For the more vulnerable use it is necessary to ensure that the requirements of the Exception Test are satisfied. The Exception Test will need to demonstrate that the development will provide wider sustainability benefits and will not increase flood risk at the site or downstream.

The vulnerability from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.

Table 9.1 Flood risk assessment issues specific to Bridport

FRA issue	Areas of search for potential development					
	South west quadrant	Land off St. Swithins Road	Land at Kisem, North Mills Road	Land East of Bredy Vet Centre, Sea Road North	Land adjacent to Jessop Avenue	Land around Vearse Farm
Potential development	Mixed use	Residential	Residential	Residential or Employment	Residential	Mixed use
Key flood risk issues	Tidal & fluvial (localised); surface water	Tidal & fluvial (localised); surface water	Tidal & fluvial (localised); surface water	Tidal & fluvial (localised); surface water	Tidal & fluvial (localised)	Tidal & fluvial (localised); surface water
Typical flood depths: defended 1% AEP	No flooding for current defended condition	No flooding for current defended condition	No flooding for current defended condition	No flooding for current defended condition	No flooding for current defended condition	Localised up to 0.5m
Typical flood velocity: defended 1% AEP	As above	As above	As above	As above	As above	Localised up to 1 m/s
Typical flood hazard: defended 1%+CC	As above	As above	As above	As above	As above	Localised 'low'
Breach scenario: 1%AEP	- area <10% impacted - depth: 0.5-1.0m - velocity: 0-0.25m/s - hazard: low	- area 40% impacted - depth: 0.5-1.0m - velocity: 0-0.50m/s - hazard: low-significant	- area <5% impacted - depth: 0.0-0.5m - velocity: 0-0.25m/s - hazard: low	- area <5% impacted - depth: 0.0-1.0m - velocity: 0.0-0.25m/s - hazard: low-moderate	No breach scenario tested as no flood risk to site would result	No breach scenario tested as no flood risk to site would result
Solution to flood risk issues to be considered	Build floor levels above breach scenario flood levels	Build floor levels above breach scenario flood levels	Build floor levels above breach scenario flood levels	Build floor levels above breach scenario flood levels	Not applicable	- Local flood banks - Flood resilience
Floodplain storage compensation	Not required	Not required	Not required	Not required	Not required	Requirement depends on development layout
Emergency evacuation plan	Not required	Not required	Not required	Not required	Not required	Requirement depends on development layout

9.3 Using SFRA results to inform flood risk assessments

This SFRA provides an assessment of flood risk at a level appropriate to inform WDDC's planning decisions. Site specific FRAs need to be prepared for specific development sites by prospective developers.

The following reflects the minimum requirements under PPS25 for a FRA (reference should also be made to Tables D.1-D.3 in PPS25) on the basis of the fluvial/tidal flood risk identified for the site for the lifetime of the proposed development.

The FRAs should make reference to the best available information. In the case of Bridport, this SFRA Level 2 provides detailed information on flood risks for the defended and breach scenarios based on modelling. For the rest of West Dorset, reference should be made to the Level 1 SFRA flood maps. The surface water flood risk map provided with this SFRA Level 2 updates that prepared in the SFRA Level 1.

Sites in Flood Zone 1

Many of the sites being considered by WDDC for future development, as part of the 2008 Strategic Housing Land Availability Assessment, lie within Flood Zone 1. The following details the requirements for development in Flood Zone 1. To prevent a piecemeal approach, if large sites are split into units less than one hectare a FRA will still be required.

- In accordance with Table D3 of PPS25, any type of development can be located in Low Probability Flood Zone 1.
- The vulnerability of the development from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.
- Floor levels should be situated above the 100 year (fluvial) and 200 year (tidal) plus climate change predicted maximum level plus a minimum freeboard of 600mm.
- 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.
- Where the site forms part of a dry island surrounded by ground which is now or will be subject to classification as Flood Zone 3 consideration will need to be given to how safe access will be achieved in accordance with FD2320.
- The potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, with appropriate mitigating action, should be incorporated in a FRA for the site.

  This should take the form of a Drainage Impact Assessment (DIA), required to demonstrate that runoff from the site is the same as in the predevelopment case, thereby ensuring flood risk is not increased (though wherever possible, betterment should be achieved). This will involve the use of SuDS techniques which should take into account the local geological and groundwater conditions. Where possible these should be strategic SuDS. Space should also be set-aside for SuDS at the master planning stage.

Sites in Flood Zone 2

Where possible, as part of the sequential approach process, alternative sites in Flood Zone 1 should be considered in preference to those in Flood Zone 2. Only two sites in Bridport (South west quadrant and Land around Vearse Farm) of the six sites of potential development are assessed as containing Flood Zone 2 (defended scenario). The following details the requirements for development in Flood Zone 2.

- In accordance with Table D3 of PPS25, land use within Medium Probability Flood Zone 2 should be restricted to the 'essential infrastructure', 'water compatible', 'less vulnerable' and 'more vulnerable' categories. Only if the Sequential Test process has been carried out and passed can development occur in Flood Zone 2.
- 'Highly vulnerable' uses in Flood Zone 2 will have to pass the Exception Test.
- A FRA will be required, which should confirm flood extents and levels within the site.
- The development should not increase flood risk elsewhere, and opportunity should be taken to decrease overall flood risk.
- Floor levels should be situated above the 100 year (fluvial) and 200 year (tidal) plus climate change predicted maximum level plus a minimum freeboard of 600mm.
- Dry pedestrian access to and from the development should be possible above the 1 in 100 year (fluvial) and 200 year (tidal) plus climate change flood level.
- The development should be safe, meaning that: people (including those with restricted mobility) should be able to remain safe inside the new development up to a 1 in 1000 year event; and rescue and evacuation of people from a development (including those with restricted mobility) to a place of safety is practicable up to a 1 in 1000 year event.
- If the land use of the development proposed is 'highly vulnerable', consideration should be given to the incorporation of flood resistance and resilience measures
- 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.
- SuDS should be implemented to ensure that runoff from the site (post development) is reduced. Space should be set-aside for SuDS at the master planning stage.
- The vulnerability of the development from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.
- Residents should be made aware that they live in a flood risk area. The Environment Agency plan to make their flood warning service 'opt-out' instead of 'opt-in', but until such time residents should be encouraged to sign up to Floodline Warnings Direct, should a Flood Warning system exist (as indicated by the Level 1 SFRA).
- Car parking needs to be safe, especially in terms of flood warning and overnight parking areas.

Sites in Flood Zone 3a

Wherever possible, development in Flood Zone 3a should be avoided, unless it can be clearly demonstrated that the overall level of flood risk in an area will be reduced to an acceptable level as a result of the development. Only one site in Bridport (Land around Vearse Farm) of the six sites of potential development is assessed as containing Flood Zone 3a (defended scenario). The following details the requirements for development in Flood Zone 3a.

- Only if the Sequential Test process has been carried out and passed can development occur in Flood Zone 3a
- Land use with High Probability Flood Zone 3a should be restricted to the 'less vulnerable' and 'water compatible' uses.
- 'Essential Infrastructure' and 'More vulnerable' uses in Flood Zone 3a will have to pass the Exception Test.
- An FRA should be prepared for the site, which should confirm flood extents and levels.
- Properties situated within close proximity to formal defences or water retaining structures (reservoirs) will require a detailed breach and overtopping assessment to ensure that the potential risk to life can be safely managed throughout the lifetime of the development. The nature of any breach failure analysis should be agreed with the Environment Agency.
- The development should not increase flood risk elsewhere, and opportunities should be taken to decrease overall flood risk.
- If any part of the development falls within the floodplain, assess any compensatory flood storage requirements as part of the FRA.
- Floor levels should be situated above the 100 year (fluvial) and 200 year (tidal) plus climate change predicted maximum level plus a minimum freeboard of 600mm.
- Dry pedestrian access to and from the development should be possible above the 1 in 100 year (fluvial) and 200 year (tidal) plus climate change flood level. The provision for access specified for windfall sites also apply – refer to Section 5.6.
- The development should be safe, meaning that: people (including those with restricted mobility) should be able to remain safe inside the new development up to a 1 in 1000 year event; and rescue and evacuation of people from a development (including those with restricted mobility) to a place of safety is practicable up to a 1 in 1000 year event.
- If the land use of the development proposed is 'more vulnerable' or 'essential infrastructure', consideration should be given to the incorporation of flood resistance and resilience measures.
- Basements should not be used for habitable purposes. Where basements are permitted for commercial use, it is necessary to ensure that the basement access points and any venting are situated 600 mm above the 1 in 100 year (fluvial) and 1 in 200 year (tidal) flood level plus climate change for the life of the development. Near the coast an allowance for wave action should also be considered.
- An evacuation plan should be prepared in consultation with WDDC's Emergency Planning team.

- Residents should be made aware that they live in a flood risk area. The Environment Agency plan to make their flood warning service 'opt-out' instead of 'opt-in', but until such time residents should be encouraged to sign up to Floodline Warnings Direct, should a Flood Warning system exist (as indicated by the Level 1 SFRA).
- 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, if appropriate.
- SuDS should be implemented to ensure that runoff from the site (post development) is reduced. Space should be set-aside for SuDS at the master planning stage.
- The vulnerability of the development from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.

Sites in Flood Zone 3b

Flood Zone 3b has been derived by modelling as the area effected by an event with a 4% AEP (1 in 25-year). This zone may be subject to change in built up areas to reflect the presence of buildings and other structures. Only one site in Bridport (Land around Vearse Farm) of the six sites of potential development is assessed as containing Flood Zone 3b (defended scenario) and to a limited extent. The following details the requirements in Flood Zone 3b.

- Development in High Probability Flood Zone 3b should be restricted to 'water-compatible uses' only.
- PPS25 dictates that 'essential infrastructure' can be located in Flood Zone 3b if the Exception test is passed. However, appropriate judgement should be exercised when attempting the Exception Test for essential infrastructure in Flood Zone 3b. Essential infrastructure includes: essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk; and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
- Essential transport infrastructure may be appropriate if designed in such a way that flood flow routes and flood storage areas are not affected (e.g. designing a bridge to cross the flood risk area).
- Utility infrastructure may be less appropriate due to the potential consequences that may occur should the utility site become flooded. This is reinforced by recent experience during the summer 2007 flood event, which in Gloucestershire caused flooding of Mythe Treatment Works and near-flooding of a power station.
- 'Essential infrastructure' in this zone must be designed and constructed to remain operational in times of flood and not impede water flow.

9.4 Site specific risk

Site specific risks and recommendations are considered in the policy matrices in Chapter 9, and generic recommendations regarding the use of SuDS, appropriate flood avoidance, site layout, and resistance/resilience measures are detailed in Chapter 8. The requirements for access points, levels and safe design are dependent on flood risks at the site as detailed above.

10 Implications of Weymouth & Portland SFRA

10.1 Overview

This chapter reviews the Weymouth and Portland Borough Council SFRA Level 2 in relation to the Southill/Chickerell and Littlemoor areas to ensure that the assessments are sound in relation to the West Dorset LDF. The review also considers the associated feasibility study of Southill watercourse, including the modelling aspects, commissioned by Weymouth & Portland Council and WDDC (August 2009).

10.2 Weymouth & Portland SFRA Level 2

The Weymouth & Portland SFRA examines nine areas with potential for additional development where flood risks are identified. Four of these areas with potential for urban extension (option for up to 700 dwellings in each area) fall within West Dorset district as located in Figure 10.1.

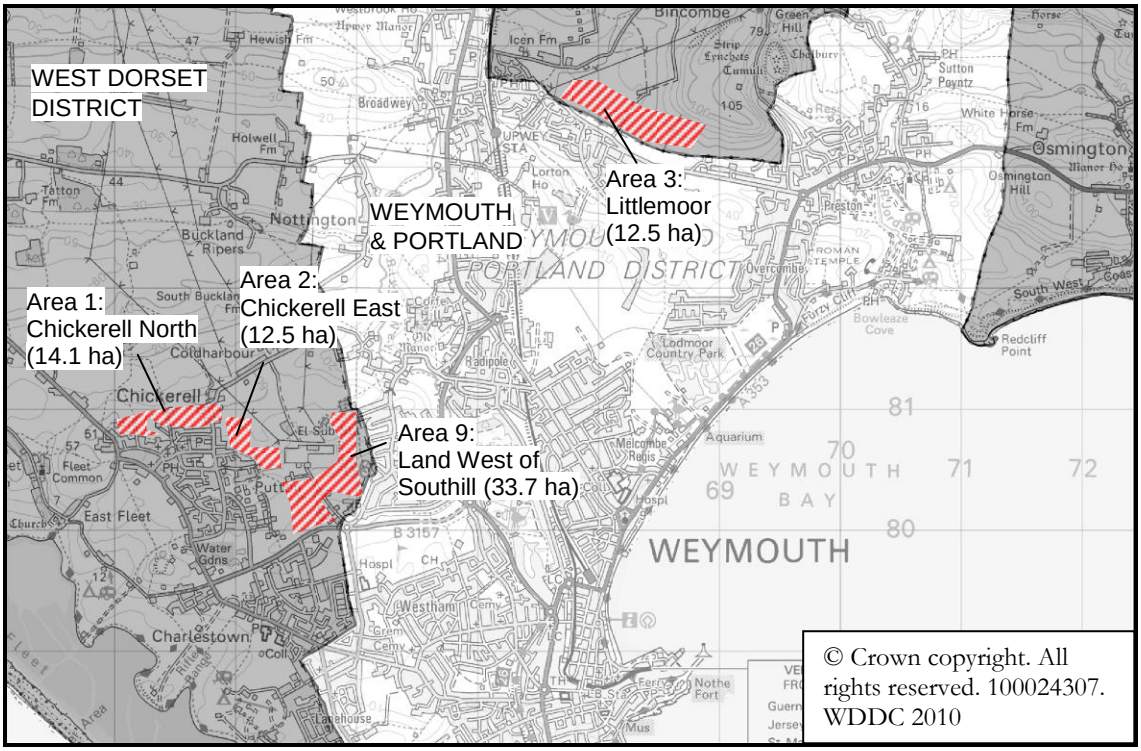


Figure 10.1 Areas with potential for additional development

10.3 Feasibility study for Southill watercourse

This study (2009) was commissioned in response to Southill flooding in December 2008, affecting several commercial/residential properties. A major contributor to this flooding was, reportedly, due to blocked or insufficiently sized surface water drainage. The study included modelling to assess the flood risk associated with this problems and to test options for flood alleviation.

No Flood Zones for Southill watercourse are available as it is not designated as Main River, and for this reason not investigated by the Environment Agency in their national programme of flood mapping.

This study determined the December event was "…*in excess of a 1 in 10 year return period event*…", and with minor drainage improvements "…*the capacity of the network should be realised and maintained to the equivalent of a 1 in 50 year return period if clear of deposited silt and other debris*…".

This study also determined that the open channel upstream of Southill culvert restricts flow and could be reprofiled to increase in-channel flood conveyance "…*up to 2.3m^3/s may be achievable*…". Alternatively, upstream storage is considered a feasible option and for a "…*1 in 30 year return storm the storage volume estimated equates to approximately 5,000m^3*…".

The flood alleviation options for Southill have implications for Area 9: Land West of Southill and Area 2: Chickerell East. Channel improvements and upstream storage may fall within one or both of these areas and are important planning considerations.

The modelling, including hydrological, calibration and design assessment, provides a basic 1D representation of the river and its culverts in the Southill area. The focus was on the flooding problems experienced in Southill and options for flood alleviation. No flood mapping was reported.

It would require more detailed hydrological analysis and modelling, using additional data, to prepare flood maps for the Southill area to a standard in line with the Environment Agency published requirements for completing modelling for FRAs. The flood risk in the Southill area, and for the watercourse upstream through Chickerell, is therefore uncertain.

10.4 Flood risk implications

The flood risk implications for the four areas with potential for urban extension are assessed based on the Weymouth & Portland SFRA and the uncertain flood risk for Southill and Chickerell.

- Area 1: Chickerell North
  The Weymouth & Portland SFRA claims the flood risk to this area to be minimal and therefore only the impact of any development on flood risk needs to be considered further, noting that there are surface water and sewer flooding problems downstream in Chickerell. No information has come to light to change this.
- Area 2: Chickerell East
  The Weymouth & Portland SFRA claims this area to be FZ1, and ground levels mean there is little flood risk to its northern extent. As the site is very low-lying at the southern end further investigation is advised as it "…*may be useful in order to clarify the impact of development on flood risk in relation to the capacity of the drain along the southern border of the site*…".

  This drain is part of the modelled watercourse that passes through Southill downstream, and as such the flood risk associated with this drain are uncertain. The degree of maintenance of this watercourse and its culverts are clearly factors that should also be taken into consideration, as this will affect the level of flood risk to Southill and Chickerell. Further study is recommended to evaluate the flood risks of this watercourse, which should build on the recent feasibility study modelling.

- Area 3: Littlemoor
  The Weymouth & Portland SFRA claims this area to be FZ1 and there to be no recorded historic flood incidents though the adjacent developed area has flooded on a number of occasions. A precautionary approach is recommended for any development such that areas designated as open space should be located in the lowest point to the north west of the area.

  The Weymouth & Portland SFRA assumes the flood risk to be minimal and therefore only the impact of any development on flood risk needs to be considered further. No information has come to light to change this.

- Area 9: Land west of Southill
  The Weymouth & Portland SFRA claims this area to be FZ1, and there to be no recorded historic flood incidents though the area is very flat and low-lying with Chafeys Stream running through the southern end of the site. Due to this watercourse, FZ2 and FZ3 are in close proximity to the area.

  The Weymouth & Portland SFRA makes reference to the flooding problems in the Southill area immediately downstream, including the December 2008 event, and the feasibility study reported finding that:

  "…*the current maximum capacity of the culvert corresponds to a 1 in 50 year event and that during a 1 in 100 year event it would be expected to see flooding at least equivalent to that experienced by the Southill area on 13th December 2008*…".

  However, there is no mention of the channel capacity restriction upstream of the culvert, or that the December event is only reported in the feasibility study to be "…*in excess of a 1 in 10 year return period event*…". The 1 in 100 year event can be expected to result in much more extensive flooding, noting that blockage is one factor that contributed to the December flooding.

  The Weymouth & Portland SFRA assumes the flood risk to be minimal and therefore only the impact of any development on flood risk needs to be considered further. It recommends only that no development is located adjacent to the watercourse, and this requires careful consideration as the area is very flat and low-lying.

  As noted above, the flood risk associated with the Southill watercourse is uncertain and the degree of maintenance of this watercourse and its culverts are clearly factors that should also be taken into consideration, as this will affect the level of flood risk to Southill and Chickerell. Further study is recommended to evaluate the flood risks of this watercourse, which should build on the recent feasibility study modelling.

10.5 Recommended further study

The majority of the areas of search for potential development fall within Flood Zone 1, but parts of the areas adjacent to the watercourses will be Flood Zones 2 and 3 and this will dictate the types of development that are appropriate. A further modelling study to determine the Flood Zones for the Southill/Chickerell areas is recommended in accordance with the Environment Agency requirements for strategic flood mapping.

An initial review of available topographic data (LiDAR aerial survey) has suggested the indicative outer limits of flood risk potential for the Chickerell and Southill sites due to the watercourse upstream of Southill culvert – see 'blue band' in Figure 10.2. It is recommended that the area for development be restricted to exclude this 'blue band' unless the developer provides a site-specific FRA that demonstrates by detailed modelling that the flood risk is less extensive. This modelling should build on the recent feasibility study modelling.

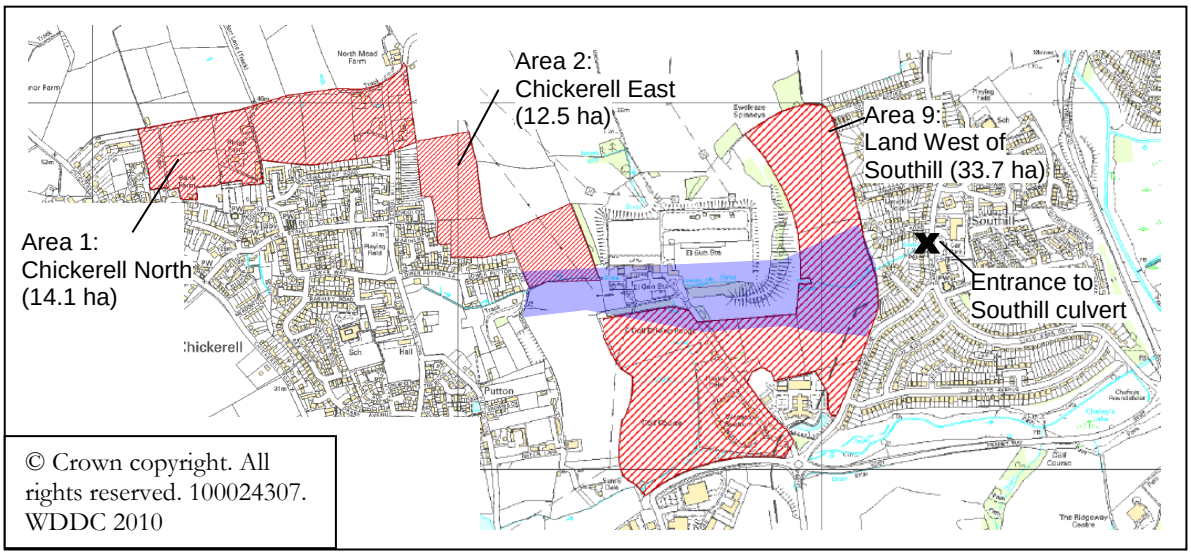


Figure 10.2 Indicative flood limits for Chickerell / Southill sites

11 Concluding remarks

The SFRA Level 2 fulfils the study requirement to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) to update and improve the Level 1 SFRA to be compliant with PPS25 and to provide an evidence base to assist in the assessment of the various options and proposals for development the Council is considering as part of the Local Development Framework.

The SFRA (Levels 1 and 2) provides an overview of flood risk within West Dorset and aims to provide general guidance to WDDC planners, developers and other interested people, including the general public, about locations where flood risk is an issue. Preparation of this SFRA has followed PPS25 and its associated Practice Guidance, with guidance provided at all stages by WDDC and the Environment Agency.

The SFRA forms part of the evidence base for the LDF and will be an integral part of the Sustainability Appraisal of relevant component documents of the LDF. It will be used by WDDC to inform decisions regarding land allocation and policies. The detailed information on flood risk for the Bridport area, included in this SFRA Level 2, confirms that development in the majority of the areas of search is viable as flood risk can be sustainably managed.

In Bridport the tidal / fluvial flood risk is limited for all the areas of search for potential development, though there are associated flood hazards and also other (e.g. surface water) flood risks. In view of this, promoting any of the areas of search will require a formal site-specific FRA, with the exception of one area – land adjacent to Jessop Avenue where no flood risks are identified. This FRA requirement also applies to windfall sites affected by flood risk.

This SFRA Level 2 includes policy recommendations for the planning system and advice for flood risk management such as SuDS and appropriate flood damage avoidance measures. It also includes advice for planners and developers for site specific FRAs, including the issues specific to Bridport.

The best information is to be used to guide the site selection process for future developments. For this reason the SFRA is a living document (reports and maps) to be updated by WDDC as new information becomes available. No additional SFRA study requirements are identified at this time.

Glossary

Annual Exceedance Probability	Annual exceedance probability (AEP) is the probability associated with a return period. Thus an event of return period 50 years has an AEP of 1/T (where T is the return period in years). This is often expressed as a percentage so the 50 year event is the 2% event.
Breach hazard/analysis	Hazard attributed to flooding caused by the constructional failure of a flood defences or other structure that is acting as a flood defence.
CIRIA	The construction industry research and information association: and seeks to "*address industry issues, challenges and opportunities and all with the aim of providing business and delivery improvement [as well as] working collaboratively across traditional sector boundaries provides opportunities to identify best practice, develop new approaches and to identify and enable innovation*" http://www.ciria.org/service/AM/ContentManagerNet/HTMLDisplay.aspx?ContentID=14550&Section=about
CFMP	Catchment Flood Management Plan. A CFMP is a high-level strategic plan through which the Environment Agency seeks to work with other key-decision makers within a river catchment to identify and agree long-term policies for sustainable flood risk management.
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.
Culvert	A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal, or other impediment
Defra	Department of Environment, Food and Rural Affairs Development
DPD	Development Plan Document. A DPD is a spatial planning document within the Council's LDF 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.
Dry pedestrian egress	Routes to and from buildings that will remain dry and allow pedestrian/wheelchair evacuation to dry land in times of flood.
DTM	Digital Terrain Model.
Environment Agency	The leading public body for protecting and improving the environment in England and Wales.
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.
Flood defence	Natural or man-made infrastructure used to reduce the risk of flooding
Flood risk	Flood risk is a combination of two components: the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred
FRA	Flood Risk Assessment. Assessment of flood risk posed to a defined area (usually a new development site) as defined above.
Flood risk management	Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences and reduce the impact through influencing development on flood risk areas, flood warning and emergency response.
Flood risk vulnerability	PPS25 provides a vulnerability classification to assess which uses of land maybe appropriate in each flood risk zone.
Flood warning	A system maintained by the Environment Agency to enable warning messages to be sent to homeowners and businesses when floods are predicted.
Flood defence	A structure built and maintained specifically for flood defence purposes.
Flood Zones	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

Functional Floodplain Zone 3b	Defined as areas at risk of flooding in the 5% AEP (1 in 20 year) design event. In any one year the chance of a 5% AEP (1 in 20 year) event occurring is 5%. In areas where the 4% (but not 5%) AEP event has been modelled previously; this was taken to represent the functional floodplain as agreed between WDDC and the Environment Agency.
GIS	Geographic Information System. GIS is any system which stores geographical data, such as elevations, location of buildings and extent of flood outlines.
High Probability Zone 3a	Defined as areas at risk of flooding in the 1% Annual Exceedance Probability (AEP) (1 in 100 year) design event for fluvial or 0.5% AEP (1 in 200 year) for tidal. In any one year the chance of a 1% AEP (1in 100 year)event occurring is 1% and for a 0.5% AEP (1 in 200 year) event occurring is 0.5%.
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).
LDD	Local Development Documents
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.
LDF	Local Development Framework. The LDF consists of a number of documents which together form the spatial strategy for development and the use of land.
Low Probability Zone 1	The area outside Zone 2. Defined as an area with less that 0.1% AEP (1 in 1000 year) chance of flooding. In any one year the chance of a 0.1% AEP (1 in 1000 year) event occurring is less than 0.1%.
LPA	Local Planning Authority
'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.
Medium probability Zone 2	Defined as an area at risk of flooding from flood events that are greater than the 0.1% AEP (1 in 1000 year), and less than the 1% AEP (1 in 100 year) fluvial or 0.5% AEP (1 in 200 year) tidal design event. The probability of flooding occurring in this area in any one year is between 1% (fluvial)/0.5% tidal) and 0.1%.
mAOD	Metres Above Ordnance Datum
PPS	Planning Policy Statements. The Government has updated its planning advice contained within Planning Policy Guidance Notes with the publication of new style Planning Policy Statements.
PPS25	Planning Policy Statement 25: Development and Flood Risk. PPS 25 reflects the general direction set out in 'Making Space for Water'.
PPS25 Practice Guide	The Practice Guide explains how to implement PPS25's commitment to deliver appropriate sustainable development in the right places while taking full account of flood risk.
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.
Residual Risk	The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.
Return period	The probability of a flood of a given magnitude occurring within any one year e.g. a 1% AEP (1 in 100 year) event has a probability of occurring once in 100 years, or a 1% chance in any one year. However, a 1% AEP (1 in 100 year) event could occur twice or more within 100 years, or not at all.
RBMP	River Basin Management Plan. Prepared under the Water Framework Directive and Integrated Coastal Zone Management.
RSS	Regional Spatial Strategy. The RSS for WDDC is the South West RSS, a regional planning policy providing the overarching framework for the preparation of LDFs. It provides a broad development strategy for the South West region up to 2026.
SA	Sustainability Appraisal. An SA is an appraisal of plans, strategies and proposals to test them against broad sustainability objectives.

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.
SFRA	Strategic Flood Risk Assessment. An SFRA 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 FRAs.
SHLAA	Strategic Housing Land Availability Assessment
SPD	Supplementary Planning Document. An 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.
SoP	Standard of Protection. The return period against which a defence offers protection.
SWMP	Surface Water Management Plan (described in detail in report).
SuDS	Sustainable Drainage Systems. SuDS are drainage systems which are designed to reduce the impact of urbanisation on the hydrology of a river system.
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).
TUFLOW	A 2D hydraulic modelling package.
Flood hazard	A measure of hazard of a given flood event, calculated by using the following equation from Defra's Flood Risks to People – Phase Two Document (FD2321/ TR2) (2006). Hazard is calculated as follows: Hazard = d x (v + 0.5) + DF where: d = depth (m); V = velocity (m/s); DF = debris factor
UKCIP	UK Climate Impacts Programme helps organisations assess how they might be affected by climate change, by publishing technical reports on scientific research, guidance on how to adapt to climate change and summary documents for decision-makers who need only an overview. Recently published UK Climate Projections: Science Reports (2009).

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Appendix A
Sequential Test template

Sequential Test Template for Local Planning Authorities (Source: Environment Agency)

Demonstrating the flood risk (PPS25) Sequential Test for Planning Applications

This template is to be used in conjunction with the Sequential Test process set out in the Environment Agency's Flood Risk Standing Advice. Flood Risk Standing Advice for LPAs can be downloaded for use from standing advice pages on the Environment Agency website - www.environment-agency.gov.uk

Application details

Planning application reference number
Site address and development description

Date

Completed by

Stage 1 – strategic application & development vulnerability

Has the Sequential Test already been carried out for this development at development plan level? Enter Yes or No	**Provide details of site allocation and LDD below**

State the Flood Risk Vulnerability Classification in accordance with PPS25 table D2	**State the Flood Zone of development site**

Stage 2 – defining the evidence base

State the defining parameters for the geographical area over which the Sequential Test is to be applied e.g. functional requirements of the development; regeneration need *identified in the LDF;* serves a national market. Indicate if no parameters exist for example, windfall development.	State the area of search in view of identified parameters e.g. whole LPA area, specific market area, specific area of need/regeneration area or on a sub regional or national level.
Additional justification (if needed):	

Evidence base to be used as source for 'reasonably available' sites	Provide details below e.g. date, title of document and where this can be viewed
Strategic Housing Land availability Assessment	
Other housing land study	
Employment Land Review	
National Land Use Database – Previously Developed Land	
Register of Surplus Public Sector Land	
Rural Exceptions Strategy	
Regeneration strategy	
Other sites known to the LPA e.g. sites of other planning applications	
Other sources not stated	

Method used for comparing flood risk between sites	Provide details below e.g. date, title of document and where this can be viewed
Environment Agency Flood Map	
Strategic Flood Risk Assessment (if comparing flood risk within the same Flood Zone)	
Site specific Flood Risk Assessments where they are suitable for this purpose.	
Other mapping / source of flooding information not stated	

Stage 3 – applying the Sequential Test

Name and location of the reasonably available sites	**Flood Zone:** (Higher (H) Lower (L), Same(=)	**Allocated in plan with flood risk sequential test?** (Indicate the status of the plan)	**Approx Capacity[5] of site**	**Constraints to delivery[6]**
Conclusion: Are there any reasonably available sites in a lower flood risk zone or at a lower risk of flooding than the application site?				

[5] based on LDF density policies and past performance

[6] constraints to delivery include: availability, policy restrictions, physical problems or limitations, potential impacts of the development, and future environmental conditions that would be experienced by the inhabitants of the development.

Appendix B
Surface water flood risk maps, West Dorset

Appendix C
Fluvial/tidal flood risk maps: defended scenario, Bridport

- 5% AEP (1 in 20-year) defended (SFRA FZ 3b – functional floodplain), depth
- 5% AEP (1 in 20-year) defended (SFRA FZ 3b – functional floodplain), velocity
- 5% AEP (1 in 20-year) defended (SFRA FZ 3b – functional floodplain), hazard
- 1% AEP (1 in 100-year) defended (SFRA Flood Zone 3a), depth
- 1% AEP (1 in 100-year) defended (SFRA Flood Zone 3a), velocity
- 1% AEP (1 in 100-year) defended (SFRA Flood Zone 3a), hazard
- 0.1% AEP (1 in 1000-year) defended (SFRA Flood Zone 2), depth
- 0.1% AEP (1 in 1000-year) defended (SFRA Flood Zone 2), velocity
- 0.1% AEP (1 in 1000-year) defended (SFRA Flood Zone 2), hazard
- 1% AEP (climate change) defended (SFRA Flood Zone 3a), depth
- 1% AEP (climate change) defended (SFRA Flood Zone 3a), velocity
- 1% AEP (climate change) defended (SFRA Flood Zone 3a), hazard

Appendix D
Fluvial/tidal flood risk maps: defences breach scenario, Bridport

- 1% AEP (1 in 100-year) breach scenario 1, depth
- 1% AEP (1 in 100-year) breach scenario 1, velocity
- 1% AEP (1 in 100-year) breach scenario 1, hazard
- 1% AEP (1 in 100-year) breach scenario 2, depth
- 1% AEP (1 in 100-year) breach scenario 2, velocity
- 1% AEP (1 in 100-year) breach scenario 2, hazard
- 1% AEP (1 in 100-year) breach scenario 3, depth
- 1% AEP (1 in 100-year) breach scenario 3, velocity
- 1% AEP (1 in 100-year) breach scenario 3, hazard
- 1% AEP (1 in 100-year) breach scenario 4, depth
- 1% AEP (1 in 100-year) breach scenario 4, velocity
- 1% AEP (1 in 100-year) breach scenario 4, hazard
- 1% AEP (1 in 100-year) breach scenario 5, depth
- 1% AEP (1 in 100-year) breach scenario 5, velocity
- 1% AEP (1 in 100-year) breach scenario 5, hazard

Appendix E
Fluvial/tidal flood risk maps: undefended scenario, Bridport

- 5% AEP (1 in 20-year) undefended (SFRA FZ 3b – functional floodplain), depth
- 5% AEP (1 in 20-year) undefended (SFRA FZ 3b – functional floodplain), velocity
- 5% AEP (1 in 20-year) undefended (SFRA FZ 3b – functional floodplain), hazard
- 1% AEP (1 in 100-year) undefended (SFRA Flood Zone 3a), depth
- 1% AEP (1 in 100-year) undefended (SFRA Flood Zone 3a), velocity
- 1% AEP (1 in 100-year) undefended (SFRA Flood Zone 3a), hazard
- 0.1% AEP (1 in 1000-year) undefended (SFRA Flood Zone 2), depth
- 0.1% AEP (1 in 1000-year) undefended (SFRA Flood Zone 2), velocity
- 0.1% AEP (1 in 1000-year) undefended (SFRA Flood Zone 2), hazard
- 1% AEP (climate change) undefended (SFRA Flood Zone 3a), depth
- 1% AEP (climate change) undefended (SFRA Flood Zone 3a), velocity
- 1% AEP (climate change) undefended (SFRA Flood Zone 3a), hazard

Appendix F
Fluvial/tidal flood risk maps: flooding onset & overland flow paths, Bridport

- 0.1% AEP (1 in 1000-year) defended (SFRA Flood Zone 2), flooding onset
- 0.1% AEP (1 in 1000-year) defended (SFRA Flood Zone 2), overland flow paths

Appendix G
Flood Risk Management Options

Principal Measures	Structural Options	Non-Structural Options	Effectiveness*
A. River and Coastal Engineering			
• Increase flood conveyance (affects d/s)	Channelisation, channel restoration, dikes and embankments, by-pass and diversion channels, structure upgrade/improvement		Major
• Increase flood storage	Dams, floodplain/wetland storage, floodplain restoration, temporary channel storage		Marked
• Flood defences	Flood defence along river, ring dykes for key areas, special structures		Major
• Flood water transfer	Bypass or diversion across river/tributary catchments		Marked/Major
B. Manage Flood Events			
• Pre-flood measures**		Preparedness planning; major incident plans, flood risk mapping, education and awareness raising; family/community flood plans	Marked
• Real time forecasting & warning		Forecast systems (sensing, incl. g/w monitoring, modelling, etc.), warning dissemination systems	Marked
• Flood fighting	Demountable defences, water level control structures (weirs, sluices)	Emergency repair, emergency diversions	Marked
• Collective/individual scale damage avoidance	Demountable defences, temporary flood proofing	Evacuation of floodplain, moving assets to safety	Marked
C. Manage Flood Losses			
• Reduce exposure by land-use management		Managed retreat, relocate exposed infrastructure	Minimal
• Reduce exposure through flood proofing		Retro-fit flood proofing – self help programmes	Marked
• Limit increased exposure by land-use planning		Planning of land use, financial measures (floodplain charging), locate critical facilities out of floodplain	Minor
• Limit increased exposure with better construction	Flood proofing	Property/structure designs	Minor
• Facilitate economic and financial recovery		Insurance, state aid and compensation, tax relief on losses, self insurance	n/a
• Lessen health, social and practical impacts**		Target health/counselling services, practical aid (clean up)	n/a
D. Urban (Fabric) Management			
• Increase urban storage	Detention ponds, underground storage, temporary flood storage (parkland), storage along flood system	Building design, urban area development design, source control, groundwater management, design of drainage/ sewerage systems	Minor
• Increase infiltration		Building design, permeable land cover	Minimal
• Manage land surface conveyance	Separate storm and foul sewers, alter river channels to improve outfalls reopen culverted watercourses (daylighting).	Design of building drainage, multiple drainage systems, design of roads and gully pots	Minimal
E. Rural Land Management			
• Increase retention/infiltration	Increase field drainage storage	Change tillage practice, extensification, afforestation, buffer strips/zones	Minimal
• Water retention/storage schemes	Detention pond/bunds	Wetlands/washlands, riparian zone management, rainwater harvesting	Minimal
• Manage conveyance	Realign channels	Maintain channels, manage hillslope connectivity	Minimal