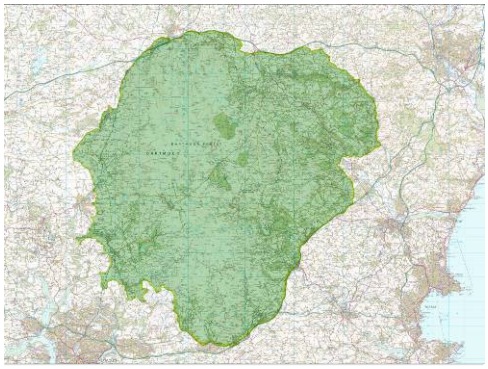
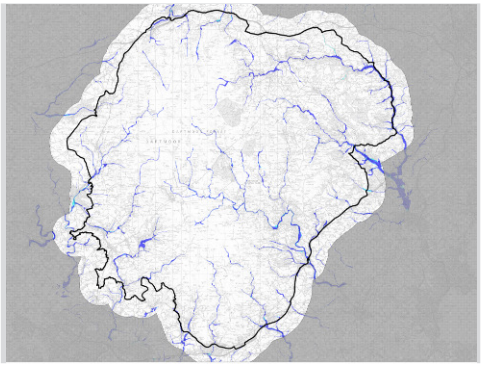
Dartmoor National Park Authority

Level 1 Strategic Flood Risk Assessment

Final Report
November 2010





Prepared for

Revision Schedule

Level 1 Strategic Flood Risk Assessment
November 2010

Rev	Date	Details	Prepared by	Reviewed by	Approved by
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Executive Summary

This Level 1 Strategic Flood Risk Assessment (SFRA) was produced by Scott Wilson for Dartmoor National Park Authority (DNPA) between June and October 2010. This Executive Summary has been produced to enable the wider user to understand the technical content of the Level 1 SFRA report and accompanying mapping outputs and Geographical Information System (GIS) data files. A list of Abbreviations and Glossary of Terms follow immediately after the contents page.

Strategic Flood Risk Assessment

DNPA require a Level 1 SFRA to form a key part of the evidence base that will support the Local Development Framework (LDF), in particular the preparation of a Development Management and Delivery (DMD) Development Plan Document (DPD). This document will provide more detailed development management policies to support the adopted Core Strategy.

The DNPA Level 1 SFRA provides an overview of flood risk from all sources of flooding within the administrative boundary of DNPA. This provides DNPA, developers and other interested parties with general guidance on flood risk and issues associated with flooding. Floods have the potential to cause damage and disruption to homes, businesses, transport routes and the environment. This is costly in both social and economic terms and can cause distress, harm and in worst cases, the loss of life.

The key objectives of the SFRA are to:

- Identify existing and historic flood risk from all known sources of flooding within the study area taking the potential effects of climate change climate change into account;
- Identify existing flood risk management infrastructure with an indication of how much of the area is defended by flood risk management infrastructure;
- Determine location and extent of Functional Floodplain with a focus on designated Local Centres within study area;
- Provide guidance on application of the Sequential Test and the scope for application of the Exception Test where required;
- Provide guidance on the preparation of Flood Risk Assessments (FRAs) for sites of varying risk across the Flood Zones, including specific FRA requirements for potential sites within the designated Local Centres;
- Provide guidance on information about the use of SuDS techniques to manage surface water runoff from development within the study area;
- Identify areas where flood risk should be considered in more detail via Level 2 work or at the site specific FRA level;
- Provide meaningful recommendations to inform policy, development control and technical issues.

Study Area

The study area covers an approximate area of 950 km^2. The bordering districts of Teignbridge District Council, Mid Devon District Council, South Hams District Council and West Devon Borough Council include land which lies within the National Park boundary. However, DNPA is the Local Planning Authority

(LPA) responsible for the whole of the designated area of the National Park. The 'Local Centres' where development is likely to be focused within the study area are:

- Ashburton;
- Buckfastleigh;
- Moretonhampstead;
- South Brent;
- Chagford;
- Horrabridge;
- Princetown;
- Yelverton.

A general description of potential flood sources present within the study area is provided in Table 1.

Table 1: Potential Flood Sources Present within Study Area

Flood Source	Description
Fluvial	River flooding occurs when river water exceeds the flow capacity of the river channel
Surface Water	Surface water flooding is caused by water flowing over the ground surface that has not entered a natural drainage channel or stormwater management system
Sewers	Sewer flooding occurs when a sewer overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity
Groundwater	Groundwater flooding occurs when water in the ground rises above surface elevations
Artificial Sources	Artificial flood sources include ponds, reservoirs and leats. Flooding from artificial sources may occur in the event of structual failure or breach of retaining wall

The main sources of flooding within the study area are from fluvial and surface water sources, there is no tidal influence. There are a number of reservoirs, which may also present a potential flood risk in the event of a breach. A number of leats also exist within the study area. The hard rock geology (granite) underlying river catchment headwaters within the study area minimises the risk of groundwater flooding.

The study area includes the upper reaches of rivers that typically have steep gradients and flow to the coast in relatively steep sided valleys that have confined floodplains. These confined floodplains and the underlying hard rock geology result in relatively short rainfall response times in the upper catchments. The main river catchments within the study area are the River Dart, River Teign, River Avon, River Plym, River Yealm, River Erme, River Tavy, River Lyd, River Taw, and River Okement.

Information Sources

Information for the production of this Level 1 SFRA has been collected from the Environment Agency (EA), DNPA, South West Water Ltd, Highways Agency and Devon and Somerset Fire and Rescue Service. All of the information/data was provided in GIS format, or the raw data was manipulated into this format for use within the study (where suitable). Once collated and reviewed the information was then presented in a format to enable DNPA to apply the Sequential Test to their potential development areas.

Prior to a decision being made about the suitability of a site for development in terms of flood risk, additional data may need to be sought from the developer in the form of a site specific Flood Risk Assessment.

Sequential Approach

Planning Policy Statement 25: Development and Flood Risk (PPS25) requires a sequential approach to flood risk to be considered within the strategic planning undertaken by LPAs. This approach is referred to as the application of the Sequential Test and is used to test preferred land allocations for development with respect to flood risk.

The Sequential Test should be undertaken by LPAs and be accurately documented to ensure decision processes can be transparently communicated and reviewed where necessary. The Sequential Test should be carried out on all development sites, seeking to balance the flood probability and development vulnerability of sites throughout the administrative area.

The Sequential Test uses the PPS25 Flood Zones to differentiate between low probability (Flood Zone 1), medium probability (Flood Zone 2) and high probability (Flood Zone 3) areas. Only where there are no reasonably available sites in the low probability flood risk areas can development in medium and higher probability flood risk areas be considered. Flood Zone 3 is further divided into high probability (Flood Zone 3a) and Functional Floodplain (Flood Zone 3b). The Level 1 SFRA has identified Functional Floodplain within the study area, in agreement with the EA.

Table 2 illustrates the return period and probability associated with the PPS25 Flood Zones, provided by the EA for river and tidal flooding. The EA Flood Zones do not illustrate the risk of flooding from groundwater, surface water or sewer flood sources.

Table 2: PPS25 Flood Zone Definitions (from PPS25, Appendix D, Table D1)

Flood Zones	Definition
Flood Zone 1	Low Probability - Land having less than 0.1% (1 in 1000 year) annual probability of fluvial or tidal flooding in any year.
Flood Zone 2	Medium Probability - Land having between 0.1% and 1% (between 1 in 1000 and 1 in 100 year) annual probability of fluvial flooding or between 0.1% and 0.5% (between 1 in 1000 and 1 in 200 year) annual probability of tidal flooding in any year.
Flood Zone 3a	High Probability - Land having a 1% or greater (1 in 100 year or greater) annual probability of fluvial flooding or 0.5% or greater (1 in 200 year or greater) annual probability of tidal flooding in any year.
Flood Zone 3b	Functional Floodplain – Land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of Functional Floodplain and its boundaries accordingly, in agreement with the EA. The identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the Functional Floodplain.

Exception Test

Where no reasonably available sites can be identified in areas of lower flood risk to meet development targets, the scope of the SFRA should be increased to provide information for the application of the Exception Test. This forms a Level 2 SFRA.

The Exception Test provides a method of managing flood risk while still allowing necessary development to take place. PPS25 indicates that it is appropriate to apply it only in those instances where there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites and where development is necessary for wider sustainable development reasons.

The guidance goes on to note that it may also be appropriate to use it where national designations (e.g. such as national parks) prevent the availability of unconstrained sites in lower risk areas. Paragraphs D9 to D14 of PPS25 set out criteria that must be satisfied for the Exception Test to be passed.

Deliverables

The mapping and associated GIS data files form a primary deliverable of this Level 1 SFRA. The mapping provides a tool for planning and development management officers to identify areas where flood risk may be an issue. This will ensure the DNPA make consistent and sustainable planning decisions with respect to flood risk.

The mapping outputs provide information on flood risk and flood risk management within the study area in the following formats:

- A3 size strategic overview maps of the DNPA study area (Appendix A);
- A2 size focused assessment maps of the eight Local Centres (Appendix B);
- A1 size map of the whole of the DNPA study area (Appendix C).

The above mapping outputs are based on GIS data files, which form the main tool for application of the Sequential Test. The GIS data files are grouped into three themes of layers, namely:

- Planning policy layers;
- Information layers;
- Flood Risk layers.

The information presented in this Level 1 SFRA should not be considered as an exhaustive list of all available flood related data for the study area. This Level 1 SFRA report is a presentation of flood sources and risk, based on the best available data collected following consultation with and input from DNPA and relevant stakeholders within the available timeframe.

SFRAs are 'live' documents and should be updated on a regular basis as new information becomes available to DNPA. This includes the GIS data files, which can easily be updated as new information becomes available, which will help to ensure that future decisions made by DNPA are based on the most up-to-date information.

Technical Guidance

Sustainable flood risk management recommendations to be considered when formulating both catchment wide and area specific development management policies have been provided. These recommendations

have been formed with regards to national, regional and local policies, together with Catchment Flood Management Plans (CFMPs) objectives identified by the EA.

Guidance on Sustainable Drainage Systems (SuDS), the preferred method for managing the surface water run-off generated by development sites is provided within the Level 1 SFRA. This guidance includes information on SuDS design and potential constraints associated with their implementation.

Guidance on site specific Flood Risk Assessments (FRAs) is also provided. A site specific FRA is required to ensure proposed developments are sustainable/safe for their lifetime and do not exacerbate flood risk. PPS25 requires that a site specific FRA presents information on the flood risk to a proposed development and the consequences a development may have for flood risk elsewhere. Where necessary, the assessment must also present the mitigation measures that will be incorporated into the development to alleviate flood risk to and arising from the development.

Summary and Recommendations

Based on the information presented in the Level 1 SFRA and the accompanying mapping and GIS layers, DNPA have sufficient information to apply the PPS25 Sequential Test to their development sites, seeking to guide development to areas of lowest flood risk wherever possible.

Where there are insufficient sites in Flood Zone 1 to accommodate the required growth, consideration should be given to the vulnerability classification of the development to ensure that it is located in an area of acceptable risk as defined in PPS25. In some cases this may require application of the Exception Test.

Until DNPA have undertaken the Sequential Test it is not possible to determine the requirements and scope of the Level 2 SFRA. However, based on the information presented within this Level 1 SFRA and growth targets set out in the DNPA Core Strategy, further work may be required within Ashburton and Buckfastleigh.

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Abbreviations

Acronym	Definition
mAOD	metres Above Ordnance Datum
ASTSWF	Areas Susceptible To Surface Water Flooding
CFMP	Catchment Flood Management Plan
DCC	Devon County Council
DEM	Digital Elevation Model
DMD	Development Management & Delivery DPD
DNP	Dartmoor National Park
DNPA	Dartmoor National Park Authority
DPD	Development Plan Documents
DTM	Digital Terrain Model
EA	Environment Agency
FRA	Flood Risk Assessment
FRIS	Flood Reconnaissance Information System
FWA	Flood Warning Area
GIS	Geographical Information Systems
NFCDD	National Flood and Coastal Defence Database
LDDs	Local Development Documents
LDF	Local Development Framework
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
PCPA	Planning and Compulsory Purchase Act 2004
PPG25	Planning Policy Guidance Note 25: Development and Flood Risk
PPS25	Planning Policy Statement 25: Development and Flood Risk
PSWF	Potential Surface Water Flooding
RIM	Reservoir Inundation Mapping
RSS	Regional Spatial Strategy
SAR	Synthetic Aperture Radar
SFRA	Strategic Flood Risk Assessment
SFRM	Strategic Flood Risk Mapping
SoP	Standard of Protection
SPG	Supplementary Planning Guidance
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems

Glossary

Term	Definition
Aquifer	A source of groundwater comprising of water-bearing rock, sand or gravel capable of yielding significant quantities of water.
Catchment Flood Management Plan	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Climate Change	Both natural and human actions causing long term variations in global temperature and weather patterns.
Culvert	A channel or pipe that carries water below the level of the ground.
Flood Defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map	A map that delineates the areas that have been predicted to be at risk of being flooded during an event of specified probability.
Floodplain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood Storage	A temporary area that stores excess runoff or river flow, often ponds or reservoirs.
Fluvial Flooding	Flooding by a river or watercourse.
Functional Floodplain	Land where water has to flow or be stored in times of flood. Identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the Functional Floodplain.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone beneath the water table.
Inundation	Flooding.
Local Development Framework LDF	The core of the updated planning system (introduced by the Planning and Compulsory Purchase Act 2004). The LDF comprises of the Local Development Documents, including the development plan documents that expand on policies and provide greater detail. The development plan includes a Core Strategy, site allocations and proposals map.
Local Planning Authority	Body responsible for managing planning and development through the planning system.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Risk	Combination of the probability of the occurrence with its potential consequences.
Sequential Testing	A risk based approach in to assessing flood risk, which gives priority in ascending order of flood risk, i.e. lowest risk first.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Stakeholder	A person or organisation that has interest in, or affected by the decisions made within a site.

Sustainability Appraisal	A form of assessment that considers the social, economic and environmental effects of policies and proposals and which fully incorporates the requirements of European Directive 2001/42/EC on sustainable environmental assessment.
Sustainable drainage system	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
1 in 100 year event	Event that on average will occur once every 100 years. Also expressed as an event which has a 1% probability of occurring in any one year.
1 in 100 year event plus climate change	Event that on average will occur once every 100 years with a 20% allowance for climate change when considering peak river flows up to 2115. In terms of SuDS design up to a 30% increase in peak rainfall intensity would be required when allowing for climate change impacts up to 2115 (see Table B.2 PPS25).
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.
1 in 1000 year event	Event that on average will occur once every 1000 years. Also expressed as an event, which has a 0.1% probability of occurring in any one year.
1 in 1000 year event plus climate change	Event that on average will occur once every 1000 years with a 20% allowance for climate change.

1 Introduction

1.1 Background

1.1.1 The Planning and Compulsory Purchase Act 2004 (PCPA) requires Local Planning Authorities (LPAs) to produce Local Development Frameworks (LDFs) that will replace the system of Local, Structure and Unitary Development Plans. LDFs are a portfolio of documents (Local Development Documents (LDDs)) that collectively deliver the spatial planning strategy for the authority area. The PCPA 2004 requires LDDs to undergo a Sustainability Appraisal (SA), which assists LPAs in ensuring that their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) constitute a component of the SA process and should be used in the review of LDDs or in their production.

1.1.2 The release of Planning Policy Guidance Note 25: Development and Flood Risk in July 2001 (PPG25) introduced the responsibility that LPAs have to ensure flood risk is understood and managed effectively using a risk-based approach as an integral part of the planning process.

1.1.3 PPG25 was superseded by Planning Policy Statement 25: Development and Flood Risk (PPS25) in December 2006, with a revised addition published in March 2010[1]. PPS25 re-emphasises the active role LPAs should have in ensuring that flood risk is considered in strategic land use planning, PPS25 states that this should be achieved by the production of a SFRA. A Practice Guide to PPS25 provides supplementary information, including a suggested approach for the production of SFRAs. The guide undergoes periodic updates to ensure it remains fresh and relevant. The current version was updated December 2009[2].

1.2 Dartmoor National Park SFRA

1.2.1 Dartmoor National Park Authority (DNPA) require a Level 1 SFRA to form a key part of the evidence base that will support the LDF, in particular the preparation of a Development Management and Delivery (DMD) Development Plan Document (DPD). This document will provide more detailed development management policies to support the adopted Core Strategy[3].

1.2.2 The spatial planning of any proposed development must be considered with regard to the current and future risk of flooding from a number of sources, including tidal, fluvial, surface water (stormwater and direct runoff), groundwater and artificial flood sources. It is therefore vitally important that flood risk is considered at a strategic scale to inform land allocations and future developments proposed by the emerging LDF.

1.3 SFRA Structure

1.3.1 An SFRA is a tool which provides an overview of the flood risk, from a variety of sources, within a particular LPA area. In accordance with the PPS25 Practice Guide, SFRAs are completed in two stages (where required). These two stages are:

[1] Available online: http://www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement25.pdf
[2] Available online: http://www.communities.gov.uk/documents/planningandbuilding/pdf/pps25guideupdate.pdf
[3] Available online: http://www.dartmoor-npa.gov.uk/pl-core_strategy_adopted-2.pdf

Level 1 SFRA

1.3.2 The Level 1 SFRA is primarily a desk-based study using information and data collected from a variety of stakeholders, including the Environment Agency (EA), LPAs and water utility companies. The collation, review and preparation of this information allows a broad scale assessment of flood risk, which provides details of historic flooding incidents, areas at risk and areas which may become at risk from flooding in the future. It also identifies details of existing flood defences intended to reduce the aforementioned flood risk. Furthermore, consideration of the impact of new development upon flood risk is also of critical importance.

1.3.3 To assist LPAs in their strategic land use planning, SFRAs should present sufficient information to enable LPAs to apply the Sequential Test to their proposed development sites. The Sequential Test seeks to guide development to areas of low flood risk (i.e. Flood Zone 1) or, when development cannot be located in Flood Zone 1, to where the particular development vulnerability is appropriate to the flooding probability of an area, as defined within PPS25.

1.3.4 The Level 1 SFRA should inform the preparation of strategies and development management policy to be included within the LDF. It should also inform development management decisions, underpinning a consistent approach, including the requirements of site specific Flood Risk Assessments (FRAs) throughout the LPA area.

1.3.5 Where allocation of development sites is necessary within areas at high risk of flooding (such as in Flood Zone 2 or 3), the Level 1 SFRA is unlikely to provide sufficient information for an appropriate evaluation of flood risk, a Level 2 SFRA may be required.

Level 2 SFRA

1.3.6 Where no reasonably available sites can be identified in areas of lower flood risk to meet development targets, a Level 2 SFRA will provide sufficient information to facilitate the application of the Exception Test, where required.

1.3.7 The objective of a Level 2 SFRA is to provide more detailed information pertaining to a particular site and reduce uncertainty so that development can be designed appropriately, with consideration of flood risk. The Level 2 SFRA is based on information collected during the Level 1 SFRA and additional information where necessary.

1.4 SFRA Objectives

1.4.1 The key objectives of the SFRA are to:

- Identify existing and historic flood risk from all known sources of flooding within the study area taking the potential effects of climate change climate change into account;
- Identify existing flood risk management infrastructure with an indication of how much of the area is defended by flood risk management infrastructure;
- Determine location and extent of Functional Floodplain with a focus on designated Local Centres within study area;
- Provide guidance on application of the Sequential Test and the scope for application of the Exception Test where required;
- Provide guidance on the preparation of FRAs for sites of varying risk across the Flood Zones, including specific FRA requirements for potential sites within the designated Local Centres;

- Provide guidance on information about the use of SuDS techniques to manage surface water runoff from development within the study area;
- Identify areas where flood risk should be considered in more detail via Level 2 work or at the site specific FRA level;
- Provide meaningful recommendations to inform policy, development control and technical issues.

1.5 Deliverables

1.5.1 This Level 1 SFRA report includes background information, technical and supplementary information, culminating in the presentation of the mapping deliverables appended to this report. A series of maps and associated Geographical Information System (GIS) data files form the primary deliverable of this Level 1 SFRA.

1.5.2 The mapping outputs provide information on flood risk and flood risk management within the study area in the following formats:

- A3 size strategic overview maps of the DNPA study area (Appendix A);
- A2 size focused assessment maps of the eight Local Centres (Appendix B);
- A1 size map of the whole of the DNPA study area (Appendix C).

1.5.3 The above mapping outputs are based on GIS data files, which form the main tool for application of the Sequential Test. The GIS data files are grouped into three themes of layers, namely:

- Planning policy layers;
- Information layers;
- Flood Risk layers.

1.5.4 The information presented in this Level 1 SFRA should not be considered as an exhaustive list of all available flood related data for the study area. This Level 1 SFRA report is a presentation of flood sources and risk, based on the best available data collected following consultation with and input from DNPA and relevant stakeholders within the available timeframe.

1.5.5 SFRAs are 'live' documents and should be updated on a regular basis as new information becomes available to DNPA. This includes the GIS data files, which can easily be updated as new information becomes available, which will help to ensure that future decisions made by DNPA are based on the most up-to-date information.

2 Study Area

2.1 Overview

2.1.1 The study area is defined by the DNPA administrative boundary and covers an approximate area of 950 km^2. The bordering districts of Teignbridge District Council, Mid Devon District Council, South Hams District Council and West Devon Borough Council include land which lies within the National Park boundary. However, DNPA is the LPA responsible for the whole of the designated area of Dartmoor National Park.

2.1.2 A map of the study area indicating the boundaries of the districts and the 'Local Centres' is provided in Figure 1. A study area overview map is also presented in Figure A1 in Appendix A. The 'Local Centres' within the study area are:

- Ashburton;
- Buckfastleigh;
- Moretonhampstead;
- South Brent;
- Chagford;
- Horrabridge;
- Princetown;
- Yelverton.

2.1.3 The DNPA LDF Core Strategy[4] indicates that at least 60% of new housing within the study area should be located within Local Centres identified in Figure 1. The current housing provision as stated within the Core Strategy indicates the delivery of 50 dwellings per year over the plan period (2006 – 2026).

2.1.4 The main sources of flooding within the study area are from fluvial and surface water sources, there is no tidal influence. There are a number of reservoirs, which may also present a potential flood risk in the event of a breach. A number of leats also exist within the study area. The hard rock geology (granite) underlying river catchment headwaters within the study area minimises the risk of groundwater flooding.

2.1.5 As identified in Figure 1 some of the Local Centres are on the edge of the study area and located within steep sided valleys which can be more susceptible to flooding than the Local Centres located on the higher ground in more central parts of the study area.

[4] Available online: http://www.dartmoor-npa.gov.uk/pl-core_strategy_adopted-2.pdf

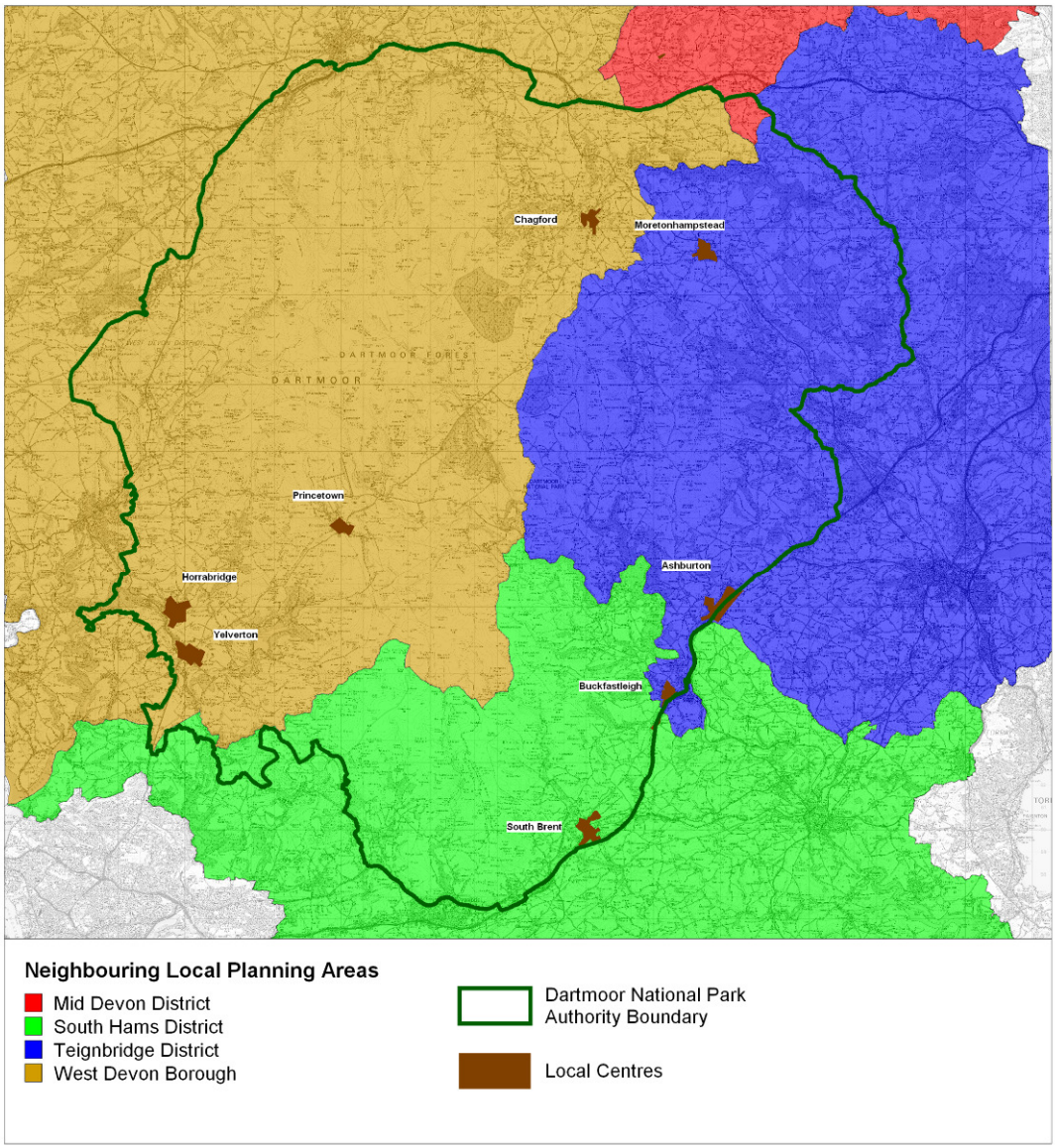


Figure 1: Overview of study area with main Local Centres and adjoining districts with land included within the DNPA boundary

2.2 River Catchments

2.2.1 The study area includes the upper reaches of rivers that typically have steep gradients and flow to the coast in relatively steep sided valleys that have confined floodplains. These confined floodplains and the underlying hard rock geology result in relatively short rainfall response times in the upper catchments.

2.2.2 The main river catchments within the study area are the River Dart, River Teign, River Avon, River Plym, River Yealm, River Erme, River Tavy, River Lyd, River Taw, and River Okement. The main watercourses and catchment areas are identified in Figure A2 in Appendix A and described below.

River Teign

2.2.3 The River Teign catchment (including its tributaries) drains approximately 30% of the study area. The source of the River Teign is at Little Varracombe (520 m AOD) located in the north of the study area, approximately 8 km south west of Chagford. The Fernworthy Reservoir (used for public water supply) exists in the upper reaches of the River Teign catchment to the south of Chagford. Public water supply reservoirs (Kennick, Tottiford and Trenchford) also exist on tributaries of the River Teign located in the east of the study area.

2.2.4 The River Teign flows east, to the north of Chagford until it meets the study area boundary. It then flows south, where for approximately 9 km it forms the boundary of the Dartmoor National Park. Beyond the study area boundary the River Teign flows through Newton Abbot (tidal limit) and discharges to the sea at Teignmouth.

2.2.5 The River Bovey a tributary of the River Teign flows south east, to the south of North Bovey and through the woodlands of Lustleigh Cleave. The River Bovey is a relatively small river that flows through no major settlements within the study area. Beyond the study area the River Bovey flows through Bovey Tracey, before joining the River Teign.

River Dart

2.2.6 The River Dart catchment (including its tributaries) drains approximately 26% of the study area. The source of the River Dart is at Cut Hill (550 m AOD) located in the middle of the study area. The River Dart begins as two separate tributaries (the East Dart and West Dart), which join at Dartmeet. Venford Reservoir (used for public water supply) impounds a minor tributary of the River Dart to the south of Dartmeet. Prior to crossing the study area boundary, the River Dart flows southwards, to the east of Buckfast and then Buckfastleigh. Beyond the study area boundary the River Dart flows through Totnes (tidal limit) and discharges to the sea at Dartmouth.

2.2.7 The River Mardle a tributary of the River Dart flows into Buckfastleigh from the west. Prior to joining the River Dart, to the east of Buckfastleigh, the River Mardle is joined by the Dean Burn, which flows into Buckfastleigh from the south east.

2.2.8 The River Ashburn another tributary of the River Dart flows into Ashburton from the north. Within Ashburton the River Ashburn is joined by the Balland Stream, which also flows into Ashburton from the north. The River Ashburn then flows south joining the River Dart to the east of Buckfastleigh, beyond the study area boundary.

River Avon

2.2.9 The River Avon catchment (including its tributaries) drains approximately 5% of the study area. The source of the River Avon is at Avon Head (400 m AOD) an area of bog located in the southern half of the study area. Avon Dam Reservoir is located in the upper reaches of the River Avon catchment. The River Avon flows southwards, to the west of South Brent. Beyond the study area boundary the River Avon flows through Avonwick and Aveton Gifford (tidal limit) before discharging to the sea at Bantham.

River Erme

2.2.10 The River Erme catchment drains approximately 4% of the study area. The source of the River Erme is at Plym Head (470 m AOD) an area of bog located in the southern half of the study area. The River Erme flows in a southerly direction within a confined valley. Crossing

the study area boundary the River Erme flows into Ivybridge, continuing south through Ermington and Modbury, before discharging to the sea at Mothecombe.

River Yealm

2.2.11 The River Yealm catchment drains approximately 2% of the study area. The source of the River Yealm is at Yealm Head (430 m AOD) on the Stall Moor Mires of South Dartmoor. The River Yealm flows south to the east of Cornwood before crossing over the study area boundary. Beyond the study area boundary the River Yealm continues south flowing through Yealmpton, before discharging to the sea below Newton Ferrers and Noss Mayo.

River Plym

2.2.12 The River Plym catchment (and its tributaries) drains approximately 7% of the study area. The source of the River Plym is at Plym Head (450 m AOD) an area of bog located in the southern half of the study area. The River Plym flows in a south westerly direction, to the north of Shaugh Prior, before crossing over the study area boundary. Beyond the study area the River Plym flows through the confined valley of Bickleigh Valley, before flowing to the east of Plymouth and discharging to the sea via Plymouth Sound.

2.2.13 The River Meavy a tributary of the River Plym flows in a predominantly southwest direction, to the south of Meavy and then south joining the River Plym above Bickleigh Vale. Burrator Reservoir (used for public water supply) is located in the upper reaches of the River Meavy, to the east of Yelverton.

River Tavy

2.2.14 The River Tavy catchment (and its tributaries) drains approximately 16% of the study area. The source of the Tavy is South of Cut Hill (560 m AOD) in the northern half of the study area. The River Tavy flows within a confined valley, in a south westerly direction, passing between the villages of Peter Tavy and Mary Tavy. Beyond the study area boundary it flows through the centre of Tavistock. Continuing south the River Tavy joins the River Tamar, before discharging to the sea via Plymouth Sound. Wheal Jewell (Mary Tavy) Reservoir is located in the headwaters of the River Tavy and supplies the Mary Tavy hydro-generator.

2.2.15 The River Walkham a tributary of the River Tavy rises on Walkham Head (540 m AOD) in the west of the study area. The River Walkham flows predominantly south within a confined valley. Turning west the River Walkham flows into Horrabridge from the east, where it is joined by a number of minor tributaries. Continuing west the River Walkham joins the River Tavy within the vicinity of West Down.

River Lyd

2.2.16 The River Lyd drains approximately 3% of the study area. The source of the River Lyd is on Lyd Head (540 m AOD) to the north of Woodcock Hill. As the River Lyd flows south it is joined by a number of minor tributaries. Turning west the River Lyd flows to the south of Lydford before entering Lydford Gorge on the edge of the study area boundary. Beyond the study area the River Lyd continues west, flowing into the River Tamar beyond Lifton.

River Okement

2.2.17 The River Okement exists as the West Okement and the East Okement within the study area boundary, draining approximately 5% of the study area. These rivers are joined by a number of other minor tributaries, before joining together at Okehampton, immediately beyond the

study area boundary. Continuing north the River Okement flows into the River Torridge near Meeth. The River Torridge discharges to the sea on the north coast of Devon. Meldon Reservoir is located in the headwaters of the West Okement River.

River Taw

2.2.18 The River Taw drains approximately 3% of the study area. The source of the River Taw is on Taw Head (550 m AOD) a spring on the northern flanks of the study area. The River Taw flows north to the east of Belstone, before turning east and flowing through Sticklepath. Crossing the study area boundary the River Taw continues north discharging to the sea on the north coast of Devon. Ramsley Stream, a tributary of the River Taw flows north flowing through the centre of South Zeal. After crossing the study area boundary it joins the River Taw approximately 2 km downstream.

2.3 Topography and Geology

2.3.1 The geology of the study area has a major influence on its topography. The majority of the study area is underlain by granite, which intruded into Devonian and Carboniferous shales, sandstones and limestones around 280 million years ago. The granite uplands of Dartmoor are dominated by large hills, topped with outcrops of bedrock, known as Tors. Figure A3, Appendix A provides an overview of the geology (solid and drift deposits) within the study area. Table 10-2 in Chapter 10 presents an overview of the underlying geology within the study area's Local Centres.

2.3.2 Elevations within the study area range from approximately 30 m AOD (within the River Teign Valley) up to 621 m AOD at High Willhays in the north of the study area. The topography and geology, significantly influences the catchment hydrology and the response to rainfall. Many of the watercourses within the study area form incised channels flowing through steep confined valleys. Where channel gradients are steep, flood flows respond rapidly to rainfall and velocities and depths can be high.

3 Sequential Approach

3.1 Sequential Test

3.1.1 The main aim of this Level 1 SFRA is to present sufficient information to enable DNPA to apply the Sequential Test. The sequential approach is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except water-compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

3.1.2 Sequential Testing refers to the application of the sequential approach by LPAs. This allows the determination of site allocations based on flood risk and vulnerability (see Table 3-1 and Table 3-2, provided below). Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3, and to the areas of least flood risk within Flood Zone 2 and then Flood Zone 3, as identified within this SFRA.

Flood Zone Definition

Table 3-1: PPS25 Flood Zone Definitions (from PPS25, Appendix D, Table D1)

Flood Zones	Definition
Flood Zone 1	Low Probability - Land having less than 0.1% (1 in 1000 year) annual probability of fluvial or tidal flooding in any year.
Flood Zone 2	Medium Probability - Land having between 0.1% and 1% (between 1 in 1000 and 1 in 100 year) annual probability of fluvial flooding or between 0.1% and 0.5% (between 1 in 1000 and 1 in 200 year) annual probability of tidal flooding in any year.
Flood Zone 3a	High Probability - Land having a 1% or greater (1 in 100 year or greater) annual probability of fluvial flooding or 0.5% or greater (1 in 200 year or greater) annual probability of tidal flooding in any year.
Flood Zone 3b	Functional Floodplain – Land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of Functional Floodplain and its boundaries accordingly, in agreement with the EA. The identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the Functional Floodplain.

3.1.3 The application of the Sequential Test aims to manage the risk from flooding by avoidance. This will help avoid the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test, where required, through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers. Section 3.3 provides guidance on the appropriate application of the Exception Test with regards to development and flood risk within the study area.

Development Vulnerability

Table 3-2: Flood Risk Vulnerability Classification (from PPS25, Appendix D, Table D2)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind Turbines
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications 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.
More Vulnerable	• 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.**
Less Vulnerable	• Police, ambulance and fire stations which are **not** required to be operational during flooding. • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do **not** need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• 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.**

3.1.4 LPAs must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied Sequential Testing, and where necessary, the Exception Test, in the site allocation process. In cases where development cannot be fully

met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends.

Other Sources of Flooding

3.1.5 PPS25 acknowledges that some areas will (also) be at risk of flooding from flood sources other than fluvial or tidal systems. Consequently all sources of flooding must be considered when looking to locate new development. The other sources of flooding requiring consideration when situating new development allocations include:

- Surface water;
- Groundwater;
- Sewers; and,
- Artificial sources.

3.1.6 The EA has made available to LPAs Areas Susceptible to Surface Water Flooding (ASTSWF) maps, for strategic, broad-scale land use planning purposes. Whilst these maps should not be used as a definite indication of risk, it is recommended that LPAs draw on this data as it highlights those areas where the potential for surface water flooding needs further investigation.

3.1.7 For groundwater, sewer and artificial sources data primarily exists as point source data or through interpretation of local conditions. In addition, there is no guidance on suitable return periods to associate with floods arising from these sources. If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Testing.

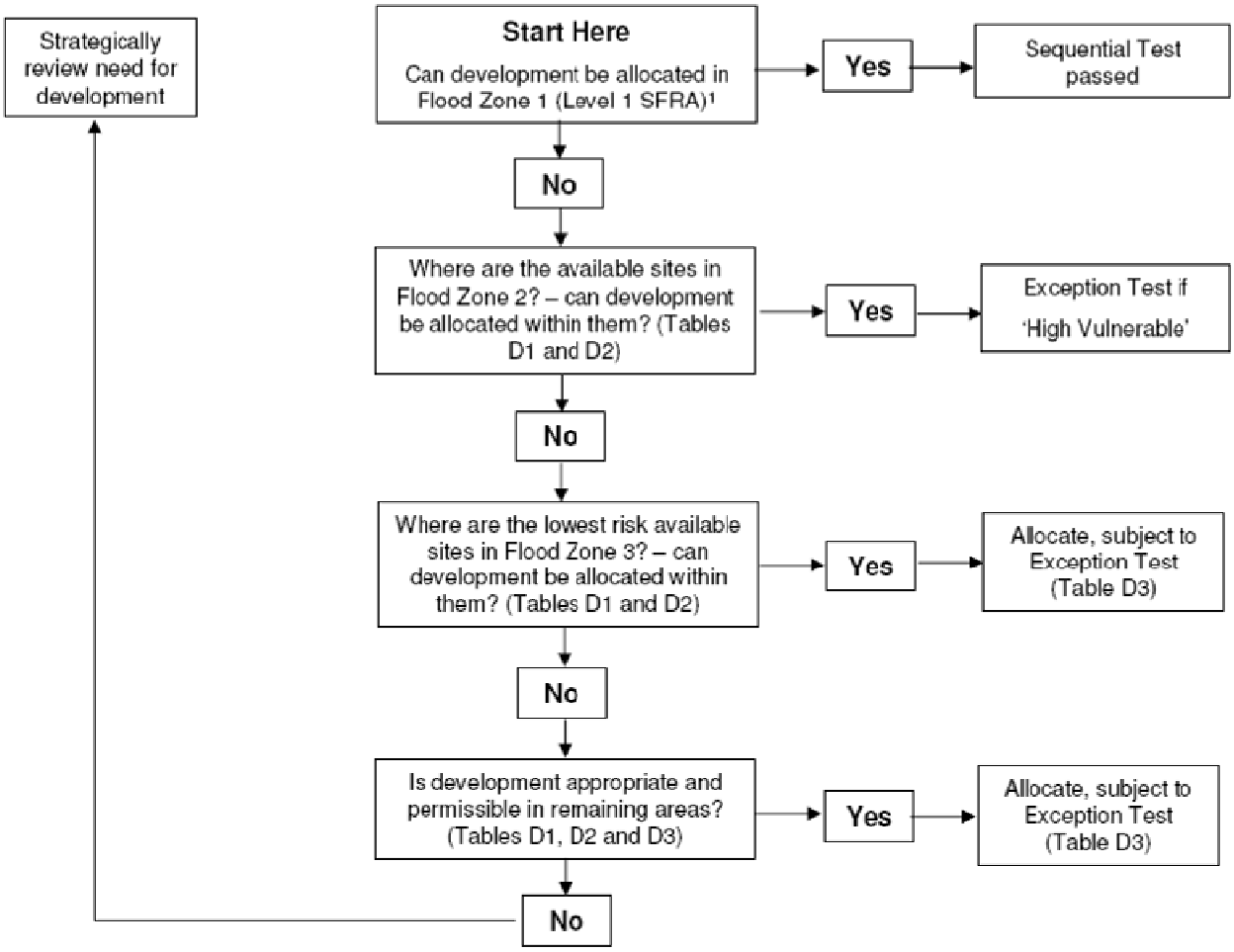
3.2 Application of the Sequential Test

3.2.1 The Sequential Test should be undertaken by LPAs and be accurately documented to ensure decision processes can be transparently communicated and reviewed where necessary. The Sequential Test should be carried out on all development sites, seeking to balance the flood probability and development vulnerability of sites throughout the administrative area. Only where there are no reasonably available[5] alternative sites should development be considered in Flood Zone 2 and then Flood Zone 3. The Sequential Test also applies to any new planning application including windfall sites.

3.2.2 The Sequential Test can also be applied within an overall Masterplan area. Vulnerable development (or for that matter, all development) should be steered into the parts of the site least at risk from flooding. Areas intended for green open space for example, could be positioned within areas with greater risk of flooding.

3.2.3 Mapping within this Level 1 SFRA provides the tools for the LPAs to undertake the Sequential Test. The recommended steps required in undertaking the Sequential Test are provided in the flow diagram provided below. This is based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 3.3 (from PPS25, Table D.3). A flow diagram for application of the Sequential Test from the PPS25 Practice Guide is also provided in Diagram 3.1.

[5] This is defined in terms of deliverable and developable as per guidance in PPS25 and the PPS25 Practice Guide that refers to PPS3: Housing and the associated practice guide – Strategic Housing Land Availability Assessments.



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

Diagram 3-1: Decision flow chart illustrating the application of the Sequential Test (adapted from Figure 4.1 from PPS25 Practice Guide).

Table 3.3: Flood Risk Vulnerability and Flood Zone 'Compatibility' (from PPS25, Appendix D, Table D.3)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test required	✓	✓
	3a	Exception Test required	✓	×	Exception Test required	✓
	3b	Exception Test required	✓	×	×	×

✓ Development is appropriate × Development should not be permitted

Recommended Stages for LPAs Application of the Sequential Test

3.2.4 The sequence of steps presented below is designed to guide the LPAs and developers through the Sequential Test. The steps are designed to ensure land allocations are primarily allocated in line with the principles of the Sequential Test or failing this the requirement for application of the Exception Test is clearly identified.

1. Assign all potential developments with a vulnerability classification (Table 3-2). Where development is mixed, this should be moved to the higher classification;
2. The location and identification of potential development should be recorded e.g. SX757699, Ashburton #1;
3. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Zones for fluvial sources as described in Chapter 5. Where these span more than one Flood Zone, all zones should be noted;
4. Other sources of flooding, such as surface water, sewer, groundwater and artificial flood sources should be considered (see Chapter 5 and 6);
5. The design life of the development should be considered with respect to climate change:
    - Residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period;
    - For development other than residential, its lifetime will depend on the characteristics of that development. Planners should use their experience within their locality to assess how long they anticipate the development being present for. Developers should justify why they have adopted a given lifetime for the development when they are formulating their FRA.
6. The effects of climate change on all flood sources should be considered when considering potential sites. The effects of climate change are explained further in Chapter 5;
7. Highly vulnerable developments to be accommodated within the LPAs area should be located in those sites identified as being within Flood Zone 1. If these cannot be located in Flood Zone 1, because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. If sites in Flood Zone 2 are inadequate then the LPAs may have to identify additional sites in Flood Zones 1 or 2 to accommodate development elsewhere in their settlements/locations within their administrative area or seek opportunities to locate the development outside their administrative area;
8. Once all highly vulnerable developments have been allocated to a development site, the LPAs can consider those development types defined as more vulnerable. In the first instance more vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate more vulnerable development, sites in Flood Zone 3a can be considered. More vulnerable developments in Flood Zone 3a will require application of the Exception Test;
9. Once all more vulnerable developments have been allocated to a development site, the LPAs can consider those development types defined as less vulnerable. In the first instance less vulnerable development should be located in any remaining unallocated

sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less vulnerable development types are not appropriate in Flood Zone 3b (Functional Floodplain);

10. Essential infrastructure should be preferentially located in the lowest flood risk zones, however, this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is fulfilled;
11. Water compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. However, water compatible development should still be located, where other constraints allow, to sites with the lowest flood risk;
12. Identify if there are existing flood defences serving the potential development sites based on the mapping presented in Chapter 7.

3.2.5 Where no reasonably available sites can be identified in areas of lower flood risk to meet development targets, the scope of the SFRA should be increased to provide information for the application of the Exception Test. This forms a Level 2 SFRA.

3.2.6 Where the development type is highly vulnerable, more vulnerable, less vulnerable or essential infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further. Confirmation of the assessment method should be established with the EA, this could be through either a Level 2 SFRA or a site specific FRA.

3.2.7 The effect of climate change for potential sites located within fluvial flood risk zones is described in Chapter 5. It is recommended that a Level 2 SFRA or a site specific FRA should investigate the effects of climate change in greater detail, where required (see Chapter 5).

3.3 Exception Test

3.3.1 The Exception Test provides a method of managing flood risk while still allowing necessary development to take place. PPS25 indicates that it is appropriate to apply it only in those instances where there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites and where development is necessary for wider sustainable development reasons.

3.3.2 The guidance goes on to note that it may also be appropriate to use it where national designations (e.g. such as national parks) prevent the availability of unconstrained sites in lower risk areas. Paragraphs D9 to D14 of PPS25 set out criteria that must be satisfied for the Exception Test to be passed.

3.4 Windfall Sites

3.4.1 PPS25 requires the application of the Sequential Test to all planning applications in flood risk areas, including those on previously developed land, unless the area or site has already been allocated through a Sequential Test, informed by an SFRA. Windfall sites are sites that become available for development during plan period but have not been allocated within a development plan that has been sequentially tested. The LPA should develop policies in their LDDs on how windfall sites should be treated in flood risk terms.

3.4.2 The PPS25 Practice Guide indicates that LPAs should identify areas where windfall development would be constituted as appropriate development i.e. defining the type of windfall development which would be acceptable in certain flood risk areas and what the broad criteria should be for submitting a planning application under these circumstances. It is suggested that where a windfall site becomes available, appropriate development options should take into account the vulnerability classification (Table 3-2) and the availability of sites with lower flood risks.

3.4.3 Planning Policy Statement 3 (PPS3): Housing indicates that LPAs should not make allowances for windfalls in their plans for the first 10 years of land supply. Only where LPAs can demonstrate genuine local circumstances that prevent specific sites being identified can a windfall allowance be included.

3.5 Additional Guidance

3.5.1 Additional guidance is provided on the EA website for the application of the Sequential Test by LPAs[6]. Furthermore the PPS25 Practice Guide provides additional guidance on the application of the Sequential Test, including guidance on the following aspects:

- Availability of alternative sites (paragraph 4.19 and 4.25);
- Regeneration areas (paragraph 4.38);
- Renewable energy projects (paragraph 4.39);
- Redevelopment of an existing single property (paragraph 4.40);
- Change of use development (paragraph 4.42).

[6] http://www.environment-agency.gov.uk/research/planning/82584.aspx

4 Level 1 SFRA – Methodology

4.1 Overview

4.1.1 As outlined in Chapter 1 the main purpose of the Level 1 SFRA is to collect, collate and review the information available relating to flooding in the study area. This information is then presented in a format to enable LPAs to apply Sequential Testing to their potential development areas (see Chapter 3) to determine sites that may need to be examined in more detail through the application of the Exception Test (if necessary) at the Level 2 SFRA stage.

4.2 Tasks

4.2.1 The sequence of tasks undertaken in the preparation of the Level 1 SFRA is shown below:

- Inception meeting with DNPA and the EA on 23rd June 2010;
- Established the local stakeholders;
- Contacted stakeholders requesting data/information;
- Collated and reviewed available data against the SFRA objectives;
- Identified missing data and re-requested from relevant stakeholder;
- Ashburton and Buckfastleigh Site visit with EA on 19th August 2010;
- Production of a broad-scale assessment of flood risk.

4.2.2 All tasks were completed between June 2010 and October 2010.

4.3 Stakeholders

4.3.1 The stakeholders that were contacted to provide data/information for the SFRA were:

- DNPA;
- EA (Devon and Cornwall area office);
- South West Water Ltd;
- Highways Agency;
- Devon and Somerset Fire and Rescue Service.

4.4 Information/Data Collected

4.4.1 In accordance with the PPS25 Practice Guide the following data/information has been collected to inform the SFRA:

EA Data/Information

- EA Flood Zones 2 and 3;
- EA ASTSWF map;

- National Flood and Coastal Defence Database (NFCDD) information;
- Additional data from the EA:
  - Catchment Flood Management Plans (CFMPs);
  - Detailed modelling and flood mapping studies;
  - Broad-scale model (JFLOW) fluvial depth grids;
  - Digital Terrain Model – LiDAR/SAR;
  - Devon hydrology strategy flows;
  - Historical flooding information (extents and point data);
  - Flood Warning Areas (FWAs);
  - Details and location of reservoirs;
  - Main River centrelines;
  - Catchment boundaries;
  - EA Devon/Cornwall office administrative regions.

Dartmoor National Park Authority Data/Information

- Ordnance Survey (OS) maps (1:10,000 and 1:50,000 scale);
- British Geological Survey (BGS) solid and drift maps;
- Detailed River Network (on and offline watercourses);
- Development areas of interest (within Ashburton and Buckfastleigh).

Other flood risk consultees

- South West Water Ltd summary of sewer flooding within the study area;
- Devon and Somerset Fire and Rescue Service flood incident call outs;
- Limited information from the Highways Agency.

4.4.2 All of the received data has been registered on receipt and its accuracy and relevance reviewed to assess a confidence level for contribution to this Level 1 SFRA (Table 4-1). All of the information/data was provided in GIS format, or the raw data was manipulated into this format for use within the study (where suitable). Details of all collected data are presented in Appendix D.

Table 4-1: Method for Qualitative Confidence Ranking of Data Received

		Relevance		
		1 – Very Relevant	2 – Partly Relevant	3 – Not Relevant
Accuracy	1 - Excellent	Very Good	Good	Good
	2 - Good	Good	Good	Fair
	3 - Fair	Good	Fair	Fair
	4 - Poor	Fair	Fair	Poor
	5 – Very Poor	Fair	Poor	Very Poor

5 Level 1 SFRA – GIS Analysis

5.1 Overview

5.1.1 Using the data collected a series of GIS layers have been collated to visually assist DNPA in their site allocation decisions and development control activities. The GIS layers contain additional attribute data, which provides more detailed information regarding the date, location and cause of the flood event.

5.1.2 Broadly, the layers can be classified into planning policy, informative and flood risk categories. Table 5-1 summarises the main GIS layers used in the SFRA.

Table 5-1: GIS Layers used in Level 1 SFRA

Planning Policy	Informative	Flood Risk
DNPA Administrative Boundary	Main Rivers	Flood Zones (Flood Zone 3a, 3b & Flood Zone 2)
Neighbouring District Boundaries	Detailed River Network (online & offline)	Availability of Detailed Hydraulic Models
EA Area Office Boundaries (Devon/Cornwall)	Catchment Areas	Historical Flood Extent Maps (Fluvial)
DNPA Development Areas of Interest	Background OS Mapping (1:10,000 and 1:50,000)	Flood Defences
	Local Geology (BGS Solid and Drift Geology)	Historical Flood Incident Point Data (All Flood Sources)
	Digital Terrain Data (LiDAR/SAR data for selected Local Centres)	Areas Susceptible to Surface Water Flooding Maps
		Potential Surface Water Flooding
		Flood Warning Areas
		Major Water Bodies under the Reservoirs Act (1975)

5.2 GIS Data Gaps and Assumptions

5.2.3 The main (potential) gaps in the data relate to unmapped watercourses where no flooding information is available. The headwaters of a number of watercourses exist within the study area with limited drainage catchments. As the EA Flood Zone mapping generally covers watercourses with drainage catchments greater than 3 km^2 the majority of these watercourses remain unmapped.

5.2.4 Where a potential development site is proposed within the vicinity of an unmapped watercourse the Potential Surface Water Flooding (PSWF) GIS layer (see paragraph 5.5.22 – 5.5.23) should be used as an indicator to determine whether further investigation is required during a Level 2 SFRA or during a site-specific FRA. This approach has been agreed with the EA.

5.2.5 At locations where there is no PSWF layer coverage it is recommended that a 10 m buffer either side of the channel should be used as an indicator to determine whether further investigation is required either during a Level 2 SFRA or during a site-specific FRA. Again this approach has been agreed with the EA.

5.3 Planning Policy GIS Layers

Area Boundaries

5.3.1 Administrative boundary GIS layers have been provided, including the DNPA study area boundary, the administrative boundaries of the bordering districts and the administrative areas of the EA Devon and Cornwall offices within the study area.

Development Areas of Interest

5.3.2 GIS layers of potential developments sites/areas of interest within Ashburton and Buckfastleigh, which require consideration during the Level 1 SFRA have been provided.

5.4 Informative GIS Layers

Watercourses

5.4.1 Watercourse information GIS layers have been provided. These layers differentiate between the varying watercourse classifications and identify the main river catchment areas within the study area (see Figure A2, Appendix A).

- Main River (Main River only);
- Detailed River Network Online (Main River and Ordinary Watercourses);
- Detailed River Network Offline (offline watercourses such as disused leats, which are no longer hydraulically connected to the river network).

Mapping

5.4.2 Digital OS mapping (1:10,000 and 1:50,000) for the entire study area.

Geology

5.4.3 BGS solid and drift geology information GIS layers for the entire study area provides an indication of the suitability of SuDS at a strategic level (see Figure A3, Appendix A).

Digital Terrain Model (DTM)

5.4.4 A DTM based on LiDAR/SAR data provides ground level information within Local Centres where the requirement for a focused assessment has been identified. This is with the exception of Moretonhampstead where no DTM coverage is available (i.e. Ashburton, Buckfastleigh, South Brent and Horrabridge).

5.5 Flood Risk GIS Layers

Fluvial Flood Zones

5.5.1 The EA has provided Flood Zones 2 and 3 (dated March 2010) for the entire study area. The Flood Zones, which ignore the presence of flood defences, cover all Main Rivers, Critical Ordinary Watercourses and Ordinary Watercourses with catchment areas greater than 3 km^2. The Flood Zones are updated on a quarterly basis, to ensure the most up to date and relevant flooding information is being used to inform planning decisions.

5.5.2 In addition to these Flood Zones the EA have provided draft Flood Zone 3 extents for Moretonhampstead (Wray and Wadley Brooks) and for the River Teign at Chagford. These draft flood extents are outputs from the 'Small Catchment Improvements' project undertaken in 2010. The EA have confirmed that the draft flood extents will be incorporated into the EA Flood Map as part of their next quarterly update. Therefore, to ensure the best available information is being used, the draft flood maps have been incorporated within the Level 1 SFRA Flood Zones layers.

5.5.3 The EA do not differentiate between Flood Zone 3a (High Probability) and Flood Zone 3b (Functional Floodplain). The Flood Zones give an indication of the areas at risk of fluvial flooding within the study area, but do not provide information on flood depth or velocity of flow. The Flood Zones provide no information on other sources of flooding, such as surface water (stormwater and direct runoff), groundwater or artificial flood sources.

5.5.4 The Flood Zone 2 and 3 extents have been developed by the EA using a combination of broad scale modelling (JFLOW) and earlier methods which include the use of SAR topography together with data based on historic records and engineering judgement.

5.5.5 Liaison with the EA during preparation of the Level 1 SFRA indicates that Flood Zone outputs from detailed hydraulic modelling studies undertaken within the study area (see paragraph 5.5.11 – 5.5.12) have not been incorporated into the EA Flood Map to date.

5.5.6 The Flood Zones are presented in Figure A4, Appendix A, the Local Centre Focused Assessment maps in Appendix B and the DNPA study area overview map in Appendix C.

Functional Floodplain

5.5.7 In accordance with PPS25 areas of Functional Floodplain (Flood Zone 3b) have been identified within the study area in discussion with the EA. Only water compatible uses and essential infrastructure (the latter requiring the Exception Test to be passed) is permitted within areas identified as Functional Floodplain.

5.5.8 The PPS25 definition for Functional Floodplain is relatively flexible to make allowances for local circumstances. However, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year is suggested as the starting point when identifying Functional Floodplain. The PPS25 Practice Guide provides the following additional guidance for the identification of Functional Floodplain:

- Areas which would naturally flood with an annual exceedence probability of 1 in 20 (5%) or greater, but which are prevented from doing so by existing infrastructure or solid building, would not normally be defined as Functional Floodplain;

- Developed areas are not generally part of the Functional Floodplain. However, developed areas, which may provide an important flood storage and conveyance function, such as parks, car parks and roads should be considered as Functional Floodplain.

5.5.9 This guidance has been used to identify Functional Floodplain within the 'Local Centres' where future development is likely to be focused. Outside the 'Local Centres' where future development is less likely to occur, a precautionary approach has been adopted whereby Functional Floodplain is assumed to equal the extent of Flood Zone 3, until an appropriate site specific FRA can demonstrate otherwise to the EA.

5.5.10 Functional Floodplain is visible on the Flood Zone maps shown in Figure A4, Appendix A, the Local Centre Focused Assessment maps in Appendix B and the DNPA study area overview map in Appendix C.

Availability of Hydraulic Models

5.5.11 The EA has provided varying levels of information relating to the availability of hydraulic models within the study area. Based on this information a GIS Layer has been produced to provide details, such as location, model type, date and purpose of study. Figure A5, Appendix A shows reaches of watercourses within the study area for which the EA holds hydraulic models.

5.5.12 Where detailed hydraulic model outputs are available, these should be used in preference to the broad scale modelled Flood Zones as detailed hydraulic modelled Flood Zones add greater definition and are also considered to be more accurate than broad scale modelling methods. It is important to take this into consideration when undertaking Level 2 SFRA work or site specific FRAs.

The Effects of Climate Change

5.5.13 It is predicted that climate change will bring milder wetter winters that are characterised by periods of long duration rainfall. In contrast, frequent and short duration, high-intensity rainfall linked with longer drier summers is predicted. These scenarios are likely to cause increased flooding from fluvial, surface water and sewer sources.

5.5.14 To ensure sustainable development now and in the future, PPS25 requires that the effects of climate change should be taken into account in an SFRA and that outlines delineating climate change should be presented. Table 5-2 provides the recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows.

Table 5-2: Recommended National Precautionary Sensitivity Ranges for Peak Rainfall Intensities and Peak River Flows (from PPS25, Appendix B, Table B2)

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%		+20%	

5.5.15 The effect of climate change on Flood Zone extents are likely to be limited due to the relatively steep sided valleys that form confined floodplains. The relatively small area of Flood Zone 2 illustrates that increases in flow from fluvial flooding are likely to increase the depth of flooding as opposed to the extent of flooding.

5.5.16 Therefore in the absence of modelled outlines for Flood Zone 3 plus climate change it is pragmatic to suggest that Flood Zone 2 should be used as a surrogate for Flood Zone 3 plus climate change until such time that more detailed information is available, such as an EA Strategic Flood Mapping Study (SFRM) study, an appropriate site specific FRA or a Level 2 SFRA.

Historical Flood Mapping

5.5.17 Historical flood extents provided by the EA have been combined to delineate approximate areas that have previously flooded. The historical extents are generally based on estimates following a flood and therefore some inaccuracies may exist. However the layers serve as a useful comparison to the Flood Zone maps and in areas show land beyond the Flood Zone extents where flooding may have previously been experienced.

Areas Susceptible to Surface Water Flooding

5.5.18 The EA has provided ASTSWF GIS layers which are distributed to LPAs in a similar way to the EA Flood Maps. The ASTSWF map provides three bandings, which indicate whether an area is 'less', 'intermediate' or 'more' susceptible to surface water flooding. The map was produced following a simple method that uses rainfall data for a 6.5 hour storm with a 1 in 200 year return period.

5.5.19 EA guidance indicates that the maps should not be used to show the susceptibility of individual properties to surface water flooding, but should be used at a strategic 'broad brush' level to identify potential surface water flooding hotspots. Generally the maps represent surface water flooding better in steep catchments compared to areas with flat topography.

5.5.20 Given the uncertainties in the ASTSWF maps, the EA state that they should not be used with a more detailed base map scale than 1:50,000. Therefore, the ASTSWF maps are presented in Figure A6, Appendix A, but have been omitted from the Local Centre focused assessment mapping, shown in Appendix B, which uses 1:10,000 OS base mapping.

5.5.21 The salient recommendations of the ASTSWF guidance document with regards to the planning process are as follows:

- Maps should indicate where more detailed studies may be appropriate;
- They are not appropriate to act as the sole evidence for any specific planning decision without further evidence;
- Other data such as that collated as part of the SFRA or data from the local drainage engineers should be used to indicate where further assessment may be necessary.

5.5.22 Regarding unmapped watercourses within identified Local Centres the EA acknowledge that the ASTSWF maps provide users with a more comprehensive understanding of flood risk. Therefore, in agreement with the EA a PSWF layer has been produced based on the 'less susceptible' ASTSWF layer. This PSWF layer will ensure a conservative (precautionary) approach is adopted when considering flood risk within the Local Centres.

5.5.23 Further details on the application of the PSWF layer within the SFRA is provided in Section 5.2. The PSWF layer has been presented on the Local Centre focused assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

Historical Flood Incidents – All Flood Sources

5.5.24 The EA has provided GIS layers from their Flood Reconnaissance Information System (FRIS) database, which provides historic flood incident (including properties affected by flooding) records from all sources of flooding within the study area. This information has been supplemented with flood incident call outs recorded by Devon and Somerset Fire and Rescue Service.

5.5.25 Reported historical flood incidents are presented in Figure A7, Appendix A, the Local Centre focused assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

5.5.26 This information represented the best available data attributed to flooding from sewer, groundwater and artificial flood sources (e.g. reservoirs and leats) and provides additional datasets for fluvial and surface water flooding.

Flood Defence

5.5.27 Traditionally, flood defences are often man-made structures, such as walls or embankments, aligned along the banks of a river system, which are intended to prevent flooding of land that lies behind. More recently, 'softer' approaches have been adopted, such as the allocation of land to flood in preference of somewhere more vulnerable. Flood defences do not entirely remove flood risk, a residual risk will remain, if for example an embankment becomes breached or is overtopped.

5.5.28 The EA has provided GIS layers from their NFCDD showing details of structures and flood defence assets within the study area. This provides details of the asset reference, location and Standard of Protection (SoP) that the structure or defence provides. All NFCDD entries are presented in Figure A8, Appendix A. Man made flood defences with a recognised SoP are also highlighted on Figure A8, Appendix A, the Local Centre Focused Assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

Flood Warning Area

5.5.29 The EA has provided a GIS layer indicating areas located within an EA Flood Warning Area (FWA). This information can be used by DNPA in conjunction with the Flood Zone maps and defence information to assist in developing emergency plans for areas at risk of flooding within the study area. FWAs across the study are presented in Figure A9, Appendix A.

Reservoir Act (1975) Water Bodies

5.5.30 The location and details of reservoirs within the study area, which fall under the Reservoir Act (volume greater than 25,000 m^3)[7] have been provided by the EA Reservoir Team (Exeter). Reservoir locations across the study area are presented within Figure A2, Appendix A and Figure A7, Appendix A.

5.5.31 The EA have produced Reservoir Inundation Maps (RIM) to quantify the risk of flooding from medium and high risk reservoirs throughout the United Kingdom. RIM provides detailed flood extent and hazard data, which can be used to identify areas at risk of flooding in the event of a reservoir breach.

[7] This may be reduced to 10,000 m^3 due to new legislation within the Flood and Water Management Act 2010

5.5.32 It is understood that RIM outputs are available to top-tier local authorities to manage the development of emergency flood plans with their Local Resilience Forum (LRF). Once in place these plans should be followed in the event of a breach or overtopping of the reservoir control structure or embankment.

5.5.33 For the purpose of this SFRA a simplified assessment based on local topography and the DTM (based on LiDAR/SAR data) has been undertaken to identify the predominant flow route in the event of a breach. The predominant flow routes are shown in Figure A7, Appendix A. **It is important to note that this assessment does not provide a definitive indication of flow routes or risk. Where development is proposed downstream of a reservoir, for example within Buckfastleigh, South Brent or Chagford, DNPA should contact Devon County Council (DCC) for further guidance.**

6 Assessment of Flood Risk

6.1 Flooding History

6.1.1 There have been a number of reported incidents of flooding from different sources within the DNPA study area. Figure 6-1 below shows the main sources of flooding reported in the study area based simply recorded flood events, not taking severity into account.

6.1.2 Fluvial flooding is the main flood source in the study area, with urban development in the floodplain, insufficient channel capacity and inadequate culvert capacity being the main issues. Surface water flooding, which includes direct runoff, inadequate stormwater drainage and land drainage is a significant flood source within the study area. Artificial flood events are shown as being a relatively minor flood source with blockages within the study area's leats being the main issue.

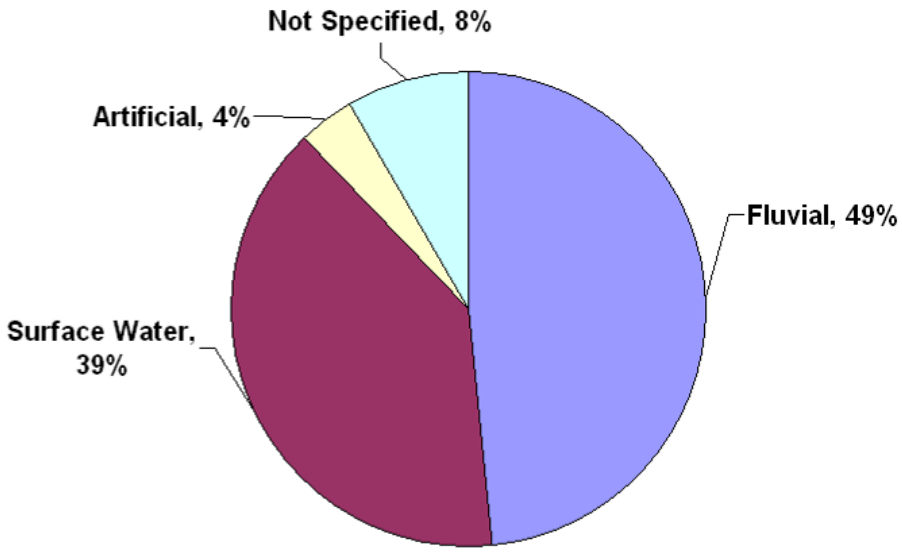


Figure 6-1: Study Area Flood Sources (based on EA FRIS database)

6.1.3 Figure A7, Appendix A presents a strategic overview of reported flood incidents within the study area and provides an indication of the cause of flooding at any given location. The majority of the flood incidents reported are in the Local Centres of Ashburton, Buckfastleigh, Horrabridge and South Brent. The smaller settlements of South Zeal, Cornwood, Sticklepath, Walkhampton, Lustleigh and North Bovey also shown to have experienced a number of flooding incidents.

6.1.4 Selected historical flood incidents recorded within the study area are provided in Table 6.1. These flood incidents have been predominantly sourced from the CFMPs covering the study area (see Chapter 9).

Table 6-1: Selected Historical Flood Incidents within Study Area

Date	Watercourse	Location	Details
February 1974	River Ashburn	Ashburton	Insufficient river channel. Approximately 120 properties flooded.
December 1979	River Mardle	Buckfastleigh	Insufficient river channel. Approximately 70 properties were flooded.
November 1980	Minor Tributary of River Meavy	Dousland	Torrential rain and surface water causing rivers to overtop. Number of properties affected unknown.
1988	River Avon	South Brent	Insufficient river channel. Approximately 4 properties.
January 1999	River Walkham	Horrabridge	Torrential rain and surface water causing rivers to overtop. Number of properties affected unknown.
January 1999	River Mardle	Buckfastleigh	Insufficient river channel.1 property flooded.
October 2000	Ramsley Stream	South Zeal	Combination of insufficient river channel and culvert capacity. Approximately 10 properties flooded.

6.2 Fluvial Flooding

6.2.1 The updated Flood Zones are shown in Figure A4, Appendix A, the Local Centre focused assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

6.2.2 As previously discussed the entire extent of Flood Zone 3 outside the identified Local Centres is assumed to be Functional Floodplain (Flood Zone 3b). Within the Local Centres Functional Floodplain has been defined using guidance provided within PPS25 and the PPS25 Practice Guide (see Chapter 5).

6.2.3 The Flood Zone maps indicate that areas of land located within Flood Zone 2 (medium risk) and Flood Zone 3 (high risk) is low compared to the area of land located within Flood Zone 1 (low risk) across the study area. This is due to the floodplain extent (Flood Zone 3a/b and Flood Zone 2) being confined within steep sided valleys. However, areas located within the Flood Zones are at significant risk of flooding, as the steep river catchments respond quickly to localised rainfall with river flows becoming fast and deep with little or no flood warning.

6.2.4 Settlements where people and property are at greatest risk are in the Local Centres of Ashburton, Buckfastleigh, and Horrabridge and to a lesser extent South Brent where floodplain development constricts the natural floodplain. This allows fast flows to build up, overtopping at the lowest point and causing severe localised flooding. This fluvial flood risk can be exacerbated by culvert and bridge blockages and/or infrastructure failure.

6.2.5 Smaller settlements within the study area, such as South Zeal, Cornwood, Sticklepath, Walkhampton, Lustleigh and North Bovey are likely to have similar flooding issues as those mentioned above albeit on a smaller scale.

6.2.6 As previously discussed in Chapter 5, the effect of climate change on future Flood Zone extents are likely to be limited due to the relatively steep sided valleys that form confined floodplains. The relatively small area of Flood Zone 2 illustrates that increases in flow from fluvial flooding are likely to increase the depth of flooding as opposed to the extent of flooding.

6.3 Surface Water Flooding

6.3.1 Overland flow is caused by water flowing over the ground surface that has not entered a natural drainage channel or stormwater management system. Overland flow often occurs typically when the soil is saturated and natural drainage channels or stormwater management systems do not have the capacity to absorb the additional flow. Flooding from this source can occur anywhere within a catchment, but is most likely to occur in low points in terrain (natural valley bottoms), or where the pathway for runoff is restricted by terrain or man-made obstructions.

6.3.2 The ASTSWF map provided in Figure A6, Appendix A identifies areas susceptible to surface water flooding within the study area. Generally, the low lying areas along the river valleys and along the course of culverted watercourses as well as natural low points appear to be most susceptible.

6.3.3 There are a number of reported historic surface water flooding events within the study area these are generally caused by a combination of factors, such as, direct runoff and inadequate or blocked drainage systems. Types of drainage systems identified as being contributing factors to surface water flood events within the study area include highway drains, stormwater drains and combined sewers. Reported surface water flood incidents are shown in Figure A7, Appendix A, the Local Centre focused assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

6.4 Sewer Flooding

6.4.1 South West Water are the statutory water undertakers within the study area and are responsible for the public sewer systems, which include surface water, foul and combined sewers. Liaison with South West Water during the preparation of this Level 1 SFRA indicates that sewer flooding from surface water sewers is not related to the capacity, structural or service condition of the sewer, but occurs due to sewer blockages from debris.

6.4.2 Where future development is proposed sewer networks may need to be upgraded to ensure sufficient capacity is maintained. The effects of climate change may also place further pressure on sewer systems with predictions of milder wetter winters and increased rainfall intensity in summer months. This combination is likely to result in more frequent sewer flooding.

6.4.3 Due to the combined nature of reported sewer flooding incidents within the study area they are included within the category ‘surface water’ flooding, as shown in Figure A7, Appendix A, the Local Centre focused assessment mapping in Appendix B and the DNPA study area overview map in Appendix C.

6.5 Groundwater Flooding

6.5.1 Groundwater flooding tends to occur after much longer periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

6.5.2 There have been no reported groundwater flood incidents within the study area. The nature of the geology within the study area means that groundwater flooding is unlikely to be a significant issue when compared to fluvial, surface water and sewer flooding.

6.6 Artificial Flood Sources

Reservoirs

6.6.1 The risk of flooding from reservoirs is mainly due to dam/reservoir wall failure and emergency releases into the catchment. Table 6-2 provides details of the nine reservoirs located within the study area which fall under the Reservoir Act (volume greater than 25,000 m^3)[8], together with the predominant flow route anticipated in the event of a breach, based on the simplified method described in Chapter 5.

6.6.2 Figure A7, Appendix A also shows the location of the nine reservoirs within the study area, together with the predominant flow route anticipated in the event of a breach.

Table 6-2: Details of Reservoirs within the Study Area

Reservoir	Location	Dam Type	Capacity (m3)	Predominant Flow Route
Avon	Headwaters of River Avon, 5 km north of South Brent	Concrete Gravity	1,386,500	Confined within the River Avon valley
Burrator	Headwaters of River Meavy, 3 km east of Yelverton	Masonry Gravity	4,464,000	Confined within the River Meavy valley
Fernworthy	Headwaters of River Teign, 4 km south west of Chagford	Concrete Gravity	1,727,300	Confined within the South Teign River valley
Kennick	Headwaters of River Teign, 6 km south east of Moretonhampstead	Gravity and Earthfill	882,000	Into Tottiford Reservoir
Tottiford	Headwaters of River Teign, 6 km south east of Moretonhampstead	Gravity and Earthfill	468,200	Into Trenchford Reservoir
Trenchford	River Teign minor tributary, 6 km south east of Moretonhampstead	Gravity and Earthfill	777,000	East towards River Teign
Meldon	Headwaters of West Okement River, 4 km north of Okehampton	Concrete Gravity	3,170,000	Confined within the West Okement River valley
Venford	River Dart minor tributary, 2 km north west of Holne	Concrete Gravity	909,000	North towards River Dart
Wheal Jewell (Mary Tavy)	Headwaters of River Tavy, 3 km north east of Mary Tavy	Gravity and Earthfill	30,924	South towards the River Tavy

6.6.3 As previously mentioned in Chapter 5 the EA have produced RIM to quantify the risk of flooding from reservoirs throughout the United Kingdom. The outputs from the RIM should be used as the main source of information to inform development decisions and evacuation procedures when considering the flood risk posed by reservoirs.

6.6.4 It should be noted that the risk of flooding from reservoirs is extremely low. Reservoirs are inspected regularly by specially qualified Engineers to ensure they are structurally safe and the correct operation and maintenance procedures are being followed.

Leats

6.6.5 A leat is an artificial watercourse, which is designed to convey water from a natural watercourse to a specific destination where there is a water demand. Historically leats within

[8] This may be reduced to 10,000 m^3 due to new legislation within the Flood and Water Management Act 2010

the study area have supplied water for domestic, industrial and agricultural purposes. Table 6-3 list the names and location of identified leats within the study area which remain in use.

Table 6-3: Name and Location of Leats within the Study Area

Leat	Location
Sticklepath Leat	River Taw catchment near Finch Foundary
Grimstone Leat	River Walkham catchment near Grimstone
Sortridge Leat	River Walkham catchment near Sortridge
Wheal Friendship Leat,	River Tavy catchment near Mary Tavy
Wheal Jewell Leat	River Tavy catchment near Mary Tavy
Hamlyn's leat,	River Dart catchment near Holne
Holne Town Gutter	River Dart catchment near Holne
Gidleigh Leat	River Teign catchment near Gidleigh
Devonport Leat	River Meavy catchment near Dousland

6.6.6 There are a small number of reported historic flood events linked to leats within the study area, most notably the Devonport Leat where previous blockages have caused overtopping of the leat causing localised flooding to properties in Dousland. The majority of the flood incidents reported date back more than 20 years therefore mitigation works may have since been carried to alleviate problem areas identified in the mapping presented in Figure A7, Appendix A.

7 Flood Risk Management

7.1 Flood Defence Infrastructure

7.1.1 The flood defence infrastructure and management regimes for the watercourses within the study area are shown in the NFCDD database GIS layer provided by the EA. The database indicates that the flood defence infrastructure with a recognised SoP is limited to the Local Centres of Ashburton, Buckfastleigh and Horrabridge.

7.1.2 The SoP associated with the flood defence infrastructure within these Local Centres typically ranges from 1 in 2 year to 1 in 50 year SoP. Types of defences include raised man made defences (masonry or concrete walls and earth embankments) and culverted channels. Key flood defence schemes are summarised in Table 7-1. Figure A8, Appendix A shows all the entries in the NFCDD database and identifies the location of key flood defence infrastructure with a recognised SoP within the study area.

Table 7-1: Key Flood Defence Schemes within the Study Area

Flood Defence Scheme	Standard of Protection / Capacity	Details
Ashburton	1 in 50 year	Completed in 1980s, River Ashburn is culverted to prevent flood water running down Rew Road into the town. A second culvert diverts high flows from the River Ashburn in the town centre. Masonry walls exist along the River Ashburn.
Buckfastleigh	1 in 50 year	Completed in 1980s, a culvert diverts high flows from the Dean Burn upstream of Damarell Bridge. The weir on River Mardle below the A38 road bridge was removed and walls raised upstream of Church Bridge. The weir structure upstream of Dial Motors was also removed.
Horrabridge	1 in 20 year	Raised defence (man made) consist of masonry wall and flood embankment along the River Walkham

7.1.3 The SoP of flood defences shown in Table 7-1 provides an indication of the level of protection offered to areas benefiting from these defences. Although areas of Local Centres are considered to be benefiting from flood defences up to the 1 in 50 year SoP, the EA Flood Zone 3 is based on the 1 in 100 year return period; therefore it may not be appropriate to allocate development in these areas.

7.1.4 Generally development should not be permitted where flood defences, properly maintained and in combination with agreed warning and evacuation arrangements, would not provide an acceptable standard of safety taking into account climate change (according to Annex G PPS25).

7.1.5 The SoP provided by flood defences should be considered as indicative as the defence type, age, condition and ownership of the defence is not taken into account. Therefore the information provided within the NFCDD should be treated with low confidence and used as a preliminary assessment of the SoP provided by flood defences. Where necessary, a more detailed assessment of the defences should be undertaken as part of a Level 2 SFRA.

Climate Change

7.1.6 Impacts of Climate Change include an increase in frequency of flooding events, the lowering of the SoP offered by flood defences and the carrying capacity of culverts, drains, sewers and watercourse channels. These potentially lead to areas being at risk of flooding that were previously not at risk and highlights the increasing conflicts and pressures that are emerging between climate change scenarios and future development aspirations.

Residual Risk

7.1.7 Whilst flood defences do offer significant benefit, residual risk must be considered during evaluation of suitable sites for development allocation. Furthermore, it is suggested that an assessment of the likely flood routes associated with overtopping or infrastructure failure should form part of a Level 2 SFRA or site specific FRA where required. An appreciation of the actual or residual risk can therefore be identified through this process.

7.2 Emergency Planning

7.2.1 When extreme flood events occur it is essential to have an emergency plan in place to provide clear procedural instructions. The mobilisation and organisation of the emergency services and supporting agencies is required to rescue, treat and transport potentially large numbers of people. During and after a flood event the relevant district council (see Figure 1, Chapter 2) is responsible for providing transport for the evacuees and safe rest centres to house people in the event of homes being flooded. Further health and welfare issues are inevitable as a result of serious flood event.

7.2.2 DCC has a Flood Warning and Response Plan (FWRP)[9]. The FWRP seeks to bring together emergency services, LPAs and other partners to provide a co-ordinated response to a specific flood warning. The FWRP provides a framework for responding to all forms of major flooding events across the study area.

7.2.3 At a strategic level this Level 1 SFRA will provide a useful information base which can be used to consider viable safe access and escape route during flood events. However, at a site specific level, a more detailed assessment of proposed evacuation routes will need to be investigated to ensure that safe access and escape routes are achievable for the lifetime of the development. If required this can be undertaken either within a site specific FRA, or at the Level 2 SFRA stage.

7.2.4 This Level 1 SFRA can also be used to contribute to the development of emergency planning policy for existing development at risk of flooding within the study area.

7.3 Flood Warning Areas

7.3.1 The EA operates a Flood Warning Service (FWS), details of which are available on their website[10]. The GIS layer provided by the EA identifies areas covered by the FWS within the study area. The main areas and approximate flood warning lead times (time to react after flood warning) are summarised in Table 7-2.

7.3.2 The EA aim to give a minimum of two hours warning prior to the onset of a flood event. However, the flood warning lead times within the study area are typically less than 2 hours.

[9] Available online: http://www.devon.gov.uk/flood_warning_response_plan_nov_06-2.pdf
[10] Available online: http://www.environment-agency.gov.uk/

Ashburton notably has no flood warning service; neither does the River Mardle at Buckfastleigh.

7.3.3 The short lead time associated with the study areas catchments are due to the impermeable geology and steep topography which result in rapidly responding catchments. FWAs across the study are presented in Figure A9, Appendix A.

Table 7-2: Flood Warning Service coverage within study area

Settlement	Watercourse	Lead Time (in hours)
Ashburton	Balland Stream/River Ashburn	No Service
Buckfastleigh	River Dart	<1
Buckfastleigh	River Mardle	No Service
South Brent	River Avon	<2
Horrabridge	River Walkham	<2
Mary Tavy	Minor tributary of River Tavy	<2
Cornwood	River Yealm	<2
Sticklepath	River Taw	<1

7.3.4 There are four flood warning codes that indicate the level of severity of flooding expected to the area. The flood warning codes are summarised in Table 7-3.

Table 7-3: EA Flood Warning Codes

Flood Warning Code	Description
	Flooding of low-lying land and roads is expected. Be aware, be prepared, and watch out.
	Flooding of homes and businesses is expected. Act now!
	Severe flooding is expected. There is extreme danger to life and property. Act now!
	Flood Watches or Warnings are no longer in force for this area.

7.3.5 The flood warnings are disseminated through a variety of mediums that include TV, radio, and Flood Warnings Direct, which is a service direct to a phone/fax/pager/internet. Loudhailers are also used in certain circumstances. There is also an emergency Floodline number (0845 988 1188) and a quick dial number for individual rivers.

8 Focused Assessments

8.1 Overview

8.1.1 In addition to the focused assessment maps for the eight Local Centres presented in Appendix B, further information for five selected Local Centres is provided in this Chapter. Current and future flood risk within these five Local Centres, together with flood risk management provisions has been considered.

8.2 Ashburton

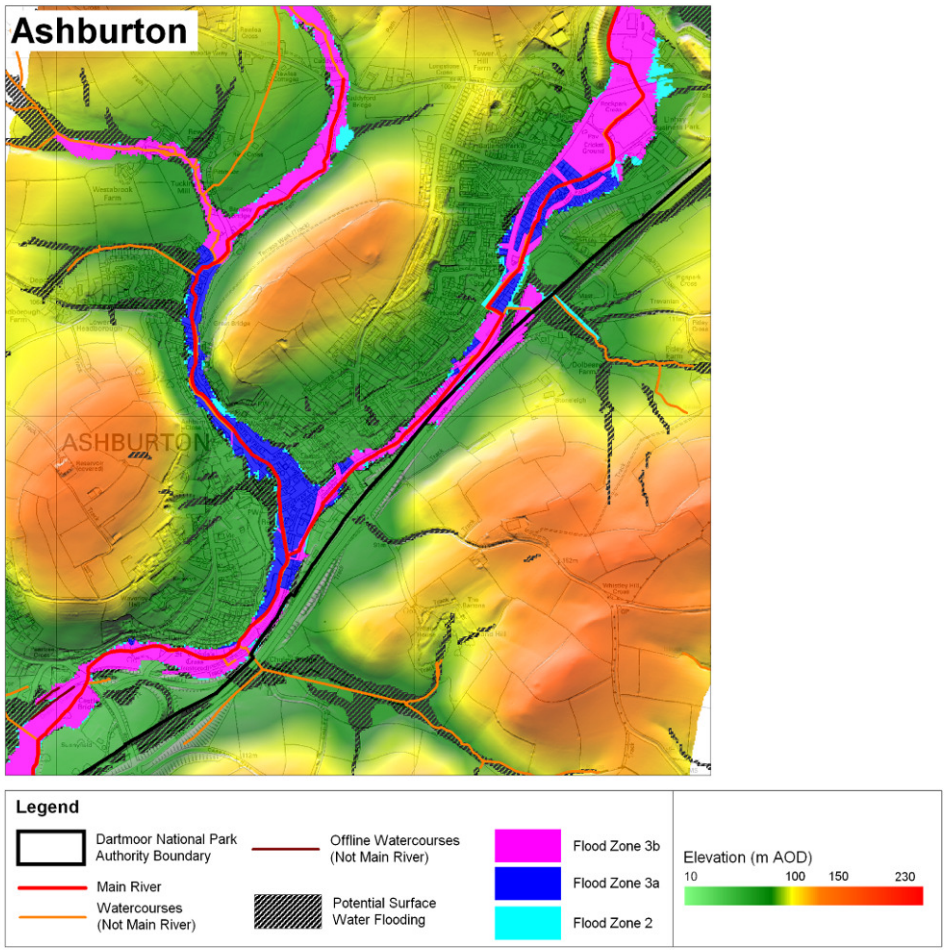


Figure 8-1: Ashburton Topography and Flood Risk

Overview

8.2.1 Ashburton is located on the eastern edge of the study area adjacent to the A38 Devon Expressway. Figure 8-1 shows how the River Ashburn and Balland Stream enter the town from the north within confined river valleys. The Balland Stream joins the River Ashburn to the south of the town centre. Both the Balland Stream and River Ashburn are designated Main River by the EA. The confined river valleys and steep channel gradients (approximately 1 in 50) result in river catchments that respond rapidly to rainfall with relatively high velocity flows.

8.2.2 Figure 8-1 also identifies the location of a number of unmapped minor watercourses either within, or in close proximity to the town. These unmapped watercourses generally drain relatively small catchments and flow to the River Ashburn or the Balland Stream.

Flood Risk Management

8.2.3 The NFCDD database indicates that there are two flood defence schemes, which provide a 1 in 50 year SoP from the River Ashburn. One upstream of the town centre and the other within the town centre. Both schemes include culvert diversion channels, which divert high flows from the River Ashburn. Since their completion in the late 1980s the capacity of these schemes has been exceeded. During such events the narrow roads lined with buildings within the town centre becoming the major flow routes. For example flood waters are known to flow down North Street, across the Bull Ring and along St Lawrence Lane.

8.2.4 A recent flood defence scheme has also been completed on the upper Balland Stream, which consists of a culverted channel beneath Eastern Road and a channel diversion further downstream. This is in response to a number of historical flood events affecting properties in the area. The Balland Stream flows through a number of under capacity culverts further downstream, where again roads, such as Love Lane, become the major flow route.

8.2.5 There is no flood warning for Ashburton on either the River Ashburn or Balland Stream, therefore flood levels can rise quickly without prior warning.

Current Flood Risk

8.2.6 Development within the River Ashburn and Balland Stream floodplain has led to a significant number of properties being at risk from flooding within the town. The South Devon CFMP indicates that 150 properties are at risk of flooding during the 1 in 100 year event with 350 properties at risk of flooding during the 1 in 1000 year event. Fluvial flood depth grids provided by the EA suggest flood depths within the town are generally between 0.5 and 2 m during the 1 in 100 year fluvial event.

8.2.7 Figure B1, Appendix B indicates a significant number of fluvial and surface water flood incidents reported within the town. The large number of properties also affected by flooding within the town is highlighted on Figure B1, Appendix B. The road in front of the police/fire station is known to have previously flooded, and would be affected during the 1 in 100 year event. Therefore emergency services operational duties maybe affected during a flood event of this magnitude.

8.2.8 Figure B1, Appendix B identifies the estimated SoP offered by the towns flood defences. Land located within Flood Zone 3 protected by flood defences with a 1 in 20 year SoP or greater, should be considered to be in Flood Zone 3a. All other land within Ashburton located within Flood Zone 3, with the exception of existing developed areas, should be considered to be Functional Floodplain (Flood Zone 3b).

Future Flood Risk

8.2.9 Future flood risk due to anticipated affects of climate change on rainfall and peak river flows is unlikely to have a significant effect on Flood Zone extents within Ashburton. Increases in flow are likely to increase the depth of flooding as opposed to the extent of flooding. This is illustrated by the relatively small area of Flood Zone 2 within the town.

8.2.10 The SoP offered by the towns flood defences may be lowered due to the anticipated affects of climate change. For example land currently protected by flood defences during the 1 in 20 year flood event may not be protected to the same standard in the future.

Other Considerations

8.2.11 The majority of unmapped watercourses identified in Figure 8-1 are covered by the PSWF layer. Where development is proposed in close proximity to an unmapped watercourse the PSWF layer should be used as an initial indicator to determine whether further investigation is required as part of a Level 2 SFRA or as part of a site specific FRA. Where an unmapped watercourse is not covered by the PSWF layer a 10 m buffer should be used to determine whether further investigation is required.

8.2.12 To ensure flood risk to third parties does not increase, every new development within the town is required to have a high standard of SuDS. Further SuDS guidance is provided in Chapters 9 (Section 9.5) and 10.

8.3 Buckfastleigh

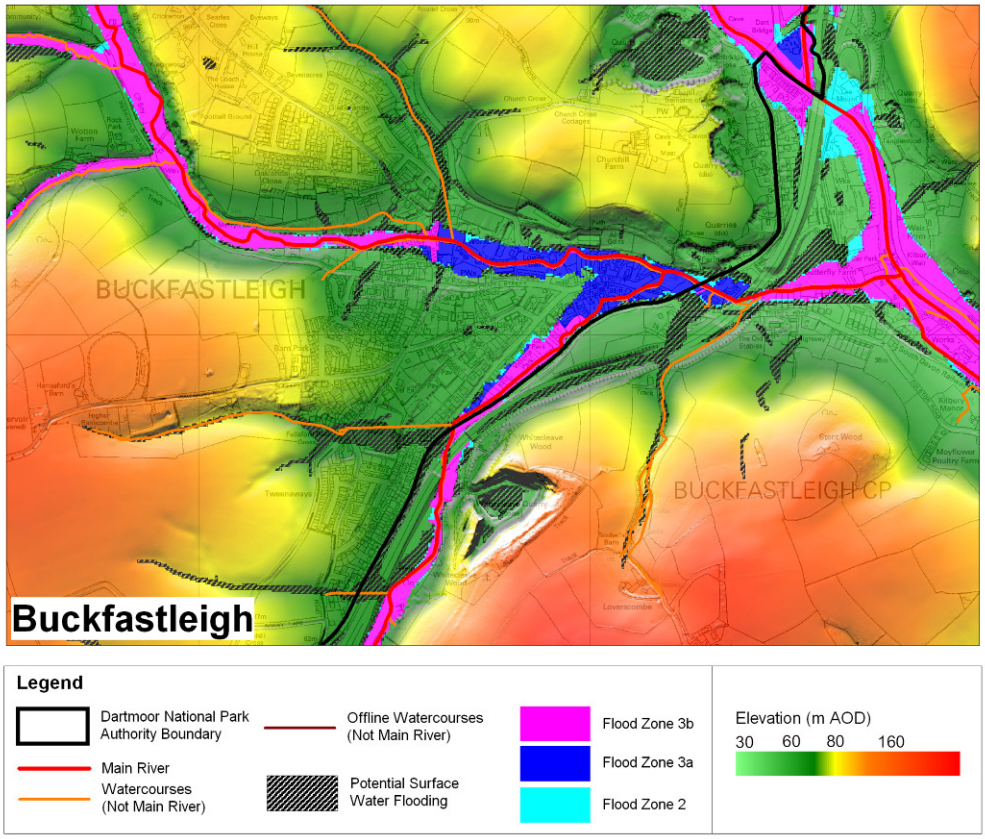


Figure 8-2: Buckfastleigh Topography and Flood Risk

Overview

8.3.1 Buckfastleigh is located on the eastern edge of the study area adjacent to the A38 Devon Expressway. Figure 8-2 shows how the River Mardle flows into Buckfastleigh from the west. Prior to joining the River Dart, to the east of the A38, the River Mardle is joined by the Dean Burn, which flows into Buckfastleigh from the south east. Both the River Mardle and the Dean Burn are designated Main River by the EA. The steep hills and confined river valleys shown in Figure 8-2, combined with steep channel gradients (approximately 1 in 50) result in river catchments that respond rapidly to rainfall with relatively high velocity flows.

8.3.2 Figure 8-2 also identifies the location of a number of unmapped minor watercourses either within, or in close proximity to the town. These unmapped watercourses generally drain relatively small catchments and flow into the River Mardle or the Dean Burn. A mill leat, raised above the floodplain of the River Mardle is located within the Higher Town area of Buckfastleigh. The mill leat is identified on Figure 8-2 as an unmapped watercourse.

Flood Risk Management

8.3.3 The NFCDD database provided by the EA indicates that the flood defence schemes within the centre of Buckfastleigh are considered to offer a 1 in 50 year SoP. The flood alleviation scheme on the Dean Burn consists of a diversion culvert upstream of Damarell Bridge, which

diverts peak flows from the Dean Burn into the River Mardle downstream of the two rivers confluence.

8.3.4 The flood defence scheme on the River Mardle consists of a raised masonry wall upstream of Church Bridge. The weir below the A38 road bridge has also been removed to increase the channel capacity during high flows. Flooding generally occurs along the River Mardle when bridges with limited capacity restrict flows, causing flood waters to over top the right bank in the vicinity of Fore Street and Station Road. There is less than 1 hour flood warning for areas of Buckfastleigh at risk of flooding from the River Dart. There is no flood warning on either the River Mardle or the Dean Burn.

Current Flood Risk

8.3.5 Development within the River Mardle and the Dean Burn floodplain has led to a significant number of properties being at risk from flooding within the town. The South Devon CFMP indicates that 95 properties are at risk of flooding during the 1 in 100 year event with 230 properties are at risk of flooding during the 1 in 1000 year event. Key infrastructure at risk of flooding during the 1 in 100 year fluvial event includes a care home and surgery. During the 1 in 1000 year fluvial event an electricity substation and school are also at risk of flooding.

8.3.6 Figure B2, Appendix B indicates a significant number of fluvial and surface water flood incidents reported within the town. The large number of properties also affected by flooding within the town is also highlighted on Figure B2, Appendix B. Fluvial flood depth grids provided by the EA indicate that flood depths within the town are generally between 0.5 and 1 m during the 1 in 100 year fluvial event.

8.3.7 Figure B2, Appendix B identifies the estimated SoP offered by the towns flood defences. Land located within Flood Zone 3 protected by flood defences with a 1 in 20 year SoP or greater, should be considered to be in Flood Zone 3a. All other land within Buckfastleigh located within Flood Zone 3, with the exception of existing developed areas, should be considered to be Functional Floodplain (Flood Zone 3b).

Future Flood Risk

8.3.8 Future flood risk due to anticipated affects of climate change on rainfall and peak river flows is unlikely to have a significant effect on Flood Zone extents within Buckfastleigh. Increases in flow are likely to increase the depth of flooding as opposed to the extent of flooding. This is illustrated by the relatively small area of Flood Zone 2 within the town. One exception in Buckfastleigh is to the east of the A38 along the River Dart where the extent of Flood Zone 2 is relatively large.

8.3.9 The SoP offered by the towns flood defences may be lowered due to the anticipated affects of climate change. For example land currently protected by flood defences during the 1 in 20 year flood event may not be protected to the same standard in the future.

Other Considerations

8.3.10 The majority of unmapped watercourses identified in Figure 8-2 are covered by the PSWF layer. Where development is proposed in close proximity to an unmapped watercourse the PSWF layer should be used as an initial indicator to determine whether further investigation is required as part of a Level 2 SFRA or as part of a site specific FRA. Where an unmapped watercourse is not covered by the PSWF layer a 10 m buffer should be used to determine whether further investigation is required.

8.3.11 Where developed is proposed in the vicinity of the mill leat located within the Higher Town, particularly where development is proposed down slope of the leat, a Level 2 SFRA or site specific FRA should investigate further the potential flood risk posed by the leat to future development.

8.3.12 To ensure flood risk to third parties does not increase, every new development within the town is required to have a high standard of SuDS. Further SuDS guidance is provided in Chapters 9 (Section 9.5) and 10.

8.4 Moretonhampstead

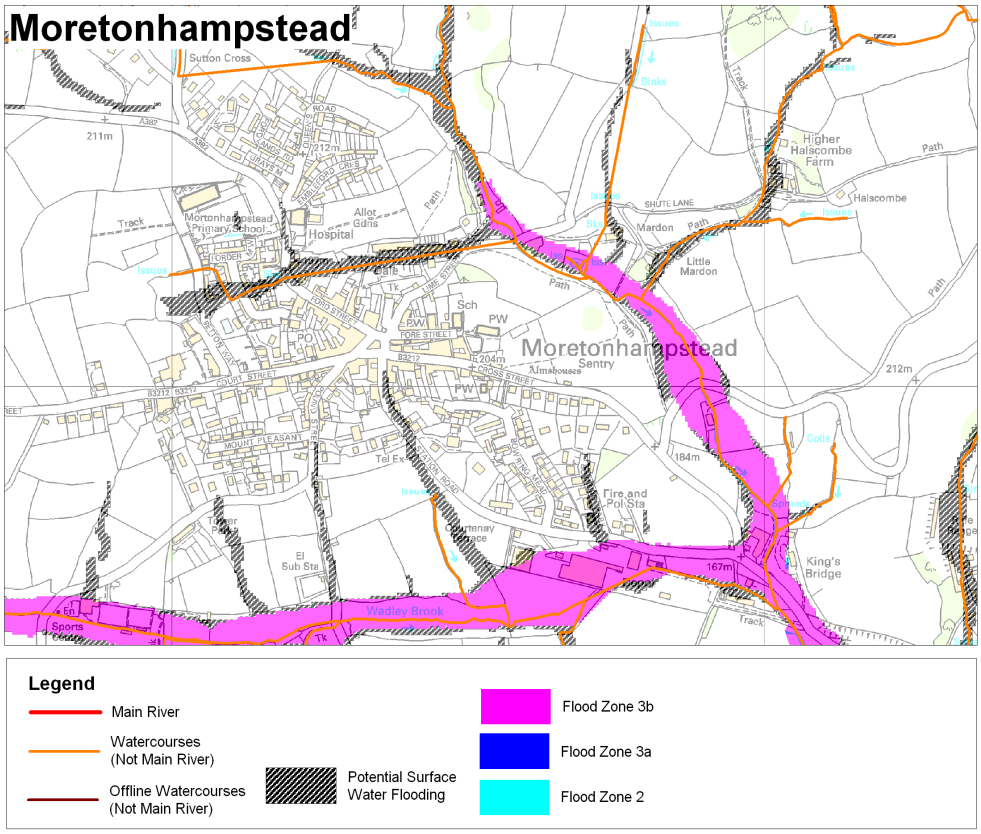


Figure 8-3: Moretonhampstead Flood Risk

Overview

8.4.1 Moretonhampstead is located to the north east of the study area. Figure 8-3 identifies the location of a number of unmapped watercourses, either within, or in close proximity to the settlement. These minor watercourses form the headwaters of Wray Brook, which can be seen to the east of the settlement. Wray Brook flows into the River Bovey approximately 8 km downstream of the settlement to the south of Lustleigh. Wadley Brook located to the south of Moretonhampstead flows into Wray Brook to the south east of the settlement.

8.4.2 In the absence of DTM coverage for the settlement a review of OS mapping indicates that ground levels across the site are between 180 m AOD and 210 m AOD. The surrounding topography consists of steep hills to the north with peaks between 300 m AOD and 350 m. The river valleys draining these steep hills to the north are relatively confined and are likely to respond rapidly to rainfall.

8.4.3 To the south the surrounding hill slopes are gentle in comparison with peaks approximately 250 m AOD. The floodplain of Wadley Brook to the south of the settlement is less confined and is likely to be less responsive than the headwaters of the Wray Brook to the north.

Flood Risk Management

8.4.4 The NFCDD database indicates that there is no flood risk management infrastructure within the vicinity of the settlement or surrounding area.

8.4.5 There is no flood warning for Moretonhampstead, on either the headwaters of Wray Brook or Wadley Brook, therefore flood levels can rise quickly without prior warning.

Flood Risk

8.4.6 The flood risk posed to Moretonhampstead is considerably less than that posed to Ashburton and Buckfastleigh. Figure B3, Appendix B identifies a limited number of flood related incidents within the settlement. Most of these incidents have been recorded on the Devon and Somerset Fire and Rescue Service database. Therefore these recorded flood incidents should not be relied upon in isolation when determining flood risk.

8.4.7 The main road into Moretonhampstead from the south east (A382) is known to have flooded on more than one occasion, at the entrance to Moretonhampstead. The PSWF layer covering the settlement suggests that this area may be at risk from a combination of fluvial and surface water flooding during extreme rainfall events.

Other Considerations

8.4.8 The majority of unmapped watercourses identified in Figure 8-3 are covered by the PSWF layer. Where development is proposed in close proximity to an unmapped watercourse the PSWF layer should be used as an initial indicator to determine whether further investigation is required as part of a Level 2 SFRA or as part of a site specific FRA. Where an unmapped watercourse is not covered by the PSWF layer a 10 m buffer should be used to determine whether further investigation is required.

8.4.9 To ensure flood risk to third parties does not increase, every new development within the settlement is required to have a high standard of SuDS. Further SuDS guidance is provided in Chapters 9 (Section 9.5) and 10.

8.5 South Brent

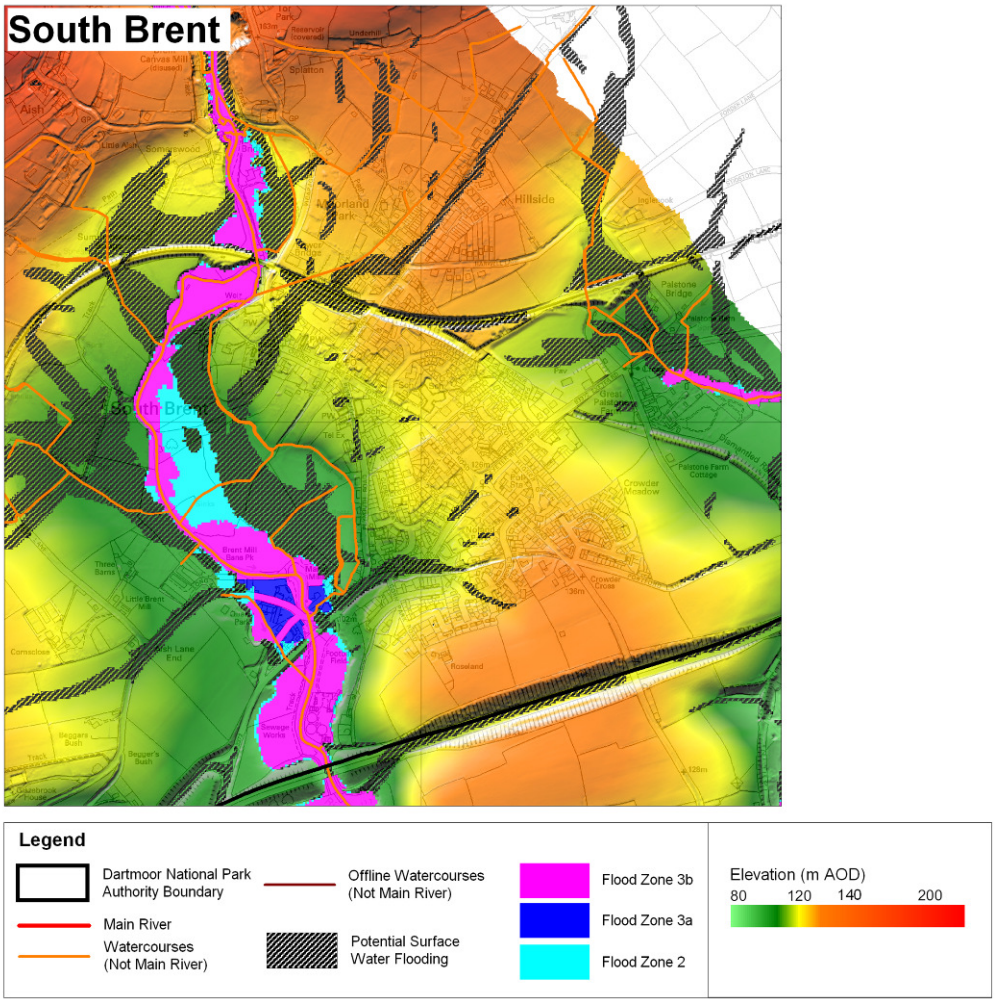


Figure 8-4: South Brent Topography and Flood Risk

Overview

8.5.1 South Brent is located to the south of the study area adjacent to the A38 Devon Expressway. Figure 8-4 shows how the River Avon flows within a confined valley from the steep hills of Dartmoor located to the north of the settlement. The steep hills and confined river valley, combined with the very steep channel gradient, results in a river catchment that responds rapidly to rainfall with relatively high velocity flows. The majority of South Brent, however, is located on land elevated above the floodplain with ground levels between 100 m AOD and 130 m AOD.

8.5.2 Figure 8-4 shows the location of a number of unmapped watercourses, either within, or in close proximity to the settlement. These unmapped watercourses are tributaries of the River Avon and drain relatively small areas of land within the vicinity of the settlement.

8.5.3 A mill leat, raised above the floodplain of the River Avon is located to the west of the settlement. The mill leat is identified on Figure 8-4 as an unmapped watercourse.

Flood Risk Management

8.5.4 The NFCDD database indicates that there is no flood risk management infrastructure within the vicinity of the settlement or surrounding area. There is less than 2 hours flood warning for vulnerable parts of South Brent on the River Avon.

Current Flood Risk

8.5.5 The flood risk posed to South Brent is considerably less than that posed to Ashburton and Buckfastleigh. The South Devon CFMP states that a small number of properties are known to have been flooded from the River Avon in the last 15 years. Key infrastructure at risk of flooding during the 1 in 100 year fluvial event includes the waste water treatment works located within the River Avon floodplain immediately north of the A38. Figure B4, Appendix B indicates a smaller number of reported fluvial flood incidents to the east of Brent Mills Business Park to the south west of the settlement.

8.5.6 As no flood risk management infrastructure exists within the settlement all land located within Flood Zone 3, with the exception of existing developed areas, should be considered to be Functional Floodplain (Flood Zone 3b).

Future Flood Risk

8.5.7 Future flood risk due to anticipated affects of climate change on rainfall and peak river flows may increase the extent of the River Avon floodplain to the west of the settlement. Therefore the depth of flooding in areas already at risk of flooding is likely to increase. This is illustrated by the relatively large area of Flood Zone 2 to the west of the settlement.

Other Considerations

8.5.8 The majority of unmapped watercourses identified in Figure 8-4 are covered by the PSWF layer. Where development is proposed in close proximity to an unmapped watercourse the PSWF layer should be used as an initial indicator to determine whether further investigation is required as part of a Level 2 SFRA or as part of a site specific FRA. Where an unmapped watercourse is not covered by the PSWF layer map a 10 m buffer should be used to determine whether further investigation is required.

8.5.9 A review of the PSWF layer covering the settlement suggests that Hillside Road and Station Road towards the north of the settlement may be at risk from surface water flooding during to extreme rainfall events.

8.5.10 Where developement is proposed in the vicinity of the mill leat located to the west of the settlement, particularly where development is proposed down slope of the leat, a Level 2 SFRA or site specific FRA should investigate further the potential flood risk posed by the leat to future development.

8.5.11 Figure B4, Appendix B also shows the estimated flood extent on the River Avon during the 1979 flood event. Where development is proposed within this historic flood extent a site specific FRA should investigate further the potential flood risk posed to the site from the River Avon and unmapped watercourses in the vicinity.

8.5.12 To ensure flood risk to third parties does not increase, every new development within the settlement is required to have a high standard of SuDS. Further SuDS guidance is provided in Chapters 9 (Section 9.5) and 10.

8.6 Horrabridge

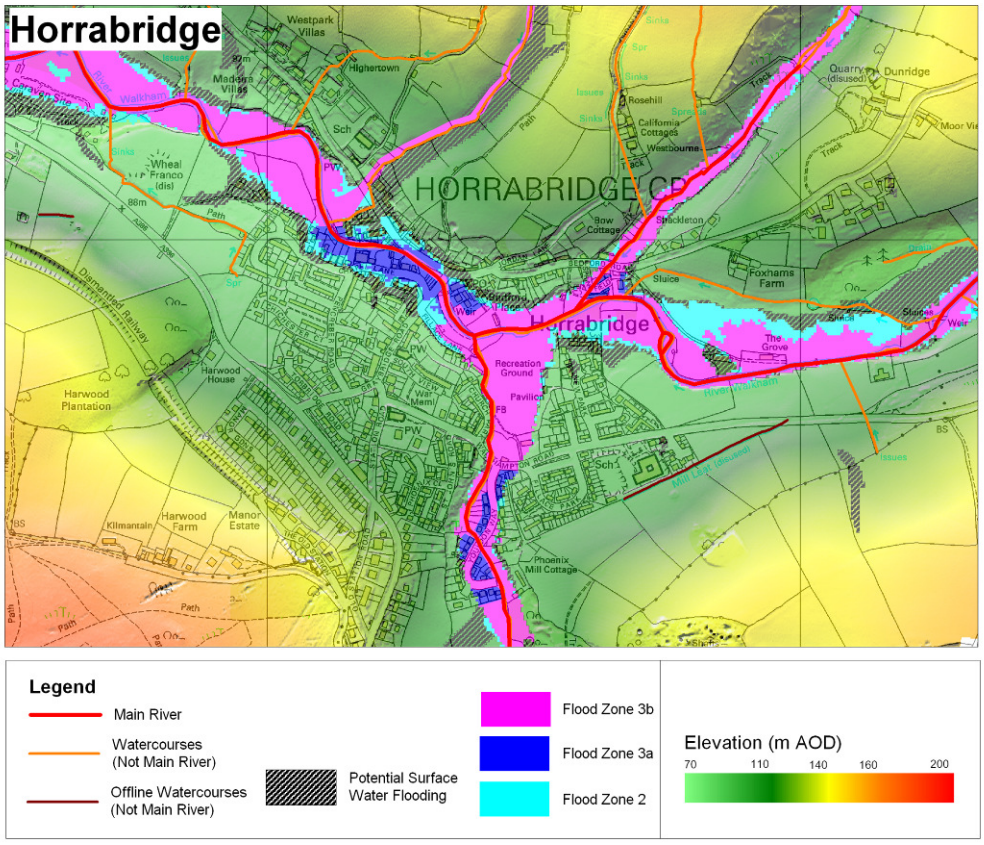


Figure 8-5: Horrabridge topography and flood risk

Overview

8.6.1 Horrabridge is located on the south west edge of the study area. Figure 8-5 shows how the River Walkham enters the town from the east within a relatively confined river valley. Springfield Brook and Fillace Park Stream enter the settlement from the north and south respectively. The River Walkham, Springfield Brook and Fillace Park Stream are all designated Main River by the EA. The relatively confined river valleys and steep channel gradients (approximately 1 in 50) result in local river catchments that respond rapidly to rainfall with relatively high velocity flows.

8.6.2 A fourth mapped watercourse (not Main River) joins the River Walkham further downstream within Horrabridge. Figure 8-5 also identifies a number of unmapped watercourses which drain towards the River Walkham within the settlement.

8.6.3 A disused mill leat, is located to the south east of Horrabridge near Fillace Park. The mill leat is identified on Figure 8-5 as an offline watercourse. It is considered offline because it is not hydraulically connected to another online watercourse.

Flood Risk Management

8.6.4 The NFCDD database indicates that there are raised flood defences offering a 1 in 20 year SoP from the River Walkham within the centre of Horrabridge. The location and SoP offered

by flood defences are shown on the focused assessment map provided in Figure B5, Appendix B. The raised flood defences along the River Walkham consist of a masonry wall and earth embankment.

8.6.5 There is less than 2 hours flood warning for areas of Horrabridge at risk of flooding from the River Walkham. There is no flood warning on either the Springfield Brook or Fillace Park Stream.

Current Flood Risk

8.6.6 Development within the River Walkham floodplain has led to a number of properties being at risk of flooding within the settlement. The Tamar CFMP states that there are a number of properties at risk from sewer flooding within Horrabridge. Figure B5, Appendix B identifies the locations of a number of reported flood incidents from a combination of fluvial and surface water (including stormwater management systems) flood sources. A number of properties within the vicinity of Chapel Lane and Bedford Road (including Springfield Cul-de-sac) are also reported to be affected by flooding.

8.6.7 Land located within Flood Zone 3 protected by flood defences with a 1 in 20 year SoP or greater, should be considered to be in Flood Zone 3a. All other land within Horrabridge located within Flood Zone 3, with the exception of existing developed areas, should be considered to be Functional Floodplain (Flood Zone 3b).

Future Flood Risk

8.6.8 Future flood risk due to anticipated affects of climate change on rainfall and peak river flows may increase the extent of the River Walkham floodplain within the town centre and to the west of the settlement, where the extent of Flood Zone 2 is more apparent. The depth of flooding in areas already at risk of flooding is also likely to increase due to climate change.

8.6.9 The SoP offered by the settlements flood defences may be lowered due to the anticipated affects of climate change. For example land currently protected by flood defences during the 1 in 20 year flood event may not be protected to the same standard in the future.

Other Considerations

8.6.10 The majority of unmapped watercourses identified in Figure 8-5 are covered by the PSWF layer. Where development is proposed in close proximity to an unmapped watercourse the PSWF layer should be used as an initial indicator to determine whether further investigation is required as part of a Level 2 SFRA or as part of a site specific FRA. Where an unmapped watercourse is not covered by the PSWF layer a 10 m buffer should be used to determine whether further investigation is required.

8.6.11 Where development is proposed in the vicinity of the mill leat located to the south east of Horrabridge near Fillace Park, particularly where development is proposed down slope of the leat, a Level 2 SFRA or site specific FRA should investigate further the potential flood risk posed by the leat to future development.

8.6.12 The 1979 estimated historical flood extent on the River Walkham predominantly covers land already identified as being located within Flood Zone 2 or 3. Using the GIS layer provided, where development is proposed within this historic flood extent a site specific FRA should consider further the potential flood risk posed to the site from the River Walkham.

8.6.13 To ensure flood risk to third parties does not increase, every new development within the settlement is required to have a high standard of SuDS. Further SuDS guidance is provided in Chapters 9 (Section 9.5) and 10.

9 Policy Review

9.1 Overview

9.1.1 This section provides sustainable flood risk management recommendations to be considered by DNPA when formulating both catchment wide and area specific development management policies. These recommendations have been formed with regards to national, regional and local policies, together with CFMPs objectives identified by the EA.

9.2 Catchment Flood Management Plans

South Devon CFMP (December 2008)

9.2.1 The area covered by the South Devon CFMP is divided into 13 policy units; three of these policy units are located within the study area. A description of each of these policy units, together with the flood risk management policy assigned to each of the policy units is provided below:

Policy Unit 1 – Dartmoor

9.2.2 This policy unit covers the rural areas of Dartmoor located within the Teign, Dart, Avon and Erme Catchments. There are no major towns located within this policy unit. The policy for this area is P6 '*take action to increase the frequency of flooding to bring benefits locally or elsewhere*'. The management policy for this area involves a strategic increase in flooding in allocated areas. It is important to note that it will not be increasing the risk to individual communities and may even reduce the risk posed to individual communities within this policy unit area.

Policy Unit 3 – Ashburton

9.2.3 This policy unit covers the town of Ashburton located on the River Ashburn and Balland Stream, both tributaries of the River Dart. The policy for this area is P5 *'take further action to reduce flood risk'.* The management policy for this area seeks to assess flood risk management measures with the aim to reduce flood risk from both the River Ashburn and Balland Stream within the town.

Policy Unit 13 – Buckfastleigh

9.2.4 This policy unit covers the towns of Buckfastleigh and Buckfast. Buckfastleigh is located at the confluence of the River Mardle and the Dean Burn. The confluence of the River Mardle and the River Dart is located to the east of the town. Buckfast lies just upstream of this confluence on the River Dart. The policy for this area is P4 *'take further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change and climate change)'*. The management policy for the area seeks to assess flood risk management measures with the aim to sustain the level of protection offered to the town. The management policy will also seek to improve flood warning services, targeting communities at risk of flooding in Buckfast and Buckfastleigh.

Tamar CFMP (December 2008)

9.2.5 The Tamar CFMP covers the whole of the Tamar catchment area, which is located to the west of the South Devon CFMP area. The area covered by the Tamar CFMP is divided into 6 policy

units; only one of these policy units includes land located within the study area. A description of this policy unit, together with the flood risk management policy assigned to this policy unit is provided below:

East Tamar

9.2.6 This policy unit includes land located within the River Yealm, River Tavy and River Plym catchments. The majority of the land located within this policy unit is located outside of the study area. Key study area settlements located within this policy unit include Horrabridge, Walkhampton, and Dousland. The policy for this area is P4 *'take further action to sustain the current level of flood risk into the future'*. The management policy for the area seeks to assess flood risk management measures with the aim to sustain the level of protection offered to key settlements identified within the policy unit.

North Devon CFMP (December 2008)

9.2.7 The North Devon CFMP includes land drained by the River Taw, the River Torridge, and the North Devon Coastal Rivers. The area covered by the North Devon CFMP is divided into 14 policy units, of which, only 1 policy unit is located within the study area. A description of this policy unit, together with the flood risk management policy assigned to the policy unit is provided below:

Policy Unit 4 – Dartmoor

9.2.8 This policy unit covers the central northern part of the study area and includes land that drains to the River Taw and the East and West Okement. Key settlements located within this policy unit are Sticklepath and South Zeal. The policy for this area is P6 *'take actions to increase the frequency of flooding'*. The management policy for this area seeks to investigate opportunities to increase floodplain storage and attenuation, improve awareness and resilience in communities at risk of fast onset flooding and assess works to reduce flood risk. It is important to note that it will not be increasing the risk to individual communities and may even reduce the risk posed to individual communities within this policy unit area.

9.3 Water Cycle Studies

9.4.1 Water Cycle Studies (WCS) provide plans and programmes for Water Services Infrastructure implementation. They are determined through an assessment of the environment and infrastructure capacity for:

1. Water supply;
2. Sewage disposal;
3. Flood risk management;
4. Surface water drainage.

9.4.2 WCS also consider the impact of efficiency measures and provide an overall estimate of cost for the identified solution and of the identified infrastructure improvements required.

9.4.3 A Scoping WCS is currently been undertaken on behalf of Teignbridge District Council (TDC). As the towns of Ashburton and Buckfastleigh are located on the edge of the TDC study area outputs from the WCS should be considered by DNPA once completed.

9.4 Flood Risk

Catchment Wide Strategies (in accordance with PPS25)

1. Allocate all sites in accordance with the Sequential Test reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the Flood Zone classification;
2. FRAs should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area;
3. FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2, Flood Risk to development should be assessed for all forms of flooding;
4. Where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.

Area Specific Strategies

1. Unmapped watercourses (typically catchments less than 3 km^2) should be investigated in detail as part of site specific FRAs for developments located in areas identified as being potentially susceptible to flooding. Early liaison with the EA and DNPA should be undertaken to ensure a joint approach to development is adopted;
2. Where feasible, opportunities should be sought to remove or increase the capacity of structures in known flooding hotspots to reduce flood flow restrictions;
3. Opportunities to increase biodiversity and improve amenity value (e.g. pedestrian / cycle routes along the river) should be sought in areas of higher risk adjacent to the river;
4. Seek opportunities to increase floodplain storage and attenuation within rural areas without increasing risk to vulnerable communities;
5. The EA should be consulted on development involving the carrying out of works or operations in the bed of, or within 20 metres of the top of a bank of, a main river[11];
6. The flood risk posed to potential development located in close proximity to a mill leat, especially where the development is down slope of the mill leat should be investigated further at the site specific FRA level.

9.4.1 Through integration of these suggestions, the emerging DPD will comply with PPS25 and the aspiration and policies represented in the following documents:

- Saved Policies: Devon Structure Plan 2001 – 2006;
- Dartmoor National Park Management Plan 2007 – 2012;
- Saved Policies: Dartmoor National Park Local Plan First Review 1995 – 2011;
- Dartmoor National Park Authority Local Development Framework Core Strategy Development Plan Document 2006 – 2026;
- South Devon Catchment Flood Management Plan;

[11] Available online: www.opsi.gov.uk/si/si2006/uksi_20062375_en.pdf

- Tamar Catchment Flood Management Plan;
- North Devon Catchment Flood Management Plan;
- Dartmoor Biodiversity Action Plan.

9.5 Sustainable Drainage Systems

9.5.1 Information on Sustainable Drainage Systems (SuDS) is provided in Chapter 10. Sustainable drainage policies should address the following issues as:

Catchment Wide Strategies (in accordance with PPS25 and SuDS Manual)

1. Sustainable Drainage Systems should be included in new developments unless where it is demonstrably not possible to manage surface water using these techniques;
2. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity;
3. Runoff rates from new developments on greenfield sites should be not exceed Greenfield runoff rates pre-development and should allow for climate change;
4. Runoff rates from previously developed developable land should not exceed existing rates of runoff and should seek betterment where possible. In addition, an allowance should be made for climate change;
5. Runoff and / or discharge rates should be restricted to Greenfield runoff rates in areas known to have a history of sewer and / or surface water flooding.

Area Specific Strategies

1. At the site-specific FRA level, the suitability of SuDS should be investigated for each development. Specific emphasis should be given to the implementation of SuDS in areas where permeability is low or where steep slopes exist onsite. Early liaison with the EA and DNPA should be undertaken to ensure a joint approach to development is adopted;
2. Developments should look to incorporate water re-use and minimisation technology for example green roofs and rainwater harvesting. This will aid developments in the adoption of source control SuDS as part of PPS25 requirements.

9.5.2 Through integration of these suggestions, the emerging DPD will comply with PPS25 and the aspiration and policies represented in the following documents:

- Saved Policies: Devon Structure Plan 2001 – 2006;
- Dartmoor National Park Management Plan 2007 – 2012;
- Saved Policies: Dartmoor National Park Local Plan First Review 1995 – 2011;
- Dartmoor National Park Authority Local Development Framework Core Strategy Development Plan Document 2006 – 2026;
- South Devon Catchment Flood Management Plan;
- Tamar Catchment Flood Management Plan;
- North Devon Catchment Flood Management Plan;
- Dartmoor Biodiversity Action Plan.

9.6 Water Environment

Catchment Wide Strategy

1. Development should not have a detrimental impact on the water environment through changes to water chemistry, this should be ensured through the use of drainage systems which limit the occurrence of pollution to the water environment;
2. Where feasible new development should be set-back a distance of 7 m from a watercourse to allow appropriate access for routine maintenance and emergency clearance, if necessary.

9.6.1 Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in the following documents:

- Saved Policies: Devon Structure Plan 2001 – 2006;
- Dartmoor National Park Management Plan 2007 – 2012;
- Saved Policies: Dartmoor National Park Local Plan First Review 1995 – 2011;
- Dartmoor National Park Authority Local Development Framework Core Strategy Development Plan Document 2006 – 2026;
- South Devon Catchment Flood Management Plan;
- Tamar Catchment Flood Management Plan;
- North Devon Catchment Flood Management Plan;
- Dartmoor Biodiversity Action Plan.

9.6.2 The area specific strategies should be updated following the application of the Sequential Test to provide more specific strategies for allocated development sites.

10 Drainage of Development Sites

10.1 Overview

10.1.1 SuDS are the preferred method for managing the surface water run-off generated by developed sites. Both PPS1 (Delivering Sustainable Development) and PPS25 require that LPAs should promote their use for the management of runoff. In addition, the drainage of rainwater from roofs and paved areas around buildings should comply with the 2002 Amendment of Building Regulations Part H (3). The requirements, which give priority to the use of SuDS, are as follows:

1. *Adequate provision shall be made for rainwater to be carried from the roof of the building;*
2. *Paved areas around the building shall be so constructed as to be adequately drained;*
3. *Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following in order of priority:*
    - *An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable;*
    - *A watercourse; or where that is not reasonably practicable;*
    - *A sewer.*

10.1.2 SuDS seek to manage surface water as close to its source as possible, mimicking surface water flows arising from the site, prior to the proposed development. Typically this approach involves a move away from piped systems to softer engineering solutions inspired by natural drainage processes.

10.1.3 SuDS should be designed to take into account the surface run-off quantity, rates and also water quality ensuring their effective operation up to and including the 1 in 100 year design standard flood including an increase in peak rainfall of 30% to account for climate change.

10.1.4 Wherever possible, SuDS techniques should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective. Where possible SuDS techniques for a site should seek to:

- Reduce flood risk (to the site and neighbouring areas);
- Reduce pollution; and,
- Provide landscape and wildlife benefits.

10.1.5 These goals can be achieved by the SuDS management train, as outlined in 'The SuDS Manual' (CIRIA, 2007), where each component adds to the performance of the whole system:

- Prevention - good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping);
- Source control - runoff control at/near to source (e.g. rainwater harvesting, green roofs, permeable pavements);
- Site control - water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site); and,

- Regional control - integrate runoff managed from a number of sites (e.g. into a detention pond).

10.1.6 In keeping with the guidance of PPS25, LPAs should encourage the application of SuDS techniques. This chapter presents a summary of the SuDS techniques currently available, enabling the local authorities to identify where SuDS techniques could be employed in development schemes.

10.1.7 The application of SuDS techniques is not limited to one technique per site. Often a successful SuDS solution will utilise a number of techniques in combination, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS, however, each development site must offset its own increase in runoff and attenuation cannot be "traded" between developments.

10.1.8 Detailed design guidance can be found in the SuDS Manual C697, and associated Site Handbook for the Construction of SuDS, C698. These publications provide best practice guidance on the planning, design, construction, operation and maintenance of SuDS, to ensure effective implementation within developments.

10.2 SuDS Design

10.2.1 SuDS techniques can be used to reduce the rate and volume of surface water runoff and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc).

10.2.2 The design of SuDS measures should be undertaken as part of the drainage strategy and design for a development site. A ground investigation will be required to assess the suitability of using infiltration measures, with this information being used to assess the required volume of on-site storage. Hydrological analysis should be undertaken using industry-approved procedures, to ensure a robust design storage volume is obtained.

10.2.3 During the design process, liaison should take place with the LPA and the EA in order to establish that the design methodology is satisfactory and to also agree on a permitted rate of discharge from the site.

10.2.4 A key consideration of SuDS design is the maintenance regime to ensure they operate effectively, which should be sufficiently detailed and agreed at the design stage. The maintenance regime should set out a framework with a clear identification of responsibility for the lifetime of the proposed development. Table 10-1 provides a summary of the different SuDS techniques.

10.2.5 In April 2010 the Flood and Water Management Act was passed. As part of this Act, developers will have to comply with new measures, relating to SuDS, such as submitting separate drainage applications to SuDS Approval Bodies. The SuDS Approval Body for development proposed within the study area will be DCC. However, it is important to note that the SuDS Approval Body section of the Act has not been introduced to date.

Table 10-1: Summary of SuDS Techniques (Including the Three Aims for Sustainability (see Section 10.1.4))

Management Train	Component	Description	Water Quantity	Water Quality	Amenity Biodiversity
Prevention	Green roofs	Layer of vegetation or gravel on roof areas providing absorption and storage.	●	●	●
Prevention	Rainwater harvesting	Capturing and reusing rainwater for domestic or irrigation uses.	●	○	○
Prevention	Permeable pavements	Infiltration through the surface into underlying layer.	●	●	○
Source	Filter drains	Drain filled with permeable material with a perforated pipe along the base.	●	●	×
Source	Infiltration trenches	Similar to filter drains but allows infiltration through sides and base.	●	●	×
Source	Soakaways	Underground structure used for store and infiltration.	●	●	×
Source	Bio-retention areas	Vegetated areas used for treating runoff prior to discharge into receiving water or infiltration	●	●	●
Source	Swales	Grassed depressions, provides temporary storage, conveyance, treatment and possibly infiltration.	●	●	○
Source	Sand filters	Provides treatment by filtering runoff through a filter media consisting of sand.	●	●	×
Site	Basins	Dry depressions outside of storm periods, provides temporary attenuation, treatment and possibly infiltration.	●	●	○
Site	Ponds	Designed to accommodate water at all times, provides attenuation, treatment and enhances site amenity value.	●	●	●
Site	Wetland	Similar to ponds, but are designed to provide continuous flow through vegetation.	●	●	●
Regional					

Key: ● – highly suitable, ○ - suitable depending on design, × - not suitable

10.3 Where can SuDS be utilised?

10.3.1 The underlying ground conditions of a development site will often determine the type of SuDS approach to be used at development sites. This will need to be determined through ground investigations carried out on-site; however an initial assessment of a site's suitability to the use of SuDS can be obtained from a review of the available soils/geological maps covering the specific area of interest.

10.3.2 Table 10-2 below indicates the type of SuDS techniques that may be implemented within the Local Centres based on a review of local geology. An overview of the solid and drift geology across the study area is provided in Figure A3, Appendix A.

Table 10-2: Suitable SuDS Techniques Dependent on Geology

Local Centre	Underlying Geology	Potential SuDS Technique
South Brent	Slate	Attenuation
	River Gravel & Head	Attenuation/infiltration
	Alluvium	Attenuation/infiltration
Buckfastleigh	Limestone	Attenuation/infiltration
	Schalsteins Tuffs &c.	Attenuation/infiltration
	Alluvium	Attenuation/infiltration
	Slate	Attenuation
	River Gravel & Head	Attenuation/infiltration
Moretonhampstead	Granite with abundant feldspar megacrysts	Attenuation
Chagford	Alluvium	Attenuation/infiltration
	Granite with abundant feldspar megacrysts	Attenuation
Ashburton	Mount Ararat chert; Black chert, siliceous shale, tuff and lava	Attenuation/infiltration
Princetown	Granite; coarse	Attenuation
Yelverton	Kate Brook Slate Formation; Greenish grey slate and black slate	Attenuation/infiltration
	Alluvium, River Terrace Deposits, undifferentiated	Attenuation/infiltration

10.4 SuDS Constraints

10.4.1 There are several constraints that may limit the application of SuDS. These will vary between locations and may include:

- Ground Contamination;

- Ground Conditions;
- Ground Use / Vulnerability;
- Capacity of the receiving watercourse.

Ground Contamination

10.4.2 Ground contamination has the potential to contaminate groundwater and/or surface water resources if incorrectly managed. In some cases the nature of the ground contamination may be such that certain types of SuDS are not appropriate. Ground contamination should be determined by site investigation on a site be site basis.

Groundwater Use / Vulnerability

10.4.3 Groundwater resources can be vulnerable to contamination from both direct sources (e.g. into groundwater) or indirect sources (e.g. infiltration of discharges onto land). A review of the EA Aquifer Designation Maps available on their website[12] can be used to identify the groundwater vulnerability on and surrounding a potential development site.

10.4.4 The National Rivers Authority (now the EA) groundwater vulnerability maps can be used to identify the underlying soils leaching potential, which indicates their ability to transmit pollutants, which may impact on groundwater should a pollution event occur. The vulnerability of the groundwater is important when determining the suitability of SuDS. The EA should be consulted on proposals where it is proposed to discharge to groundwater.

Groundwater Source Protection Zones

10.4.5 The EA also defines groundwater Source Protection Zones (SPZ). SPZs are defined to protect areas of groundwater that are used for potable (drinking) supply, including public/private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks.

10.4.6 It is unlikely that proposed development will be located within a SPZ due to the nature of the geology underlying the study area. However, where development is proposed within a SPZ, restrictions may be placed on the types of SuDS appropriate. Further information is available on the EA website.

Planning Considerations for SuDS

10.4.7 The application of SuDS may require space on development sites to be set-aside. Early consideration of SuDS will assist in determining the space required and identify methods to spread the management of storm water throughout a site using the Management Train principle presented in the CIRIA report C697.

10.4.8 The design of SuDS measures should be undertaken as part of a drainage strategy proposed during the master planning of development sites. A ground investigation will be required to access the suitability of using infiltration SuDS, with this information also being used to assess the required volume of on-site storage. Hydrological analysis should be undertaken using industry-approved procedures; to ensure a robust design storage volume is obtained. The consideration of utilising SuDS as part of a development will depend on many factors such as:

[12] Available online: www.environment-agency.gov.uk

- Underlying geology and drift layers;
- Depth of the groundwater table;
- Site slopes;
- Run-off quality;
- Site restrictions;
- Maintenance requirements;
- Economical viability; and,
- Groundwater protection and ecological considerations.

10.4.9 The final drainage scheme and SuDS for a site should consider each of these elements in its design.

10.4.10 All relevant organisations should meet at an early stage of the drainage design process to agree on the most appropriate drainage system for the particular development. These organisations may include the LPA, the sewerage undertaker, HA, and the EA. Liaison with these organisations should focus on establishing a suitable design methodology, any restrictions and provision for the long-term maintenance of the feature.

10.4.11 The most convenient vehicle for agreeing long-term management responsibilities is through Section 106 of the Town and Country Planning Act. Under this, agreement for SuDS maintenance can be a requirement of the planning application, forcing the issue to be addressed.

11 Site Specific FRA Guidance

11.1 Overview

11.1.1 This Level 1 SFRA presents sufficient information to assist DNPA to apply the Sequential Test and identify where the Exception Test may be required. The broad scale assessment undertaken for a Level 1 SFRA provides sufficient detail to identify Flood Zones relevant to potential and existing allocations but is not of sufficient resolution to provide a detailed assessment within them.

11.1.2 A site specific FRA aims to refine the available information and minimise these risks through site design, layout and where required, mitigation. This chapter presents the recommendations for site specific FRAs prepared for submission with planning applications in the DNPA administrative area. Prior to committing expenditure or other resources on an FRA, consideration should be given to the ability of a site to pass the Sequential Test.

11.2 When is a FRA Required?

11.2.1 When informing developers of the requirements of an FRA for a development site, consideration should be given to the position of the development relative to flood sources, the vulnerability of the proposed development and its scale. The EA website provides standing advice on the requirement of FRAs for developers and LPAs[13].

11.2.2 In the following situations an FRA should always be provided with a planning application:

- The development site is located in Flood Zone 2 or 3;
- The site area of proposed development is greater than 1 ha and located in Flood Zone 1;
- The development site is located in an area known to have critical flooding problems from any flood source;
- The development is located within 10 m of any watercourse regardless of Flood Zone classification; and
- Liaison with the LPA identifies the requirement for an FRA.

11.3 FRA Requirements

11.3.1 Annex E of PPS25 presents the minimum requirements for FRA. These include:

- Consideration of the risk of flooding arising from the development in addition to the risk of flooding to the development;
- Identify and quantify the vulnerability of the development to flooding from different sources and identify potential flood risk reduction measures;
- Assessment of the remaining 'residual' risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development;

[13] http://www.environment-agency.gov.uk/research/planning/82584.aspx

- The vulnerability of those that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification, including arrangements for safe access;
- Consideration of the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems; and,
- Fully account for current climate change scenarios and their effect on flood zoning and risk.

11.3.2 The Practice Guide to PPS25 advocates a staged approach to site specific FRA. The findings from each stage inform the next stage iteratively throughout the development process. The following paragraphs describe the three levels of site specific FRAs.

Level 1 - Screening Study

11.3.3 A Level 1 Screening Study is intended to identify if a development site has any flood risk issues that warrant further investigation. This should be based on existing information such as that presented in the Level 1 SFRA. Therefore this type of study could be undertaken by a Land Drainage Engineer/Development Control Officer in response to the developer query or by a developer where the Level 1 SFRA is available. Using the information presented in the Level 1 SFRA and associated GIS layers a Land Drainage Engineer/Development Control Officer could advise a developer of any flooding issues affecting the site. This information can then be used by the developer as the basis to further their understanding of how the flood risks could potentially affect their development.

Level 2 - Scoping Study

11.3.4 A Level 2 Scoping Study is predominately a qualitative assessment designed to further understanding of how the flood sources affect the site and the options available for mitigation. The Level 2 FRA should be based on existing available information where this is available and use this information to further a developers understanding of the flood risk and how it affects their development. This type of assessment should also be used to inform master plans of the site raising a developer's awareness of the additional elements the proposed development may need to consider.

Level 3 – Detailed Study

11.3.5 Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risks, further investigation will be required. For example, it is generally considered inappropriate to base an FRA for a residential care home at risk of flooding from fluvial sources on Flood Zone maps alone. In such cases the results of hydraulic modelling are preferable to ensure details of flood flow velocity, onset of flooding and depth of floodwater is fully understood and that the proposed development incorporated appropriate mitigation measures.

12 Recommendations

12.1 The Next Stage

Planning Policy

12.1.1 Based on the information presented in this Level 1 SFRA and the accompanying GIS layers, DNPA have sufficient information to apply the PPS25 Sequential Test to their development sites, seeking to guide development to areas of lowest flood risk wherever possible.

12.1.2 Where there are insufficient sites in Flood Zone 1 to accommodate the required growth, consideration should be given to the vulnerability classification of the development to ensure that it is located in an area of acceptable risk as defined in PPS25. In some cases this may require application of the Exception Test.

12.1.3 Where application of the Exception Test is required it will be necessary to undertake a Level 2 SFRA. The scope of the Level 2 SFRA consists of a more detailed assessment of the flood hazard to the development, which includes considering the following:

- Flood probability;
- Flood depth;
- Flood velocity; and,
- Rate of onset of flooding.

12.1.4 This will allow informed decisions to be made regarding the safety of the development.

12.1.5 Where the Exception Test is required for a development, hydraulic modelling is normally required to define the above flood characteristics. Therefore in the absence of existing detailed hydraulic modelling additional modelling may be needed.

Further Work

12.1.6 Until DNPA have undertaken the Sequential Test it is not possible to determine the requirements and scope of the Level 2 SFRA. However, based on the information presented within this Level 1 SFRA and growth targets set out in the DNPA Core Strategy, further work may be required within Ashburton and Buckfastleigh.

Development Management

12.1.7 Development Management Officers should familiarise themselves with the Level 1 SFRA and ensure that site specific FRAs are provided where necessary and prepared against the recommendations presented in Chapter 9. Development Control Officers should also familiarise themselves with the geology and soils within the study area together with local drainage issues when considering the use of SuDS as detailed in Chapter 10.

Level 1 SFRA Updates

12.1.8 Through the preparation of this Level 1 SFRA the data collected is deemed sufficient to apply the Sequential Test, however, in certain locations where data is questionable, further investigation may required within a site specific FRA. To continually improve future updates of

this Level 1 SFRA more robust recording of flood events will be of considerable benefit and enable calibration of modelled data, reducing uncertainty.

12.1.9 It may be beneficial for DNPA to develop a database, similar to the EA FRIS database, to record flood events that occur within their administrative area. This should be recorded on a GIS system, useful information would include:

- The date of the flood event;
- The location of the flood event;
- Properties affected by the flood;
- The extent of the flood event (mapped);
- The cause (source) of the flooding.

12.1.10 SFRAs should be considered as 'live' documents where regular review and monitoring should be undertaken. The associated GIS layers can be readily updated and should be considered as the live part of the Level 1 SFRA. The GIS layer should be updated as part of the annual monitoring process.

12.1.11 New Surface Water Flood Maps are currently being developed by the EA and were due for release in summer/autumn 2010 to LPAs. These use improved techniques to identify surface water flooding and early indications suggest that there is a reduction in extent in areas identified to be potentially affected by surface water flooding when compared to the ASTSWF maps. Once released, these 2nd generation surface water flood maps will supersede the existing ASTSWF maps.

Emergency Planning

12.1.12 The findings of the Level 1 SFRA may be used to refine and inform emergency plans developed for the area. This should include liaison with local emergency services to share and discuss the available data and its implications for emergency planning.

Appendices

Appendix A – Study Area Strategic Overview Maps (A3 Size)

Appendix B – Local Centre Focused Assessment Maps (A2 Size)

Appendix C – Dartmoor National Park Overview Map (A1 Size)

Appendix D – Data Collection

Title	Source	Description	Confidence
Flood Zones	Environment Agency	Flood Zone 2 and 3 GIS layers	Very Good
Areas Susceptible to Surface Water Flooding	Environment Agency	Less, intermediate and more susceptible to surface water flooding GIS layers	Very Good
NFCDD Flood Defences	Environment Agency	Provides information on maintenance, type, standard and ownership of defence assets	Fair
CFMPs	Environment Agency	South Devon CFMP North Devon CFMP Tamar CFMP	Very Good
Broad-scale model (JFLOW) fluvial depth grids	Environment Agency	Provides flood depth information for the 1 in 100 year and 1 in 1000 year flood events	Good
Devon Hydrology Strategy Flows	Environment Agency	Estimated flow rates for a range of return periods at node points across the study area. GIS layer.	Very Good
FRIS Incidents	Environment Agency	Flood incident database recording flood events from all flood sources. GIS layer.	Good
Flood Warning Areas	Environment Agency	Areas located within the Environment Agency Flood Warning Area. GIS Layer.	Very Good
Main River	Environment Agency	Watercourse designated as Main River by the Environment Agency. GIS layer).	Very Good
Buckfastleigh Modelling and Mapping Report	Environment Agency	Modelling report, including ISIS/TuFLOW outputs. GIS layers.	Very Good
South Devon Flood Zone Improvements	Environment Agency	Modelling report, including HEC-RAS models.	Very Good
South Zeal Flood Defence Scheme Pre-Feasibility Study	Environment Agency	South Zeal Flood Defence Scheme Pre-Feasibility Study	Very Good
Reservoir Information	Environment Agency	Details of location, type and capacity of reservoirs. Spreadsheet.	Good
River Catchment Boundaries	Environment Agency	Outlines of main river catchment boundaries. GIS layer.	Fair
LiDAR/SAR Data	Environment Agency	DTM providing ground levels within the study area. Coverage limited to main watercourses and their floodplains.	Very Good
Background OS mapping	Dartmoor National Park Authority	1:50,000 and 1:10,000 OS mapping	Very Good

Detailed River Network	Dartmoor National Park Authority	Centrelines of all watercourse located within the study area (both on and offline watercourses)	Very Good
Development Areas of Interest within Ashburton and Buckfastleigh	Dartmoor National Park Authority	Potential development areas identified by Dartmoor National Park Authority.	Good
Sewer flooding Information	South West Water	Background information on causes of sewer flooding.	Fair
Flood related callouts	Devon and Somerset Fire and Rescue Service	Location of flood related callouts responded to by the fire service. Spreadsheet.	Fair
Flood events recorded on Highways Agency database	Highways Agency	Description of general location, but no National Grid Reference (NGR) to allow easy display of information.	Fair