Cherwell and West Oxfordshire

Level 1 Strategic Flood Risk Assessment
Including Minerals and Waste Site Allocations

'Living Document'
April 2009




Prepared for:

Cherwell DISTRICT COUNCIL North Oxfordshire

WEST OXFORDSHIRE DISTRICT COUNCIL

OXFORDSHIRE COUNTY COUNCIL
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Revision Schedule

West Oxfordshire District Council and Cherwell District Council Strategic Flood Risk Assessment
April 2009

Rev	Date	Details	Prepared by	Reviewed by	Approved by
D1	May 2008	Draft	**Katherine Bird** Assistant Flood Risk Specialist	**Emily Blanco** Senior Flood Risk Specialist	**Damon O'Brien** Technical Director
D2	August 2008	Draft Final	**Emily Blanco** Senior Flood Risk Specialist	**Michael Timmins** Principal Flood Risk Specialist	**Damon O'Brien** Technical Director
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Glossary

Term	Definition
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Aquifer	A source of groundwater comprising 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 EA 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.
Culvert	A channel or pipe that carries water below the level of the ground.
Drift Geology	Sediments deposited by the action of ice and glacial processes
EA Flood Zone 1	Low probability of fluvial flooding. Probability of fluvial flooding is < 0.1%
EA Flood Zone 2	Medium probability of fluvial flooding. Probability of fluvial flooding is 0.1 – 1%. Probability of tidal flooding is 0.1 – 0.5 %
EA Flood Zone 3a	High probability of fluvial flooding. Probability of fluvial flooding is 1% (1 in 100 years) or greater. Probability of tidal flooding is 0.5%(1 in 200 years)
EA Flood Zone 3b	Functional floodplain. High probability of fluvial flooding. Probability of fluvial flooding is >5%
Exception Test	The exception test should be applied following the application of the sequential test. Conditions need to be met before the exception test can be applied.
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 plain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Resistant	Measures to prevent flood water entering a building or damaging its fabric. This has the same meaning as flood proof.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption)
Flood Risk Assessment	A FRA is required for any planning application at a potential risk of flooding to ensure the proposed development is not at an unacceptable risk of flooding and does not increase the risk of flooding elsewhere.
Flood storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Flood Zone	Flood Zones show the probability of river and sea flooding, ignoring the presence of existing defences (PPS25)
Fluvial	Relating to the actions, processes and behaviour of a water course (river or stream)
Fluvial flooding	Flooding by a river or a watercourse.
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Inundation	Flooding.

Term	Definition
Local Development Framework (LDF)	The core of the updated planning system (introduced by the Planning and Compulsory Purchase Act 2004). The LDF comprises 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 a proposals map.
Local Planning Authority	Body that is responsible for controlling planning and development through the planning system.
Main River	Watercourse defined on a 'Main River Map' designated by DEFRA. The EA has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Overland Flow	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
Risk	Risk is a combination of the probability of an event occurring and the potential consequences of the flood event
River Catchment	The areas drained by a river.
SAR	Synthetic Aperture Radar - a high resolution ground mapping technique, which uses reflected radar pulses.
Sequential Test	Aims to steer vulnerable development to areas of lowest flood risk.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Solid Geology	Solid rock that underlies loose material and superficial deposits on the earth's surface.
Source Protection Zone	Defined areas in which certain types of development are restricted to ensure that groundwater sources remain free from contaminants.
Sustainability	To preserve /maintain a state or process for future generations
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, aiming to mimic the natural drainage patterns of a developed site
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
Topographic survey	A survey of ground levels.
Tributary	A body of water, flowing into a larger body of water, such as a smaller stream joining a larger stream.
Watercourse	All rivers, streams, drainage ditches (i.e. ditches with outfalls and capacity to convey flow), drains, cuts, culverts and dykes that carry water.
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 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. Also applies to the design of new development in the floodplain.

Strategic Flood Risk Assessment Pro Forma

The following table has been reproduced from the Level 1 SFRA Outputs outlined in the practice guide companion to Planning Policy Statement (PPS) 25 'Living Draft'. It is presented here to demonstrate that the objectives of the Level 1 SFRA under PPS25 have been met and to provide those who review this SFRA a ready reference to where responses to the questions raised below can be found within this document.

Topic Area and Question	Location in Document
Plans showing the LPA area, Main rivers, ordinary watercourses and flood zones, including functional floodplain (if appropriate), across the local authority area, as well as all previously allocated development sites (or sites to be considered in the future)	Appendix A, B, C & D
An assessment of the implications of climate change for flood risk at allocated development sites over an appropriate time period	Section 3.14 Appendix A, B, C & D
Plans to show areas at risk from other sources of flooding such as surface water and groundwater flooding	Appendix A, B, C & D
Flood risk management measures, including location and standard of infrastructure and the location of flood warning systems	Section 7.8, 7.9, 9.8, 9.9 Appendix A, B, C & D
Locations where additional development may significantly increase flood risk elsewhere through the impact on existing sources of flooding, or by the generation of increased surface water runoff (a surface water management plan may be needed)	Section 6.4
Guidance on the preparation of FRAs for allocated development sites	Section 13
Guidance on the likely applicability of Sustainable Drainage Systems (SUDS) for managing surface water run-off at key development sites	Appendix I

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Executive Summary

Local Planning Authorities (LPAs) are required to produce Local Development Frameworks (LDFs), which are a portfolio of Local Development Documents (LDDs) that collectively deliver the spatial planning strategy for the authority area. The LDDs undergo a Sustainability Appraisal (SA) which assists Planning Authorities in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions and are a component of the SA process. Therefore, SFRAs should be used in the review or production of LDDs.

Planning Policy Statement 25: Development and Flood Risk (PPS25; Communities and Local Government, December 2006) and its Practice Guide Companion (June 2008) recommends that SFRAs are completed in two consecutive stages. The Level 1 SFRA enables application of the Sequential Test, and the Level 2 SFRA increases the scope of an SFRA for development sites where the Exception Test is required. The Sequential Test is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. Where it is not possible, due to wider sustainable development issues, to locate the development in a low flood risk area, a sequential approach within the Flood Zone is required and the Exception Test should be applied where necessary. This Executive Summary and the accompanying SFRA report constitute the Level 1 SFRA for Cherwell and West Oxfordshire Districts' Local Development Frameworks and the Minerals and Waste Development Framework being prepared by OCC.

Flood related planning policy at national, regional and district levels has been reviewed to highlight flood risk requirements at all stages of planning. This process has also helped to demonstrate how the SFRA will feed into the Councils LDF process.

The main source of flood risk policy and strategy within the Districts are Catchment Flood Management Plans (CFMPs) produced by the EA. These are used to shape flood risk management and provide guidance and strategy to the local area. Cherwell and West Oxfordshire District fall into the Upper Thames CFMP. The area is characterised by extensive floodplains and small clusters of development in a rural landscape.

PPS25 requires that, as part of any SFRA, all sources of flooding are identified. In order to assess the risk of flooding, the EA (EA) and other key stakeholders have been consulted including Thames Water Ltd., Anglian Water Ltd., Severn Trent Water Ltd, Oxfordshire County Council (OCC), Cherwell District Council (CDC), West Oxfordshire District Council (WODC) and British Waterways. Data provided has been split into five main sources of flood risk being: flooding from rivers and watercourses, sewer flooding, overland flooding, groundwater flooding and flooding from man made and artificial sources.

The predominant risk of flooding within the Cherwell and West Oxfordshire Districts is due to flooding from rivers and watercourses. Cherwell District falls within four major river catchments being: The River Thames, The River Great Ouse, The River Cherwell and The Warwickshire Avon Catchment. West Oxfordshire District falls into the catchment of The River Thames, The River Evenlode and The River Windrush. None of the catchments within the study area are tidally influenced.

In order to present the best available flood information, SFRA Flood Zones were derived using a variety of existing sources of data. Where detailed numerical modelling of rivers has been undertaken and the flood outlines mapped, these have been used in preference to broad-scale modelled flood outlines. The result is a single map for each Flood Zone using a variety of data. Information regarding the relative confidence and source of the data accompanies the electronic versions of this data. All SFRA Flood Zones are based on information provided by the EA and prescribed methodologies in PPS25. The methodology for deriving each of the SFRA Flood Zones is described below.

Flood Zone 1 refers to all areas that are considered to be at low risk of fluvial or tidal flooding. Flood Zone 1 consists of everything that falls outside of areas shown to be within Flood Zones 2 and 3. Whilst fluvial and tidal flooding is not a concern in these areas, the risk of flooding from other sources, such as surface water, groundwater, sewers and artificial sources may still be an issue.

Flood Zone 2 is the extreme flood event outline. This is the flood outline for the 1 in 1000-year (0.1% annual exceedence probability (AEP)) flood event and is based upon a combination of broadscale and detailed modelling provided by the Environment Agency (EA).

Flood Zone 3a is the outline for the 1 in 100 year (1% AEP) fluvial flood event and is the part of Flood Zone 3 that is outside Flood Zone 3b (the functional floodplain). This data is based on a combination of broadscale and detailed modelling provided by the EA.

Flood Zone 3b is the area of land falling within the 1 in 20 year (5% AEP) flood plain or land that is designed to flood within an extreme event and is termed functional floodplain (FFP). The 1 in 20 flood outline has been used to define the FFP where available. For reaches where this is not available, the 100-year flood outline (i.e. Flood Zone 3a) has been used as a proxy, in line with the guidance contained within the PPS25 Practice Guide, until such a time when more detailed information is available (i.e., an EA modelling study or hydraulic modelling undertaken for a site-specific flood risk assessment). This is not to say that the entire area used as a proxy is FFP, rather that the boundary of the FFP falls somewhere within that area as recommended by the EA.

All Flood Zones have been mapped with an allowance for climate change to 2107. For fluvial reaches, this Flood Zone is calculated by adding a net increase of 20 % over and above peak flows to the 100-year flood event. Where modelled information is not available, the Flood Zone 2 outline has been used as a proxy until such a time when more detailed information is available (i.e., an EA modelling study or hydraulic modelling undertaken for a site-specific flood risk assessment). This is not to say that the entire area used as a proxy is Flood Zone 3 plus an allowance for climate change, moreover that the boundary of Flood Zone 3 plus an allowance for climate change falls somewhere within that area

In general, the fluvial flood risk across the study area is high with large extensive floodplains being a substantial feature of the rural landscape. Urban locations within the study area that are potentially affected by fluvial flooding in Cherwell include: Banbury, Bicester, Bloxham, Kidlington and Yarnton. In West Oxfordshire they include: Witney, Bampton, Clanfield, Northmoor, The Wychwoods, Brize Norton, Eynsham, Standlake and Charlbury. In addition, there are numerous other settlements in the study area that have experienced fluvial flooding.

Flooding from the land caused by overland flow or as a result of sudden intense downpours has led to wide scale flooding of varying degrees across both Cherwell and West Oxfordshire. Flooding can range from rural roads becoming impassable at times to evacuation of schools by air due to villages being cut off on all sides.

The EA do not hold records of groundwater flooding for the area. However, local knowledge has provided a good incite into the nature of flood risk posed by groundwater in the study area. In general groundwater flooding is more likely to occur to settlements located at the base of hilly outcrops or where embankments have been formed. The following areas in Cherwell are at a greater risk of groundwater flooding: The base of Crouch Hill in Banbury, Upper Heyford, Kidlington, Bodicote, Hook Norton, Steeple Aston and Mollington. Within West Oxfordshire the following areas have experienced groundwater flooding: Shilton, Alvescot, Northmoor, Langford, Combe and Kelmscott.

Sewer flooding was identified using historical records provided from Thames Water and Anglian Water Services DG5 databases detailing the total number of flood events recorded to have affected both internal and external property over a 10 year period. The number of recorded sewer flooding events provided from the DG5 register is provided on a 5 figure grid reference basis and does not pin-point specific areas. For this reason, where available, data was provided by WODC for specific locations where sewer flooding has been reported as a problem. These records were based on data obtained during the July 2007 flood

event and show that sewer flooding is an issue in a number of parishes including Shipton-Under-Wychwood, Ascott-Under-Wychwood, Alvescot and Combe.

The EA have provided details of flood defence structures throughout the study area which provide a varied level of protection from 2 to 100 years, with the majority of defences providing protection up to a 2 to 5 year return period event. All flood defences are illustrated on settlement plans included in Appendix B and C. Witney, Kidlington and Banbury are all served by flood defences.

The Oxford Canal runs parallel to the River Cherwell and at points share the same channel. During flood conditions the Oxford Canal and River Cherwell are largely co-joined. British Waterways have provided details of points where breaches occurred in the Oxford Canal during July 2007. These points have been plotted on plans included in Appendix C.

The primary purpose of the County Council's Minerals and Waste Development Framework is to make informed decisions with regard to the location of minerals and waste sites for a period up to 2026. In order to take flood risk into account, all of the possible development sites and areas in Cherwell and West Oxfordshire have been mapped against flood risk which will then be sequentially tested by the Council to ensure that the highest risk development is located in areas at lowest risk of flooding.

A number of studies in addition to the CFMPs have identified an increased level of flood risk to the Study Area over the next 25 to 100 years as a result of climate change. Firstly, as a result of wetter and warmer winters, an increase in large fluvial flood events is likely to affect the larger rivers and watercourses in the study area. Secondly, extreme rainfall events are likely to become more frequent leading to a greater storm intensity and duration. This is likely to lead to a great deal more runoff causing surface water flooding and overwhelming of the urban sewer networks in particular. Revised guidance from UKCIP is due to be released shortly and is likely to update current figures of increases in flood risk

To attempt to counteract this increase in runoff in local areas, the use of Sustainable Drainage Systems (SuDS) is becoming more important. In addition to the more usual attenuation and infiltration systems, providing more 'green' spaces within the urban environment can also help to reduce runoff and also increase wildlife habitat. Groundwater Vulnerability (GWV) data and permeability data was collected and mapped as part of this study in order to identify areas suitable for each SuDS technique.

This SFRA was completed using the PPS25 climate change recommendations, however during the lifetime of this document it is quite likely that climate change levels may alter. As a result future site-specific flood risk assessments may have to adapt to these changes in line with current guidance in response to continuing research into climate change.

The Cherwell and West Oxfordshire SFRA has been completed in accordance with PPS25 and the current guidance outlined in the Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' (June 2008). The SFRA has been developed by building heavily upon existing knowledge with respect to flood risk within the study area. These documents have an intended lifespan of 6-10 years. Therefore it should be noted that although up-to-date at the time of production, the SFRA has a finite lifespan and should potentially be upgraded or revised as required by the local authorities. As a result, it is recommended that the SFRA be adopted as a 'Living document' and should be reviewed regularly and, if necessary, updated with new flood risk or planning policy data.

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1 Introduction

1.1 Background

1.1.1 The Planning and Compulsory Purchase Act 2004 (PCPA) (HMSO, 2004) requires Local Planning Authorities (LPAs) to produce Local Development Frameworks (LDFs) to 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 their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions; they are also a component of the SA process and should be used in the production or review of LDDs.

1.1.2 The release of Planning Policy Guidance Note 25 (PPG25): Development and Flood Risk in July 2001 introduced the responsibility placed on Local Authorities to ensure that 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. PPS25 re-emphasises the active role LPAs should have in ensuring flood risk is considered in strategic land use planning. PPS25 encourages LPAs to undertake SFRAs as part of their evidence base for the LDF process and to use their findings to inform strategic and use planning. In June 2008 an update to the PPS25 Practice Guide 'Living Draft' (February 2007) was published. The approach to SFRAs as suggested in this document has been used.

1.1.4 To assist LPAs in their strategic land use planning, SFRAs should present sufficient information to enable the LPAs to apply the Sequential Test (detailed in PPS25 and Chapter 5 of this report) to their proposed development sites.

> "*Decision-makers should use the SFRA to inform their knowledge of flooding, refine the information on the flood map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas."*
> *(PPS25, 2007*)

1.1.5 In addition, where development sites cannot be located in accordance with the Sequential Test as set out in PPS25 (i.e. to steer development to low risk sites): there is a need to apply the Exception Test. In which case;

> *"…the scope of the SFRA will be widened to consider the impact of the flood risk management infrastructure..."*
> (PPS25, 2007)

1.1.6 In addition to forming a tool for use in strategic land use planning, an SFRA should also be accessible, and provide guidance to aid in the general planning process of a LPA.

1.1.7 A preliminary desk-based SFRA was completed by Cherwell District Council (CDC) in December 2007 to cover the whole District. This Level 1 SFRA builds upon the data collected as part of this study.

1.1.8 In spring 2008 West Oxfordshire District Council (WODC) completed a series of Flood Defence Reports to outline flooding of July 2007 and suggest ways forward. Data collected in these reports has been referred to throughout this report.

1.1.9 The Banbury Regeneration Area SFRA produced in May 2007 has also been referred to.

1.2 The SFRA Structure

1.2.1 The Practice Guide Companion to PPS25 recommends that SFRAs are completed in two consecutive stages. This follows the iterative approach encouraged by PPS25 and provides LPAs with tools throughout the LDF process sufficient to inform and update decisions regarding development sites. The two stages are:

- Level 1 SFRA – Study Area Flood Source & Data Review to enable application of the Sequential Test;
- Level 2 SFRA – Increases scope of SFRA to include development site assessments for Exception Testing.

1.2.2 The results of the Level 1 SFRA will enable CDC, WODC and Oxfordshire County Council (OCC) to apply the sequential approach to the current potential major development sites and possible mineral and waste sites and to inform the scope of the Sustainability Appraisal (SA).

1.2.3 The second stage (level 2 SFRA) may be carried out following the undertaking of the Level 1 SFRA if, following application of the sequential test, potential development sites are still located in areas at risk of flooding.

1.2.4 This report comprises the Level 1 Cherwell and West Oxfordshire SFRA and also applies to that part of the Oxfordshire Minerals and Waste Development which covers those districts.

Level 1 SFRA - Study Area Flood Source & Data Review to Enable Application of the Sequential Test.

1.2.5 The Level 1 SFRA report will present sufficient information to enable the three Councils to apply the Sequential Test to proposed development sites and to assist in identifying whether the application of the Exception Test will be necessary.

1.2.6 The objective of the Level 1 SFRA, is to collate and review available information on flood risk in the Study Area. Information has been sought from a variety of stakeholders including the Environment Agency (EA), WODC, CDC, OCC, Thames Water Ltd. (TW), Anglian Water Services Ltd. (AWS), Severn Trent Water Ltd. (STW) and the British Geological Survey (BGS).

1.2.7 The information presented in a Level 1 SFRA should not be considered as an exhaustive list of all available flood-related data for the study area. The Level 1 SFRA report is a presentation of flood sources and risk, which is based on data collected following consultation with and input from the partner LPA and relevant agencies, within the timeframe available. The Level 2 SFRA will enable the contacts and relationships with key stakeholders developed in Level 1 to continue to assist in providing data and information for the SFRA.

1.2.8 The Level 1 SFRA should be used by the LPA, together with other evidential documents and the draft SA, to undertake the Sequential Test. This will help to identify where sites can be located in Flood Zone 1 or may require further investigation through a Level 2 SFRA.

Level 2 SFRA - Development Site Assessments for Exception Testing

1.2.9 A Level 2 SFRA facilitates the application of the Exception Test where required. This will be based on information collected in the Level 1 SFRA and additional works where necessary.

1.2.10 The Sequential and Exception Tests are discussed in more detail in Sections 7 and 8.

1.2.11 The structure of this Level 1 report (Figure 1-1) includes a chapter for Flood Risk in both Cherwell and West Oxfordshire Districts and a chapter on Minerals and Waste sites.

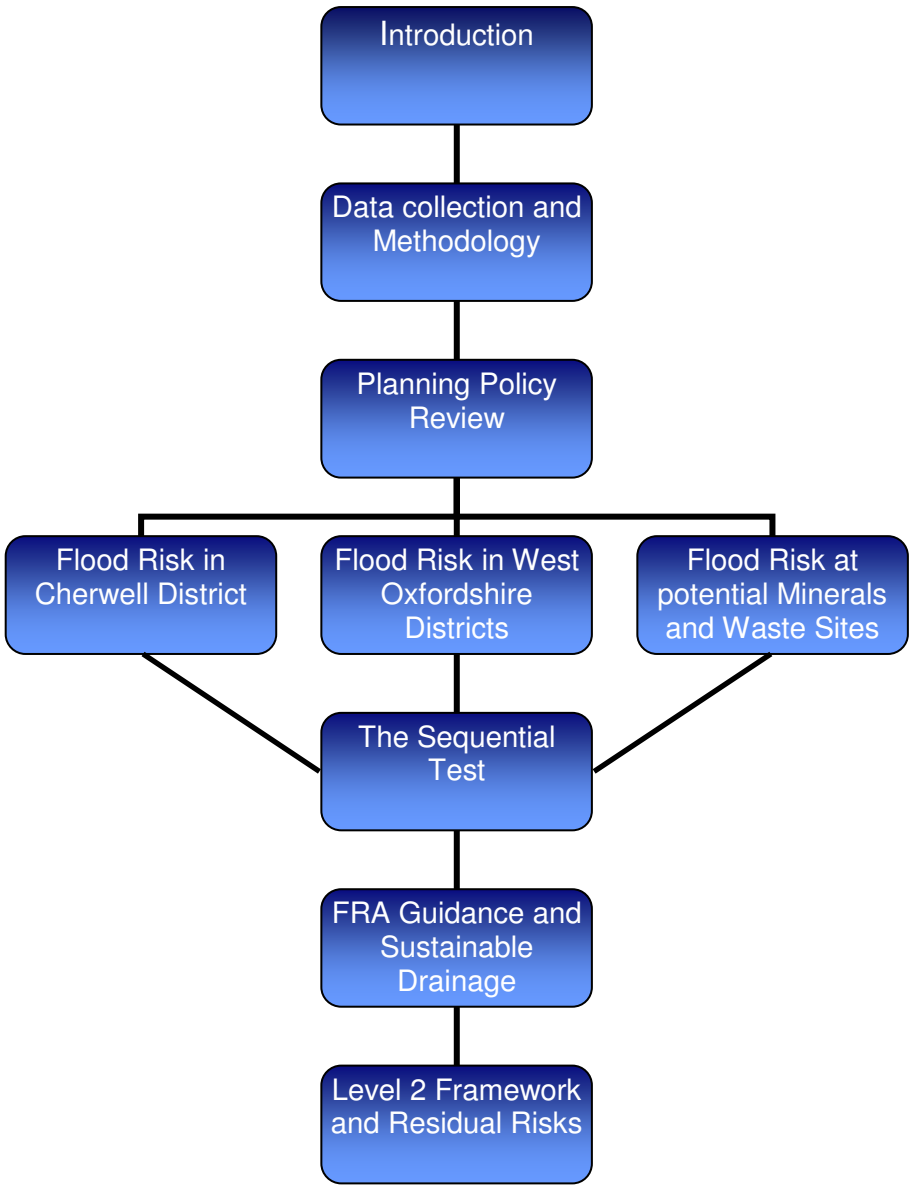

Figure 1-1: Level 1 Report Structure

1.3 SFRA Aims & Objectives

1.3.1 Scott Wilson has built on local flooding information provided by both Cherwell and West Oxfordshire District Councils and has completed one SFRA for both Districts that also assesses flood risk to proposed minerals and waste sites. This report follows the layout recommended by PPS25 and the accompanying Practice Guide Companion (June 2008) to ensure that the SFRA is sound and undertaken in accordance with current guidance.

1.3.2 The aim of the Cherwell and West Oxfordshire SFRA is '**to assess and map the different levels and types of flood risk in the study area for the land use planning process**'.

1.3.3 The aim of the SFRA will be met through the following objectives:

- To provide an assessment of the impact of all potential sources of flooding in accordance with PPS25 using the information available, including an assessment of any future impacts associated with climate change;
- Enable planning policies to be identified to minimise and manage local flooding issues;
- Provide information required to apply the Sequential Test for identification of land suitable for development in line with the principles of PPS25;
- To provide baseline data to inform the Sustainability Appraisal (SA) of the Development Plan Documents (DPDs) with regard to catchment-wide flooding issues which affect the Study Area;
- To provide sufficient information to allow the Councils to assess flood risk for specific development proposal sites to include minerals and waste sites, thereby setting out the requirements for site specific Flood Risk Assessments (FRAs);
- Enable the Councils to use the SFRA as a basis for decision making at the planning application stage;
- Provide recommendations of suitable mitigation measures including the objectives of Sustainable Drainage Systems (SuDS);
- Where necessary, provide technical assessments to demonstrate that development located in flood risk areas are appropriate and in line with the requirements of the exception test;
- Present sufficient information to inform the Councils of the acceptability of flood risk in relation to emergency planning capability.

1.3.4 The identification of sites and areas for future development must consider the current and future risks of flooding from a number of sources, including fluvial (flooding from rivers), surface water flooding (storm water), flooding from sewers, flooding from manmade/artificial sources and groundwater flooding. 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 LDFs.

1.3.5 The SFRA will also include an appraisal of minerals and waste sites across the two Districts in relation to flood risk to inform the spatial distribution of OCCs Minerals and Waste allocations.

2 Study Area

2.1.1 The Study Area comprises both Cherwell and West Oxfordshire Districts (Figure 2-1) of the study area).

2.1.2 The Cherwell District covers an area of approximately 590km^2, with a population of almost 135,500. The district is situated within north Oxfordshire, north east of the District of West Oxfordshire.

2.1.3 Cherwell has three major urban centres, Banbury with a population of 41,000, Bicester with a population of 29,000 and Kidlington with 14,000 residents. Together these three urban centres contain 65% of the district's population in what is predominantly a rural area.

2.1.4 Cherwell District falls within three major river catchments. The River Cherwell forms part of the larger Thames catchment, which comprises about 80% of the Districts total area. The Districts major urban and rural development areas are within the Upper Thames catchment. The Great Ouse catchment covers approximately 15% of the total area and the Warwickshire Avon catchment, approximately 5%.

2.1.5 West Oxfordshire District lies to the west of the City of Oxford and adjoins the Gloucestershire County Council border. The majority of the population resides in the southern section of the District with the largest settlement being the market town of Witney with a population of approximately 25,000. The District has a total population of approximately 100,000.

2.1.6 Almost all of the land area across the West Oxfordshire District drains into the River Thames. This forms the southern border of the district, flowing in a west to east direction. There are numerous other watercourses across the District, the majority of which form part of the Upper Thames catchment.

2.1.7 The main minerals worked in the Study Area are sharp sand and gravel, soft sand, limestone and ironstone – all for aggregate uses. In the north of Cherwell District there is a significant area of ironstone working and there are large limestone quarries to the north west of Bicester and between Witney and Burford. The main sand and gravel deposits are located in the south of the West Oxfordshire District, to the south east of Witney and north west of Oxford in the Thames and Windrush valleys.

2.1.8 Sites having potential for the management of waste are scatted across both districts as there is an increasing emphasis on recycling, composing and treatment of wastes in order to reduce the amount of waste that is going into landfill.

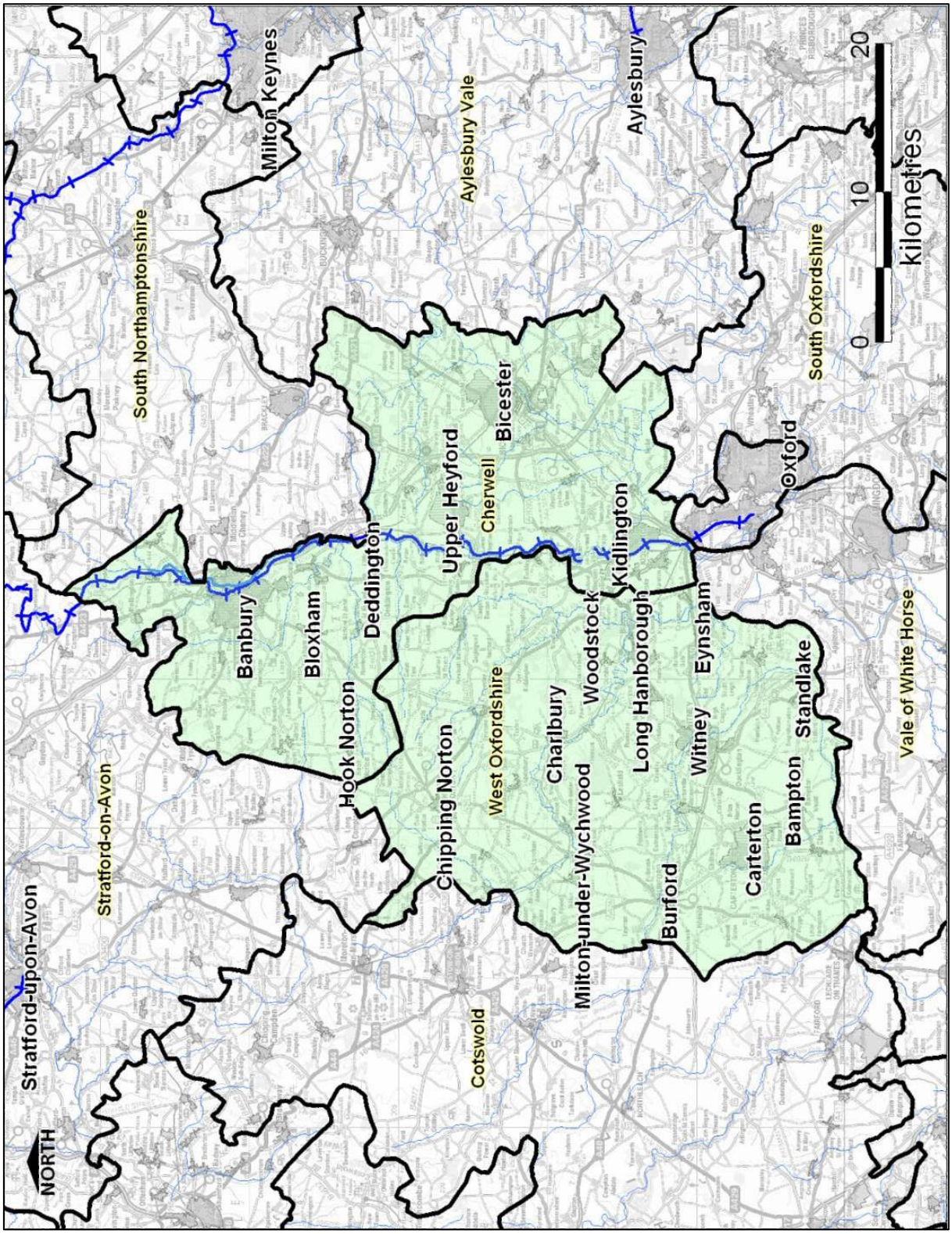

Figure 2-1: Study Area © Crown copyright. All rights reserved (LA 100024316).2008

3 Level 1 SFRA Methodology

3.1 Overview

3.1.1 As outlined in Chapter 1, the objective of the Level 1 SFRA is to collect, collate and review the information available relating to flooding in the Study Area including a review of reports completed by each District as follows:

- CDC SFRA Desk Based Study December 2007;
- WODC Parish Flood Defence Reports Spring/Summer 2008;
- Banbury Regeneration Area SFRA, May 2007;
- EA Upper Thames Catchment Flood Management Plan.

3.1.2 The information is then presented in a format to enable the Councils to apply the PPS25 Sequential Test to their potential development sites and identify sites in Flood Zone 2 and Flood Zone 3, which, according to their vulnerability, would require the application of the Exception Test through a Level 2 SFRA.

3.1.3 Gaps in the data/information have also been identified in order to ascertain additional requirements needed to meet the objectives of a Level 2 SFRA where required.

3.1.4 A comprehensive record of all the data collected through the production of the Level 1 SFRA is presented in the document register included in Appendix F.

3.2 Tasks

3.2.1 The sequence of tasks undertaken in the preparation of the Level 1 SFRA was, in chronological order:

- Inception meeting with CDC, WODC , OCC and the EA;
- Established the local stakeholders;
- Contacted stakeholders requesting data/information;
- Collated and reviewed data and populated data register;
- Presentation of available relevant information on flood sources and flood risk;
- Reviewed received data against the SFRA objectives; and,
- Identified gaps in data.

3.2.2 The above tasks were completed between January and August 2008.

3.3 Stakeholder Consultation

3.3.1 In the preparation of this Level 1 SFRA the following stakeholders were contacted to provide data and information:

- CDC;
- WODC;
- OCC;
- EA (Thames Region);
- Thames Water Ltd.;
- Anglian Water Services Ltd.;
- Severn Trent Water Ltd.;
- British Waterways;
- Buckingham Internal Drainage Board;
- British Geological Survey;
- Natural England;
- Highways Agency.

3.3.2 The principal contacts and their associated details are presented in Appendix G.

Local Authorities

3.3.3 Both CDC and WODC were contacted to provide information, advice and data on flood risk and planning issues across their administrative area and how their LDF programme is emerging. In addition to their planning and development aspirations, the councils were asked if they held any records of previous flooding issues within their administrative areas.

3.3.4 Following the flood event of July 2007, CDC gathered preliminary flood risk information for key areas within their district. The information was reviewed and endorsed to be used within the SFRA. As a result, this SFRA made extensive use of the 'SFRA tender background information' and built upon it to ensure that this SFRA is sound and meets all requirements of PPS25.

3.3.5 WODC provided a series of Parish Flood Defence Reports which outlined flood issues in each parish. This data was also extensively referred to in preparation of this SFRA report.

Oxfordshire County Council

3.3.6 OCC was approached for information on potential minerals and waste sites for inclusion in the SFRA report. Views from the County Emergency Planning Officer and the County Ecologist were also received and are taken into account in this report.

3.3.7 Oxfordshire County Council Highways Department have been contacted as they are the responsible authority for many of the Districts roads. The highways team are able to identify very detailed data such as specific gulley pots or pipes that need replacing. Much of this data is too detailed to be appropriate at the scale of a SFRA and will be picked up at the more local level studies such as Level 2 SFRAs or site specific FRAs.

Environment Agency

3.3.8 The EA is the principal holder of flood risk data in the UK. The EA has discretionary powers under the Water Resource Act (1991) to manage flood risk and, as a result, are the holders of the majority of flood risk data available in the study area. Cherwell and West Oxfordshire fall within the Thames region of the EA.

3.3.9 The EA attended the project inception meeting to determine what information could be made available for the SFRA and to discuss how to best use the data. A full list of the data provided by the EA can be found in Appendix F and can be summarised as:

- Catchment Flood Management Plans (CFMP) for the Thames Catchment;
- Strategic Flood Risk Mapping (SFRM) outlines and supporting data;
- Details and locations of historical flood events;
- LiDAR Digital Terrain Model and other survey;
- Details and locations of flood defence assets and flood warning procedures.

3.3.10 The EA have also assisted in the production of the SFRA by providing expert advice and comment.

Water Utilities

3.3.11 Thames Water Ltd. (TW) are the service provider for the majority of the Study Area. However, Anglian Water Services Ltd. (AWS) and Severn Trent Water Ltd. (STW) provide potable water distribution and wastewater collection for a small section along the northern boundary of the administrative areas.

3.3.12 TW have provided a register of flood events that have affected properties internally, and a separate register of flood events that have led to external flooding of areas such as roads. This information is provided to the regulatory body OFWAT (Office of Water Services) and is used to help define their capital programme. The register is also known as the DG5 register, and contains commercially sensitive information as well as information covered by the Data Protection Act (1998). The level of detail provided in the DG5 register is to postcode boundaries and as a result, a detailed analysis of the scale, consequences and risks of sewer flooding using TW data has not been possible at this stage of the SFRA.

3.3.13 However, it should be noted that where available, sewer flooding information from several other sources has been collected. This includes information from both District Councils and also Parish Flood Defence Reports for West Oxfordshire.

3.3.14 AWS provided details as above for two post code areas within the Study Area. However, STW did not provide details of sewer flooding instances. STW are only responsible for a small section of West Oxfordshire and Cherwell District, north of the A436.

3.3.15 Further detail regarding sewer flooding data is included in section 3.8. The principal contacts and their associated details for these stakeholders are presented in Appendix G.

British Waterways

3.3.16 British Waterways are responsible for maintaining the inland navigable waterway network across the UK including the Oxford Canal which is located in the study area.

3.3.17 Both of these canals are considered to be controlled water bodies so flood risk is deemed to be minimal unless overtopped in storm conditions. There is, however, a residual risk of structural failure.

3.3.18 For potential development sites located adjacent to canals, the residual risk of flooding should be identified during a site specific FRA. Should a major development area be located next to canals, then consideration should be given to undertaking a Level 2 SFRA study for that area. This study would determine the residual risks of flooding from canals.

3.3.19 British Waterways have provided details of locations where breaching occurred on the Oxford Canal during the flood event of summer 2007.

Buckingham Internal Drainage Board

3.3.20 Cherwell and West Oxfordshire administrative areas include some watercourses that are administered by the Buckingham Internal Drainage Board (IDB). The Board is a statutory body under the Land Drainage Act 1991. The IDB have been approached as part of this study but do not hold any details of flood history in this area.

Natural England

3.3.21 Natural England have provided details of Sites of Special Scientific Interest (SSSI) including those designated for wetland interest e.g. seasonally flooded grassland or wet woodland.

3.3.22 They have also made a suggestion that land adjacent to the Merton Brook, north of Merton be opened up as floodplain. These fields are already in the floodplain, however, a spoil bank currently prevents this land from flooding.

Highways Agency

3.3.23 The HA have stated that the A34 is not prone to flooding as it was constructed at such a height so as to avoid flooding. No flooding history for any other strategic roads in the study area has been provided by the HA. WODC Parish Flood Defence Reports have highlighted areas where highways flooded during the July 2007 flood event with information provided by the general public and local councillors.

3.4 Data / Information Collected

3.4.1 Information and data requested from the stakeholders was integrated with Scott Wilson's GIS system, where possible, to facilitate review. The information and data requested from the identified stakeholders was based on the following categories:

- Terrain Information e.g. LiDAR, SAR, river cross-sections;
- Hydrology e.g. the main and ordinary watercourses;
- Hydrogeology e.g. groundwater vulnerability zones;

- Flood Defence e.g. flood banks, sluices;
- Reservoirs Act (1975) Water Bodies within the study area;
- EA Flood Levels e.g. at flood monitoring points;
- Flood Risk Assessments e.g. on previous development sites;
- EA Flood Zone Maps;
- EA Catchment Flood Management Plans for the River catchments within the study area;
- Local Authority Information e.g. Local Development Schemes and allocation sites;
- Historical flooding;
- Sewer flooding problems; and,
- Minerals and waste information.

3.4.2 All data was registered and its accuracy and relevance reviewed to assess confidence levels for contribution to the SFRA (Table 3-1). Details of all the data collected at the time of production, is presented in Appendix F.

Table 3-1: 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

3.5 Data Presentation – GIS Layers

3.5.1 Using the data collected, a series of GIS layers were collated to visually assist the Councils in their site allocation decisions and Development Control activities.

3.5.2 Broadly, the layers can be classified into planning policy, informative and flood risk categories described in more detail below. Table 3-2 summarises the main GIS layers used in the SFRA. Appendix H includes a detailed table highlighting the GIS layers that have been used and their limitations.

Table 3-2: GIS Layers included in the Cherwell and West Oxfordshire SFRA

Planning Policy	Information	Flood Risk
Cherwell and West Oxfordshire Administrative Boundary	Main River Network	Flood Zone maps (EA FZ 2 and 3, hydraulic modelled outlines for sections of the Lower Windrush and The River Cherwell)
Urban Areas	Ordinary Watercourse Network	Flood Warning Areas
Other Land Use Pressures (Areas of Outstanding Natural Beauty/ Sites of Special Scientific Interest)	Flood Defence Locations	Historic Sewer Flooding Records (DG5 Data)
Potential Site Allocations	OS Mapping	Previous Flood Risk Reports
	Permeability Mapping	Oxford Canal Centreline
		EA Main River Centrelines

3.6 GIS Data Gaps & Assumptions

3.6.1 Some data that is necessary to satisfactorily complete an SFRA is either not available at all, or is not available in GIS format. In order to present complete Flood Zones with the best available information for the study area, it has been necessary to make certain assumptions, in agreement with the LPA and the EA, so that gaps in data could be filled; these assumptions have been outlined in the proceeding sections.

3.7 Fluvial Flooding Data

3.7.1 The extent of fluvial flooding from rivers and streams in the Study Area has been mapped in GIS using existing EA data. No additional hydraulic modelling has been undertaken as part of this study.

Data Sources & Requirements

3.7.2 The EA provided a GIS layer with all watercourses designated as 'main river' for which they are responsible for. British Waterways also provided a GIS layer for the Oxford Canal which runs north to south through the Study Area.

3.7.3 As part of the Level 1 SFRA, PPS25 requires definition of the following fluvial Flood Zones across the Study Area (Table 3-3):

Table 3-3: PPS25 Flood Zones to be Mapped as Part of the SFRA

Flood Zone	Definition	Probability of Flooding
Flood Zone 1	At risk from flood event greater than the 1 in 1000 year event (less than 0.1% annual probability of flooding each year)	**Low Probability**
Flood Zone 2	At risk from flood event between the 1 in 100 and 1 in 1000 year event (between 1% and 0.1% annual probability of flooding each year)	**Medium Probability**
Flood Zone 3a	At risk from flood event less than or equal to the 1 in 100 year event (greater than 1% annual probability of flooding each year)	**High Probability**
Flood Zone 3b	At risk from a flood event less than or equal to the 1 in 20 year event or otherwise agreed between the Local Planning Authority and the EA (greater than 5% annual probability of flooding each year). If no modelled data is available, Flood Zone 3a should be used as a conservative Flood Zone 3b extent.	**Functional Floodplain**

3.7.4 Table 3-4 identifies the sources of data used to map fluvial Flood Zones required by PPS25.

Table 3-4: Data Sources for Fluvial Flood Zone Mapping

Scenario		River
Current Flood Zones (2007)	**Flood Zone 2**	EA Flood Map (Flood Zone 2) Rivers. Where available modelled outlines have been used.
	Flood Zone 3a	Hydraulic model 100 year model run for Rivers. Where available modelled outlines have been used.
	Flood Zone 3b	Hydraulic model 20 year or 25 year model run where available (and in agreement with the EA).
Climate Change Flood Zones (2107)	**Flood Zone 2**	Not required
	Flood Zone 3a	EA Flood Map Flood Zone 2 or modelled data where available.

3.7.5 The current Flood Zones have been prepared using the best available data from appropriate hydraulic models and following the precautionary principle as detailed throughout PPS25.

Functional Floodplain

3.7.6 Functional floodplains have the highest probability of flooding of all the Flood Zones defined within Table D.1 of PPS25 (see Table 3-3 above). A functional floodplain is defined as an area of land where water has to flow or be stored at times of flood (Communities and Local Government, 2006). The functional floodplain has an annual probability of flooding of 5% (i.e. from a 1 in 20 year return period event).

3.7.7 The EA have provided modelled 1 in 20 year or 1 in 25 year flood outlines for a number of watercourses in the area including the Lower Windrush and sections of the River Cherwell. Where this is not available it was agreed that the whole of Flood Zone 3 should be assumed to be functional until such a time that more detailed information is available, such as the Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA, as recommended by PPS 25 guidance.

Climate Change

3.7.8 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 flood outlines delineating climate change should be presented. Where possible, modelled outlines for Flood Zone 3a and 2 including the effects of climate change have been presented.

3.7.9 PPS25 outlines that when completing a SFRA, planning bodies will need to agree how to factor climate change and over what timeframe. In agreement with the EA, with regard to this study, fluvial reaches where climate change has been modelled, a net increase of 20% over and above peak flows has been added to the 1 in 100 year flood event to account for climate change to 2107.

3.7.10 In areas where climate change has not been modelled or mapped it has been agreed with the Councils and the EA 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 a Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA.

Mapping

3.7.11 An overview of the designated EA main rivers and the Oxfordshire Canal within the Cherwell and West Oxfordshire Districts is included in Appendix A (Figure 6-2). Fluvial flooding GIS outlines have been included for both districts on Settlement Plans in Appendix B and C and for minerals and waste sites included in Appendix D.

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Derivation of Flood Zones

Whilst every attempt has been made to use the most up-to-date, accurate and detailed modelled data, there were some instances where it was necessary to use proxy data where modelled data was not available.

Limitations & Uncertainties

Using proxy data to define flood zones presents a series of issues and limitations and uncertainties. This is especially true when Flood Zone 3a is used as a proxy for Flood Zone 3b. In urban areas, watercourses often flow in deep and canalised channels and through culverts or tunnels. However, broad-scale modelled outlines assume a 'bank-full' state prior to flooding and therefore, large areas are shown to be flooded at both Flood Zone 3 and Flood Zone 2.

The level of confidence assigned to each Flood Zone is a result of the level of assumptions and limitations when deriving that Flood Zone. Until new modelling studies are complete, the Councils and the EA have agreed to use the best available data and to consult when new data is available during the continuing LDF progress.

3.8 Sewer Flooding Data

3.8.1 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as 'combined sewers'. Flooding can result when the sewer is overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity.

Data Sources & Requirements

3.8.2 Areas at risk from sewer flooding have been determined through review of records from DG5 registers provided by TW and AWS. In order to fulfil statutory commitments set by OFWAT, water companies must maintain verifiable records of sewer flooding, which is achieved through their DG5 registers. Water companies are required to record flooding arising from public foul, combined or surface water sewers and identify where properties have suffered internal or external flooding.

3.8.3 The data provided by each water company is limited to postcode data, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events. The data also only covers records over the last ten years. It should be noted that the flood records provided could be misleading as they may not be a complete and accurate record of flood events in the study area over the last 10 years as some minor flooding incidents may go unreported, particularly if no property is affected by internal flooding.

3.8.4 Due to the lack of resolution of the data and the relatively short period for which the records are available (≤10 years), definition of flooding probability cannot currently follow the same approach as that used for fluvial flooding. Therefore, available data has been mapped showing the areas that have been most and least affected by sewer flooding over the last 10 years. Foul, surface and combined water flooding incidents have been mapped separately. A cumulative frequency of all known forms of sewer flooding incidents has also been included to show the total records of flooding incidents across each administrative area.

3.8.5 Scott Wilson has applied two bands being medium and low incidence to the available sewer flooding data based on natural trends in the data. These are as follows:

- Low incidence of flooding - between 1 and 2 properties affected within the previous 10 year period.
- Medium incidence of flooding - 3 or more properties affected within the previous 10 year period.

3.8.6 There is no banding for a high incidence of sewer flooding as data collected for a 10 year period by TW in this area shows that the largest number of reported flooding incidents is 3, which is not classed as a high incidence of flooding. As outlined previously, data provided by TW is limited and does not represent a comprehensive record of instances of sewer flooding as many may not have been recorded. Specific recorded instances of sewer flooding provided by the councils have been outlined on Settlement Plans included in Appendix B, C and D.

3.8.7 The number of flooding incidents within each group have been shown as a 'count' to the right of the group range on each key included with each sewer flooding plan.

Climate Change

3.8.8 Climate change is estimated to result in milder, wetter winters and increased summer rainfall intensity. This combination will increase the pressure on existing sewer systems effectively reducing their design standard, leading to more frequent flooding.

3.8.9 The current data does not enable a robust assessment of the effects of climate change on sewer flooding to be undertaken. Therefore in the absence of accurate data the effects of climate change should be taken to result in an increase in the flooding probability of each post code area by one category. For example where a post code area is currently identified to have a low probability, accounting for the effects of climate change the area has been defined as medium probability.

Mapping

3.8.10 DG5 data provided by TW has recorded instances of surface water flooding from overloaded sewers as 0 for the whole of the West Oxfordshire District. For this reason, maps provided in Appendix A illustrate only incidents of foul water flooding for the West Oxfordshire District.

3.8.11 Data collected by the Engineering Team within WODC shows that contrary to the DG5 data, sewer flooding is a significant issue and therefore, the DG5 data could be misleading. To mitigate this, locations of real instances of sewer flooding reported to WODC following the July 2007 flood event have been illustrated on Settlement Plans included in Appendix B and Appendix C.

3.8.12 The following GIS mapping outputs have been produced in relation to sewer flooding, included in Appendix A:

- **Figure A-3** CDC and WODC total number of properties flooded by overloaded sewers.
- **Figure A-4** CDC and WODC total number of properties flooded by overloaded surface water sewers.
- **Figure A-5** Cherwell District total number of properties flooded by overloaded foul water sewers.

Sewer flooding data illustrated in 'bands' in Appendix A has been obtained from DG5 data, which is available to the general public. Where available, data of more specific locations where sewer flooding has historically occurred and been reported to West Oxfordshire DC has been added to the plans.

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Flooding from Sewers - Limitations & Uncertainties

Due to the significance of sewer flooding in urbanised areas, the flood risk data that utility companies hold on their sewer network is classified as critical to contribute to addressing all sources of flood risk within the SFRA. Sewer and drainage flooding has been identified using DG5 records and historic recorded instances. It must be noted that DG5 data only covers a limited period of time and should be considered a snapshot of flooding. In addition, the DG5 dataset is only provided on a five-digit postcode area, which can be large and make it difficult to determine where a sewer flooding problems may have occurred in the past.

Current Position – Flooding from Sewers

More detailed sewer flooding models, such as those produced by utility companies for certain areas, provide a much more detailed and useful appreciation of the risk posed. However much of this work is not yet publicly available due to commercially sensitive issues or the Data Protection Act.

Until more detailed and suitable data becomes available, the local authorities, the EA and the utility companies should continue to liaise to determine how sewer flooding data can best be used to inform strategic planning.

3.9 Surface Water Flooding & Overland Flow Data

3.9.1 Intense rainfall that is unable to soak into the ground or enter drainage systems can quickly run overland and result in local flooding. This is exacerbated by highly impermeable urban development or low permeability soils and geology (such as clayey soils).

3.9.2 In developed areas, this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Overland flow paths should be taken into account in spatial planning for urban developments.

Data Sources & Requirements

3.9.3 An assessment of surface water/overland flow must be undertaken as part of the Level 1 SFRA and assessed as part of site specific FRA's.

3.9.4 The location of historical surface water flooding incidents has been obtained from discussions with the council's drainage engineers and review of historical information.

Mapping

3.9.5 Instances of surface water flooding have been illustrated on settlement plans for West Oxfordshire District with data obtained from Parish Flood Defence Reports.

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Flooding from the Land - Limitations & Uncertainties

This type of flooding is frequently experienced and often very destructive and it is possibly a more serious problem than suggested by historic records. Surface water flooding does not need a watercourse in close proximity to occur and is exacerbated by areas of hard standing such as tarmac.

This source of flooding tends to suffer from a lack of historic records and almost always no predictive data based on modelling. Given the prediction for increased frequency and intensity of rainfall with climate change, surface water and pluvial flooding are likely to become more frequent and serious.

Current Position – Flooding from the Land

The Councils will continue to collate data on surface water flooding as and when it becomes available. A good example of this is the data collected through the parish Flood Defence Reports carried out by WODC. Updated information will be fed into subsequent updates of the SFRA and continue to inform the planning process.

Where areas are identified as having a surface water flooding issue, Councils may be required to undertake a Surface Water Management Plan (SWMP). There are several SWMP pilot studies being undertaken at present that will test and help to form SWMP guidance. These should be available in the spring of 2009.

3.10 Geology, Groundwater Flooding & Groundwater Vulnerability Mapping

Data Sources & Requirements

3.10.1 PPS25 states that an assessment of the risk of groundwater flooding needs to be considered; however, a quantified assessment of risk from groundwater flooding is difficult to undertake, especially on a strategic scale. This is due to lack of groundwater level records, the variability in geological conditions and the lack of predictive tools (such as modelling) that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

3.10.2 The EA's groundwater vulnerability maps have been presented in a thematic map alongside the British Geological Survey Permeability Maps to highlight areas that overlie aquifers with a high vulnerability. Major Aquifers with a high vulnerability tend to have a more permeable surface geology.

3.10.3 Groundwater vulnerability relates to the potential for contamination to groundwater and thus is a useful tool to determine the suitability of sustainable drainage (SuDS) techniques. The use of infiltration techniques will be dependant on the ground and groundwater conditions. However, Other SUDs techniques may be suitable even if groundwater conditions preclude infiltration.

3.11 Flood Defences & Flood Warning

Flood Defences

3.11.1 Flood defences are typically engineered structures designed to limit the impact of flooding. Flood defences take several forms including bunds/embankments, canalised channels, culverts and flood storage areas.

3.11.2 Information on flood defences throughout the study area has been provided by the EA as a GIS layer of the National Flood and Coastal Defence Database (NFCDD), listing details of structures and flood defences. The NFCDD aims to provide the following information:

- The location, composition and condition of fluvial and tidal defences and watercourses referenced to identified risk areas,
- The types of asset (i.e. property, infrastructure, environmental) at risk within identified risk areas and including those protected by fluvial, tidal and coastal defences,
- The extent of floods related to different flooding scenarios (e.g. different return periods and different types of flood event such as overtopping or embankment failure).

3.11.3 The locations of all NFCDD flood defences in the study area are presented on settlement plans included in Appendix B, C and D.

3.11.4 The EA Flood Zone Map defines the extent of flooding ignoring the presence of defences and the fact that their presence can not always be assured. The reason for this approach is to make an allowance for residual flood risk in the event of a failure or breach/blockage/overtopping of the flood defences. This conservative approach over time will reduce reliance on flood defences and raises the awareness of flood risk in defended areas to help ensure that it is managed appropriately as part of development proposals.

3.11.5 The EA has also provided topographic survey drawings of some flood defences from their data archives which vary significantly in age, format, level of detail and coverage. A full review of these drawings has not been undertaken as it is currently beyond the scope of this study.

Flood Warnings

3.11.6 The Civil Contingencies Bill requires that the EA 'maintain arrangements to warn the public of emergencies'. As a Category 1 responder, the EA has a duty to maintain arrangements to warn, inform and advise the public in relation to particular emergencies.

3.11.7 The County Council also has a duty under the Civil Contingencies Act to warn and inform the public and that is done mainly through the Communications Unit.

Data Sources & Requirements

3.11.8 The EA have provided details of areas benefiting from an EA flood warning system which should be used by emergency planners in conjunction with the Flood Zone maps and flood defence information to assist in developing emergency plans for areas at risk of flooding with the study area.

Mapping

3.11.9 Settlement maps included in Appendix B (Cherwell) and C (West Oxfordshire) and mineral and waste maps included in Appendix D include details of EA flood warning areas.

3.12 Planning Policy GIS Layers

Political & Urban Area Boundaries

3.12.1 In addition to the Flood Zone, and flood source GIS layers described above, a series of Planning and Policy GIS layers were provided by both Councils. These include political and built up urban area boundaries derived from settlement sustainability studies to ensure that the SFRA is using the same information as the rest of the LDF process.

Potential Allocation Sites & Alternative Development Sites

3.12.2 Both CDC and WODC have provided GIS layers of sites put forward to the Councils by landowners/developers for consideration as potential development allocation sites. These have been included on Settlement Plans. When overlain with flood risk GIS layers, it is possible to determine which sites are located in areas at risk of flooding and to what extent.

3.13 Minerals & Waste

Potential Minerals & Waste Sites

3.13.1 OCC have provided details of possible minerals and waste sites which have been mapped along with Flood Zone information to allow informed decisions regarding site allocation to be made.

Mapping

- OCC provided maps to illustrate locations of potential waste sites within Cherwell and West Oxfordshire Districts. These maps were digitised and a GIS layer created. OCC also provided a digital plan of all minerals sites and areas of search. All GIS plans for mineral and waste sites are included in Appendix D.

3.14 Climate Change & Future Flood Risk

3.14.1 PPS25 updates the approach to estimating the impacts of climate change on flooding by using newer scenarios predicted by the UKCIP02 (UK Climate Impacts Programme – Scenario 2). In addition to increasing the peak flow of larger watercourses (by up to 20%), PPS25 now also includes an increase in the peak rainfall intensity of up to 30%. This will seriously affect the modelling of smaller urban catchments, leading to rapid runoff to watercourses and surface water flooding, surcharging of gullies and drains and sewer flooding.

3.14.2 The Thames CFMP (Catchment Flood Management Plan) has also considered flood risk for the next 50-100 years and has taken into account the flood risk drivers of climate change, urban development and changes in land use.

3.14.3 The SFRA brief has asked for an assessment of the implications of climate change for flood risk over a time period of 100 years.

3.14.4 In order to account for climate change where it is absent from EA Flood Zone data, an estimate of the impacts of climate change on the 100 year flood outlines is required. In order to achieve this, the following is used as a proxy:

- Flood Zone 3a (<= 1 in 100 year) + climate change ≈ Flood Zone 2

3.14.5 This is not to say that the 100 year flood outline (Flood Zone 3a) will necessarily increase to the 1000 year outline, (Flood Zone 2) but rather that one would expect the depth and extents of flooding to increase to somewhere between the 100 year and 1000 year outlines. This is a conservative approach designed to help strategic planners identify where increased detail and resolution in the flood outlines is needed at either the Level 2 SFRA or Site Specific FRAs.

3.14.6 Sewer and surface water flooding are likely to become more frequent and widespread under urbanisation and climate change scenarios as the amount of impermeable surfaces and runoff increase, highlighting the importance of SuDS.

3.14.7 The location of future urban developments and flood defences within a catchment can heavily influence flood risk in the area and has the potential to further increase flood risk at sites downstream of such developments. Impacts include the lowering of the standard of protection offered by flood defences and the carrying capacity of culverts, drains, sewers and watercourse channels. This potentially leads 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.

3.14.8 The draft PPS 1 Supplement sets out important objectives in order to tackle climate change, sea level rise and avoid flood risk. The purpose of design policies should be to ensure that developments are sustainable, durable and adaptable to natural hazards such as flooding. Following this guidance, it should be possible to mitigate against increased flood risk through incorporating 'flood proofing' measures such as raised finished floor levels into the development design, and/or development of compensatory storage and flood storage basins.

3.14.9 In order to support PPS 1, and in partnership with the UK Climate Impacts Programme, OCC has started to assess how they can adapt to future changes in weather, as a service provider, corporate body and community leader. The Local Climate Impacts Profile project (2006) has examined incidents/consequences (e.g. power supply, transport disruption, direct danger to life) related to weather events over the last 10 years in Oxfordshire in order to gauge the Council's vulnerability to extreme weather events. The results have shown that:

- Flooding has the highest number of incidents recorded in OCC over the 10 year period;
- Council services responses to common weather impacts are well defined and implemented. However, impacts that are new or infrequent are often not responded to in a formal or timely way;
- Monitoring of weather variables and/or their costs is patchy or non-existent;
- Climate change is seen as a genuine concern;
- The Councils services are vulnerable to large-scale and un-forecast weather events.

1.1.1 In order to overcome these potential issues, OCC is:

- Working with external partners such as UKCIP and Oxford University to map trends in weather;
- Working with research partners to make findings of these studies accessible to relevant council services;
- Researching levels of preparedness and knowledge of business continuity plans within council departments;
- Working with the media to research opinions on climate change and private 'adaptations' and preparations.
- Publicise results as a means of engaging the public with the adaptation message.

4 Policy Review

4.1 Planning Policy Overview

4.1.1 The planning policy review collates and summarises policy and guidance relevant to planning for flood risk in the Cherwell and West Oxfordshire Districts of Oxfordshire and comments on the extent to which the existing European, National, Regional and Local policy framework reflects the aspirations of Planning Policy Statement (PPS) 25.

4.1.2 The scale of the data and guidance used is appropriate to the scale of the local authorities covered and is able to present a useful and useable overview to flood risk and planning issues. By bringing together the planning and flood risk reviews, a strategic overview of flood risk was completed. This highlights the main conflicts between flood risk and planning policy within the local authorities.

4.1.3 PPS25 (2006) has been reviewed as the key guidance tool for flood risk and development at a national level, followed by other key PPS and Planning Policy Guidance (PPG) documents. In turn this is followed by a review of the draft Regional Spatial Strategy (RSS) for the South East (January 2006) and the subsequent Inspectors' Report on the draft RSS (August 2007).

4.1.4 At a local level, the relevant policies for Cherwell and WODC have also been reviewed, along with those of OCC in relation to its role as Minerals and Waste Planning Authority. The review covers policies pertaining both to flood risk and to development in flood risk areas.

4.1.5 Finally the planning policy review has been expanded to consider key strategic development pressures, such as targets for housing and employment provision as set out by the draft RSS and the Inspectors' Report, as these are of direct relevance when assessing flood risk.

4.1.6 Figure 4-1 below illustrates the structure of the current planning system.

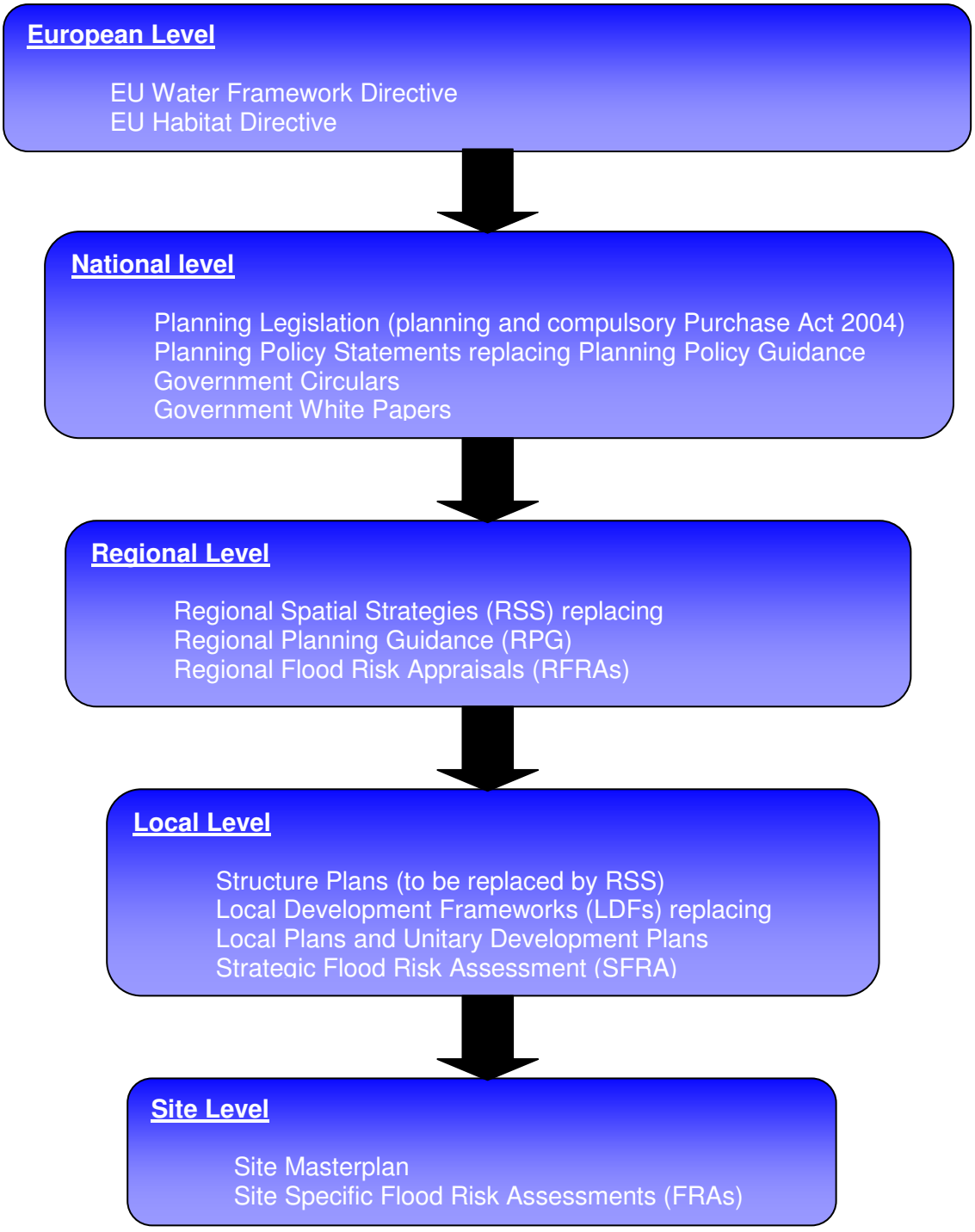

Figure 4-1: Flow Chart Illustrating Structure of the Current Planning System in Relation to Flood Risk

4.2 European Policy

Water Framework Directive (December 2000)

4.2.1 The Water Framework Directive (WFD) is a substantial piece of EC legislation and the largest directive related to water to date. The directive came into force on 22nd December 2000, and establishes a new integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. The directive requires that all member states manage their inland and coastal water bodies so that a 'good status' is achieved by 2015. This aims to provide substantial long term benefits for sustainable management of water.

4.2.2 The Directive introduces two key changes to the way the water environment must be managed across the European Community:

4.2.3 Environmental & Ecological Objectives. The WFD provides for Protected Areas and Priority Substances to safeguard uses of the water environment from the effects of pollution and dangerous chemicals. In addition, important ecological goals are set out to protect, enhance and restore aquatic ecosystems.

4.2.4 River Basin Management Plans (RBMPs). RBMPs are the key mechanism to ensure that the integrated management of rivers, canals, lakes, reservoirs and groundwater is successful and sustainable. RBMPs aim to provide a framework in which costs and benefits can be properly taken into account when setting environmental and water management objectives.

4.2.5 Each RBMP must apply to a 'River Basin District' (RBD) (a geographical area which is defined based on hydrology – see Annex 1, DEFRA & WAG River Basin Planning Guidance (RBPG), August 2006). The main RBD that is relevant to the Cherwell and West Oxfordshire areas is the Thames RBD (equivalent to the EA Upper Thames Region and including several major river catchments). The Anglian and Severn RBD's are also affected by the northern fringes of the two Districts.

4.2.6 The river basin planning process involves setting environmental objectives for all groundwater and surface water within the RBD, and designing steps and timetables to meet these objectives. The EA is responsible for implementing the WFD in England and Wales and aim to have completed draft RBMPs by 2009.

4.2.7 According to the DEFRA and WAG River Basin Planning Guidance (August 2006), a RBMP should be a strategic plan that gives all stakeholders within a RBD some confidence about future water management in their district. It should also set the policy framework within which future regulatory decisions affecting the water environment will be made.

4.2.8 Although RBMPs specifically address sustainable water management issues, the WFD also requires that other environmental considerations and socio-economic issues are taken into account. This ensures that the policy priorities between different stakeholders are balanced to ensure that sustainable development within RBDs is achieved.

4.2.9 As a result of the strategic nature of RBMPs, they are inherently linked to and can both influence and be influenced by planning policy within their areas. The following sections are extracted from the DEFRA and WAG River Basin Planning Guidance (August 2006).

Spatial Plans Influencing RBMPs

4.2.10 Emerging development plans will be an important source of information on future water management pressures that can inform the EA and refine its understanding of the current status of water bodies, and how this might change if no action was taken. The RBPG stresses the importance of taking into account the continuation of sustainable human development (including ports, recreational uses, water storage and flood risk management schemes) within RBDs and the setting of water management frameworks.

4.2.11 The EAs Catchment Flood Management Plans (CFMPs) and Catchment Abstraction Management Strategies (CAMS) are examples of such high-level planning tools that can inform development of RBMPs. Using CFMPs, the Regional Flood Risk Assessments (RFRA) and Strategic Flood Risk Assessments (SFRAs) will build upon existing flood risk and planning information to present current and potential future development within RBDs in relation to flood risk. In addition, policies that emerge from these studies (for example SuDS, Flood Risk Management procedures and mitigation options) will inform the development of the water management frameworks in RBMPs.

4.2.12 The Cherwell and West Oxfordshire SFRA should therefore play an important role in informing the water management framework in the emerging Upper Thames RBMP.

RBMPs Influencing Spatial Plans

4.2.13 As well as being informed by various spatial and catchment wide plans and strategies, RBMPs should produce strategic, regional policy information that is necessary to feed into the spatial planning process such as Local Development Frameworks. For example, where RBMPs have a direct affect on the use and development of land they will have to be material considerations in the preparation of statutory development plans for the areas they cover. It will also be necessary for planning authorities to consider WFD objectives at the detailed development control stage (not least to consider the requirements of Article 4(7) of the WFD in relation to new physical modifications).

4.2.14 To allow local authorities to incorporate WFD objectives into their various statutory development plans, the EA will provide local authorities with information such as CFMPs, CAMS and other catchment-wide guidance and strategies, to enable effective integration of the water management framework within statutory development plans. In order to address the fact that these plans have different planning cycles, and are at different stages in their development, RBMP policies that affect the development and use of land must be considered in the monitoring and review of statutory spatial plans.

4.2.15 In addition, some of the measures necessary to achieve WFD objectives will be delivered through land use planning mechanisms. For example spatial planners can make major contributions to WFD objectives by including appropriate planning conditions and planning obligations in relevant planning permissions for new developments, or by restricting some forms of development. Delivery of these measures is more likely to take place if they are included in Local Development Frameworks / Plans by land use planners. As stated above, the Cherwell and West Oxfordshire SFRA should inform the RBMPs and, as a result, the LDFs being prepared by the individual authorities should already include policies and recommendations relating to flood risk management and development within catchments.

4.3 National Policy

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

4.3.1 PPS25 is supported by a Practice Guide Companion (June 2008) and builds on the principles set out in PPG25 (July 2001). PPS25 seeks to guide the preparation of Strategic Flood Risk Assessments and the location of development in order to avoid and manage flood and residual risk. The PPS also aims to reduce flood risk to and from new development through policies on layout and design. PPS25 reaffirms that all forms of flooding and their impact on the natural and built environment are material planning considerations. Guidance for the minimum content of and best practice for the preparation of SFRA's is contained in Annex E.

4.3.2 PPS 25 sets the following minimum requirements for the appraisal, management and reduction of flood risk:

- Identify land at risk from flooding and the degree of risk;
- Preparing Regional or Strategic Flood Risk Assessments (RFRAs / SFRAs) as appropriate, either as part of the Sustainability Appraisal of their plans or as a freestanding assessment;
- Frame policies for the location of development which avoid flood risk to people and property, where possible and manage any residual risk, taking into account climate change;
- Reduce flood risk to and from new development through location, layout and design, including sustainable drainage approaches;
- Use opportunities offered by new development to reduce flood risk;
- Only permit development in areas of flood risk when there are no suitable alternative sites elsewhere and the benefits outweigh the risks from flooding. Work with the EA and other stakeholders to ensure that best use is made of their expertise and information in informing planning decisions; and,
- Ensuring spatial planning supports flood risk management and emergency planning.

A Risk-based Approach

4.3.3 PPS25 presents a three-tier approach to flood risk assessment at the regional, strategic and site specific levels. At the regional level this will be in the form of a Regional Flood Risk Assessment (RFRA) and at the district site level a Strategic Flood Risk Assessment (SFRA). Policies and proposals should be established on the basis of the strategic flood risk assessments.

4.3.4 PPS25 indicates that the Regional Planning Body should take flood risk into consideration when determining strategic planning considerations in the Regional Spatial Strategy (RSS). The RSS, guided by the RFRA, should identify broad locations and establish locational criteria for development in the region. This in turn will inform Strategic Flood Risk Assessments and consequently Local Development Documents at the local level.

4.3.5 Key requirements for SFRAs:

- SFRAs will refine information on the probability of flooding, taking into account all sources of flooding and the impacts of climate change. SFRAs should have regard to catchment-wide flooding issues that affect that area;
- The SFRA should provide the foundation from which to apply the Sequential and Exception Tests in the development allocation and development control process (see Flood Zones 1-3b). Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA to provide the information necessary for application of the Exception Test. Guidance on the application of the Sequential and Exception Tests is contained in Annex D to the PPS;
- SFRAs should be prepared in consultation with the EA, emergency response and drainage authority functions of the LPA and where appropriate Internal Drainage Boards;
- Development should not add to flood risk and should, where possible, reduce it. SFRAs should identify the four key Flood Zones as follows:
  - ***Flood Zone 1***: Low Probability of Flooding - Land having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%);
  - ***Flood Zone 2:*** Medium probability of Flooding - Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%);
  - ***Flood Zone 3a:*** High Probability of Flooding - Land having a greater than 1 in 100 annual probability of river flooding (>1%) or greater than a 1 in 200 annual probability of flooding from the sea (>0.5%);
  - ***Flood Zone 3b***: Functional Floodplain - Land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA.

4.3.6 Minimum requirements (set out in Annex E) for site specific flood risk assessments are that they should:

- Be proportionate to risk and appropriate to the scale, nature and location of the development;
- Consider risk of flooding to the development and risk arising from the development;
- Consider the impacts of climate change;
- Be undertaken early, by competent people;
- Consider adverse and beneficial effects of flood management infrastructure and consequences of failure;
- Consider vulnerability of those occupying the development, taking account of the Sequential and Exception Tests, the vulnerability classification and safe access arrangements;
- Ensure that assessments are fit for purpose by ensuring that different types of flooding are considered and quantified. Flooding should be considered from natural and human sources and joint cumulative effects should also be considered. Flood Risk reduction measures should be identified;

- The effects of flooding events (including extreme events) on people, property, the natural and historic environment and river and coastal processes should be considered;
- The remaining residual risk reduction measures should be included. It should be demonstrated that this is acceptable for the particular development/land use;
- The ability of water to soak into the ground may change with development and this should be considered, as should how the proposed layout of the development may affect drainage systems;
- Assessments should be supported by appropriate data and information including historical data on previous events.

4.3.7 Annex E also identifies that there may be considerable benefits in LPAs within a catchment area of high development pressure or a designated development area, joining together to undertake a sub-regional SFRA. This will assist LPAs to consider the issues raised by flooding on the wider scale, and enable them to contribute to, and take account of, the Water Framework Directive and River Basin Management Plans, which must be published by the EA by 2009. Para 2.27 of the Companion Guide to PPS 25, states that where sub-regional SFRAs are undertaken, these will provide more detailed information on the broad spatial distribution of flood risk and development and identify, within extensive areas of Flood Zone 3, where development is to be considered, and where it will be necessary to apply the Exception Test.

PPS 25 in Context

4.3.8 PPS 25 is clearly a key part of the Government's wider programme of responses to the challenge of climate change. If climate change is not stabilised (or mitigated) then it will have two impacts on flood risk. Projected sea level rises would suggest that the risk of flood defence levels being overtopped would increase. Secondly, climate change is likely to create higher rainfall in winter, and consequently increase the risk of flooding along river catchments. An increased frequency of intense rainfall events is also likely to increase the numbers of urban and flash floods, and could also mean increases in the extent of flooding from rising groundwater.

4.3.9 It is important to see Planning Policy Statement 25 Development and Flood Risk (PPS25) as part of a wider integrated approach to spatial planning. Flood risk should be considered alongside other spatial planning concerns such as the delivery of housing, economic growth, management of natural resources, regeneration and the management of other natural hazards. There are clear links to other Planning Policy Statements that may not be explicit in PPS 25, but which are necessary to achieve its objectives. The most obvious link is with the draft supplement to PPS1 'Climate Change and Sustainable Development'.

PPS1 (2005) & PPS1 Supplement "Climate Change and Sustainable Development" (December 2007)

4.3.10 PPS1 is the Government's overarching statement on the purpose of the planning system, and which identifies sustainability as a key tenet of policy formulation. Paragraph 3 of the PPS makes clear that 'sustainable development is the core principle underpinning planning'.

4.3.11 The PPS 1 Supplement on Climate Change sets out important objectives in order to tackle climate change, sea level rise and to avoid flood risk. The purpose of design policies should, it states, be to ensure that developments are sustainable, durable and adaptable to natural hazards such as flooding.

PPS3 Housing (November 2006)

4.3.12 PPS3 Housing sets out the Government's broad policy objectives for planning for housing and those policies it considers will help to realise those objectives, including the efficient use of land, variety of household types and supply, affordability and designing for quality. Via the consideration of climate change and flood risk, PPS3 aims to deliver housing policies that seek to minimise environmental impact.

4.3.13 PPS25 strongly supports the strategy for housing set out in PPS3. In meeting the objective of increasing housing supply the assessment of flood risk is crucial. Via the incorporation of local flood mitigation measures such as Sustainable Urban Drainage Systems and good quality design and site layout, it is possible to build safely and to manage flood risk.

PPS7 Sustainable Development in Rural Areas (July 2004)

4.3.14 PPS7 sets out the Government's planning policies for rural areas, with the protection and enhancement of the natural and historic environment, the quality and character of the countryside and existing communities all being of crucial importance. The PPS states that any development in rural areas should consider flood risk at all stages of the planning process in order to reduce future damage.

PPS9 Biodiversity and Geological Conservation (August 2005)

4.3.15 The Government's planning policies on the protection of biodiversity and geological conservation via the planning system are outlined in PPS9. Crucially, many protected sites fall within Flood Zones. There is also an imperative to consider the impact of removing woodland both upon carbon sinks and on flooding.

4.3.16 The PPS emphasises that development plan policies and planning decisions should be based on up to date information about the environmental characteristics of an area and that the avoidance of significant harm to features of biodiversity and geological interest should be prevented or, if unavoidable, counteracted through suitable mitigation and compensation measures. Inability to mitigate or compensate for significant harm should result in applications being refused.

4.3.17 Changes in farming practices and land management may lead to areas of set aside that have increased capacity for biodiversity and flood storage. At the same time pressure to develop some greenfield sites may lead to the loss of higher grade more versatile and more productive agricultural land and the consequent increased pressure to utilise presently less productive or versatile land.

PPS10 Planning for Sustainable Waste Management (September 2005)

4.3.18 PPS10 states that in deciding which sites and areas to identify for waste management facilities, waste planning authorities should assess their suitability for development against:

- the physical and environmental constraints on development, including existing and proposed neighbouring land uses;
- the cumulative effect of previous waste disposal facilities on the well-being of the local community, including any significant adverse impacts on environmental quality and social cohesion.

PPS11 Regional Spatial Strategies (September 2004)

4.3.19 PPS11 sets out the Government's policy on the preparation of Regional Spatial Strategies – what they should cover and how they should be prepared and revised. The RSS should articulate a spatial vision of what the region will look like by the end date of the strategy, and how it will contribute to achieving sustainable development objectives. The RSS must, importantly for flood risk, address regional or sub-regional issues that cross local authority boundaries, working in consultation with LPAs and other stakeholders to identify the circumstances in which a sub-regional approach should be applied. Annex 4 of PPS11 sets out the policies and guidance that should be considered and covered by the RSS, including climate change, water, and the requirements of PPS25.

PPS 12 – Local Spatial Planning (Adopted June 2008)

4.3.20 This national policy statement replaces PPS 12: Local Development Frameworks (2004) and the companion guide Creating LDFs (2004).

4.3.21 PPS12 sets out the Government's policy on the preparation of local development documents, which together comprise the Local Development Framework. Key issues include the consideration of climate change, the need to identify local areas at risk from flooding and to highlight the geographical location of such areas on the adopted proposals map. The preparation of all local development documents must be informed by a Sustainability Appraisal. Gathering information on flood risk is an important element of assembling the baseline information for these assessments.

4.3.22 Finally, PPS12 states that LPAs should publish proposals maps which should:

- identify areas of protection (locally and nationally designated) and Green Belt land;
- show areas at risk of flooding; and,
- allocate sites for particular land use development proposals included in any adopted development plan documents.

4.3.23 A Core Output Indicator which must be reported on in the Annual Monitoring Report is the number of planning permissions granted contrary to the advice of the EA.

4.3.24 In addition it states that district planning authorities should include on their adopted proposals maps, minerals and waste matters including safeguarding areas and any minerals and waste allocation which are adopted in a development plan by the county council.

MPS1 Planning and Minerals (November 2006)

4.3.25 MPS1 states in paragraph 9 that the Government's objectives are to secure working practices which prevent or reduce as far as possible, impacts on the environment and human health arising from the extraction, processing, management or transportation of minerals.

4.3.26 Paragraph 15 adds that local authorities should identify sites and preferred areas having taken account of environmental considerations to provide greater certainty of where future sustainable mineral working will take place. In addition, its states that local authorities should consider the benefits, in terms of reduced environmental disturbance and more efficient use of mineral resources including full recovery of minerals, of extensions to existing mineral workings rather than new sites.

4.3.27 Paragraph 17 states that local authorities should ensure, in association with the EA, that in areas at risk of flooding, mineral extraction proposals do not have a significant adverse impact on flood flows or flood storage capacity. In addition, it states that operators should demonstrate that mineral working should not materially increase the risk of flooding at other properties or locations and, where practicable, should increase flood storage capacity.

4.4 Regional Policy

4.4.1 The South East England Regional Assembly prepared a draft Regional Spatial Strategy between 2003 and 2006, and submitted this draft to Government on 31st March 2006. A period of public consultation drew over 7,000 responses from over 350 separate individuals and organisations.

4.4.2 The submission draft RSS was subject to an Examination in Public (EiP) by a Panel of Independent Inspectors between November 2006 and March 2007, and the Panel Report following the EiP, recommended a series of modifications

4.4.3 Following receipt of the Panel's report on 6th August 2007, the Government is now in the process of finalising the RSS, taking into account the views of the Panel and other representations made.

4.4.4 The Secretary of State published Proposed Changes to the draft Regional Spatial Strategy on 17 July 2008. Consultation on the changes ended on 24 October 2008. The Secretary of State will now be considering all responses and hope to publish the final version of the South East Plan in 2009.

Submitted Draft Regional Spatial Strategy for the South East of England

4.4.5 The following summarises the Draft Regional Spatial Strategy policies as they relate to flood risk. It incorporates an assessment of the Panel's concerns and recommendations for amendments to Section D Sustainable Natural Resource Management, and subsequently the Proposed Changes indicated by the Secretary of State. The implications for the Strategic Flood Risk Assessment are also addressed below.

Flood Risk

4.4.6 The Draft RSS states that flood risk management is of increased importance due to development in flood plains, changing patterns of rainfall, extreme weather, storms and rising sea levels accelerated by climate change, and that these factors will increase the probability and incidence of flooding of property and land.

4.4.7 Proposed changes to the Draft RSS identify Sustainable Natural Resource Management to be a key theme through the Plan. Consequently, for simplicity, and in order to strengthen and to emphasis the correlation with the Cross Cutting Issues Policies, a summary table is incorporated (BOX NRM1) that identifies Key Regional Environmental Challenges (listed in part 2 of Section D), the Issues Arising, Policy Response and the Relevant Policies.

4.4.8 The need for a Twin Track approach to water management, that is the need to manage demand whilst improving capacity, is recognised. In particular the Panel considered that the components of managing demand for water resources should be expressed more clearly. This general view is supported in Proposed Changes and impacts on the policy NRM 1 of the Draft RSS. Water

resource management and water quality have been separated out with the introduction of a new policy NRM2 and the supporting text expanded to clarify the scope of demand management.

4.4.9 Policy NRM 1 is modified to remove mention of water quality management and standards as this will be a matter for national regulation and guidance, and to avoid any regional variance. Policy NRM 1, directs local authorities, in the preparation of Local Development Documents and in determining planning applications to emphasise the twin tracked approach of demand management and water resource development. It states:

4.4.10 Water supply and ground water will be maintained and enhanced through avoiding adverse effects of development on the water environment. A twin-track approach of demand management and water resource development will be pursued.

4.4.11 In preparing Local Development Documents, and determining planning applications, local authorities will:

- ensure compatibility with River Basin Management Plans and take account of other plans and strategies including water company asset management plans, the Environment Agency's Regional Water Resources Strategy and Catchment Abstraction Management Strategies, groundwater vulnerability maps and groundwater source protection zone maps;
- identify any circumstances under which new development will need to be supported by water efficiency standards exceeding extant Building Regulations standards
- set out the circumstances under which sustainable drainage solutions should be incorporated into new development;
- encourage winter water storage reservoirs and other sustainable land management practices which reduce summer abstraction, diffuse pollution and runoff, increase flood storage capacity and benefit wildlife and recreation;
- direct new development to areas where adequate water supply can be guaranteed from existing and potential water supply infrastructure. Where this is not possible, development should be phased so that sustainable new capacity can be provided ahead of new development.

4.4.12 Policy NRM 1 and NRM 2 are grouped together with shared supporting text. Policy NRM 2 actualises the Panels recommendations to create a new policy on water quality as distinct from water management and states:-

- Water quality will be maintained and enhanced through avoiding adverse effects of development on the water environment. In preparing Local Development Documents, and determining planning applications, local authorities should:
  - Take account of water cycle studies, groundwater vulnerability maps and groundwater source protection zone maps prepared by the Environment Agency, and water and sewerage company asset management plans;
  - Ensure that the rate and location of development does not lead to an unacceptable deterioration of water quality, and not permit development that presents a risk of pollution or where satisfactory pollution prevention measures are not provided in areas of high groundwater vulnerability (in consultation with the Environment Agency and Natural England) Local authorities will work with water and sewerage companies and the Environment Agency to:
    - Identify infrastructure needs, allocate areas and safeguard these for infrastructure development;

  - Ensure that adequate wastewater and sewerage capacity is provided to meet planned demand; and,
  - Take full account of the cumulative impacts of wastewater discharges on groundwater, inland and marine receiving waters;

- Local authorities should promote land management initiatives to reduce diffuse agricultural pollution;
- Sustainable Flood Risk Management was formerly treated under policy NRM3, now Policy NRM4 within the Proposed Changes. The Panel Report is broadly supportive the Draft RSS in terms of its proposed policies and approach to flood risk. However, it does suggests this be more fully reflective of the advice and priorities within PPS25 (including expanding on the role of SFRAs) that was published during the time of the EiP. This is achieved through changes in syntax and phrasing and amendments to the supporting text;

4.4.13 The Draft RSS suggests that there are over 208,000 properties in the South East that are at risk of fluvial and tidal flooding. The Draft RSS asserts the probability and impacts of flooding can be reduced through:

- Applying the sequential test set out in PPS25;
- Ensuring that an appropriate SFRA is carried out for development on plan allocations in Flood Zones 2 and 3. This includes those areas benefiting defences of an appropriate standard;
- The SFRA should also address impacts of climate change and the policies of Catchment Flood Management Plans (CFMP) and avoid foreclosing options for realignment and management of defences to reinstate natural floodplains;
- Ensuring development does not worsen flooding in its surroundings through use of appropriate SuDs to help reduce the likelihood of flooding and pollution by controlling surface water run-off. Proposals must include an agreement on the future management and replacement of these structures;
- Encouraging positive flood risk management by changing farming and forestry practices.

4.4.14 Catchment Flood Management Plans (CFMPs) for the South East will be produced by the EA and provide long-term policies which take a whole river catchment approach to flood risk management. These are to be reflected in Local Development Documents.

4.4.15 Sequential approach to development in flood risk areas, as set out in PPS25 are addressed within the policy. It provides that inappropriate development should not be allocated or permitted in flood zones 2 and 3 of the floodplains or areas with a history of groundwater flooding.

4.4.16 Where development is proposed for parts of zones 2 and 3, local authorities (in the case of plan allocations) and developers with advice from the EA should undertake a SFRA to provide a comprehensive understanding of the flood risk and options for managing that risk in a cost effective manner.

4.4.17 Existing flood defences will be protected from development and where development is permitted in appropriately defended floodplains it must be designed to be resilient to flooding and to allow for the future maintenance, realignment or management of the defences to be undertaken.

4.4.18 In preparing LDD and the determination of planning application, local authorities should require the incorporation SuDS and other attenuation measures and take account of increased surface water drainage and sewerage effluent flows on fluvial flood risk.

Thames Catchment Flood Management Plan (CFMP)

4.4.19 A CFMP is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The EA engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change.

4.4.20 The future approach to flood risk management in Cherwell and West Oxfordshire Districts is outlined in the Thames Region CFMP, a summary of which was published in July 2008.

4.4.21 The Thames CFMP covers the whole of the EA's Thames Region which has very varied catchments. For this reason, the CFMP has been further divided into 43 policy units for each catchment. Cherwell and West Oxfordshire fall into the 'Upper Thames' policy unit which is included in Appendix E.

4.4.22 The EAs flood risk management approach in the Cherwell and West Oxfordshire Area includes the following aims:

- Maintaining (and in some places enhancing) the capacity of the natural floodplain to retain water, combined with maintaining conveyance of watercourses in urban areas reduces the risk of flooding and has benefits for the natural environment;
- To safeguard the natural floodplain from inappropriate development. The EA deem the floodplain to be their most important asset in terms of flood risk;
- Managing the consequence of flooding through making buildings and communities more resilient and by taking effective action at times of flooding.

4.4.23 The CFMP should also inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive, so that future development in the catchment is sustainable in terms of flood risk. Awareness of the role of CFMPs among land-use planners is in its infancy as these plans, along with SFRAs, are a relatively new requirement.

Town and Country Planning Association (TCPA)

4.4.24 TCPA have produced policy guidance for climate change and the development of sustainable communities. The documents provide a framework for providing guidance from a catchment to local levels including managing flood risks.

4.4.25 TCPA state that the most effective way to manage future flood risks is to reduce exposure. This involves assessing risk over the life of a development and locating and designing developments accordingly.

- *Catchment scale* – at a catchment scale the most significant risks will be from tidal and river flooding. TCPA suggest that green spaces and built spaces should be integrated with flood management strategies to include climate change and highlight opportunites to reduce flood risk wherever possible;

- *Neighbourhood scale* – a focus on understanding and managing flood pathways and protecting areas at risk should be made. Adaptations should be designed to improve water quality and resource management and enhance public spaces;
- *Building scale* – at a building scale designs should be made to minimise exposure and incorporate structural solutions to reduce vulnerability. This should include assessments of climate change and make sure that flood risks in adjacent areas are not exacerbated.

Figure 4-2 below illustrates the potential strategies for managing flood risks that the TCPA document outlines.

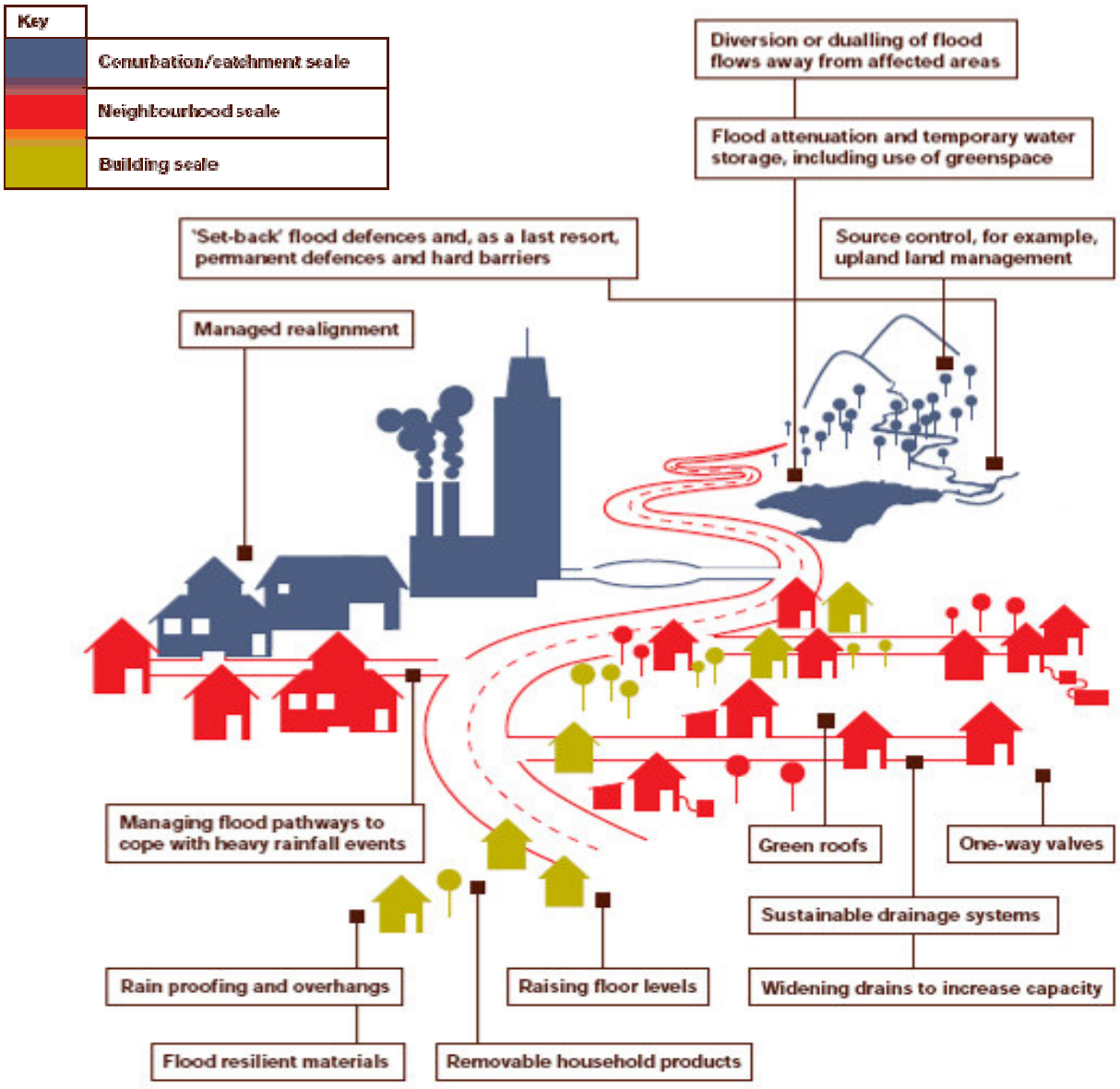

Figure 4-2: Menu of Strategies for Managing Flood Risks (as defined in TCPA "Climate Change Adaptation by Design" p25)

Climate Change

4.4.26 Policy CC2 of the Draft RSS sets out the key guidance relating to climate change and in particular states that adaptation to risk and opportunities will be achieved through, a number of means, including:

- Incorporating sustainable drainage measures and high standards of water efficiency in new and existing building stock;
- Increasing flood storage capacity and developing sustainable new water resources;
- Ensuring that opportunities and options for sustainable flood management are not foreclosed.

4.4.27 The Panel Report is widely supportive of the inclusion of a climate change policy but has not made any further recommendations on the policy to date.

4.5 Adopted Local Development Plans

Oxfordshire Structure Plan

4.5.1 The Oxfordshire Structure Plan 2016, adopted in October 2005, provides County-wide guidance to the five local authorities in Oxfordshire, including Cherwell and West Oxfordshire. Application has been made to the Secretary of State to save policies from the Plan pending adoption of the RSS.

4.5.2 A flood risk assessment will be required for proposals for development except where there is little or no flood risk. It further states that proposals for redevelopment of existing buildings and their curtilage within areas of high flood risk should aim to improve conditions locally and not worsen flood risk elsewhere.

4.5.3 Policy EN10 also adds that development will be permitted only where adequate water resources and waste water infrastructure for the development already exist or can readily be provided without risk to existing abstractions, water quality, water environment or nature conservation.

Oxfordshire Minerals and Waste Local Plan

4.5.4 The Oxfordshire Minerals and Waste Local Plan was adopted in 1996 and was initially due to cover the period up until 2006. It is now due for replacement by the forthcoming LDF. However, under the Planning and Compulsory Purchase Act 2004, the Council applied to extend some of the policies in the Minerals and Waste Local Plan beyond September 2007 to avoid a gap in planning policy on minerals and waste in Oxfordshire resulting from a delay to the LDF.

4.5.5 Forty-six policies were saved under a direction by the Secretary of State, of which the following are of relevance to the SFRA study.

4.5.6 PE4 states that proposals for mineral extraction and restoration (including waste disposal) will not be permitted where they would have an impact on groundwater levels in the surrounding area which would harm existing water abstraction, river flow, canal, lake or pond levels or important natural habitats. It adds that proposals must not put at risk the quality of groundwater.

PE7 further adds that proposals for mineral extraction and restoration in the floodplain should not result in the raising of existing ground levels. Mineral extraction or restoration by landfill should not adversely affect groundwater levels or water quality, impede flood flows, reduce the capacity of flood storage or adversely affect existing flood defence structures. It goes on to states that the developer and/or landowner will be expected to undertake any hydrological surveys necessary to establish the implications of a proposal.

4.5.7 W3 (d) states that waste development proposals for re-use/recycling will normally be permitted provided that the proposal will not pose an unacceptable risk to the water environment.

4.5.8 W7 (j) states that Proposals for waste sites must meet with the hydrological and geological requirements for safe disposal of the particular waste concerned.

4.5.9 The Oxfordshire Minerals and Waste Local Plan (1996) identifies only one site for waste management development. This is land at Langford Lane, Kidlington, identified for a waste reception centre (waste recycling centre) for household waste. No proposal to develop this site has come forward, but the policy for this site is one of those that have been 'saved'.

4.5.10 The Oxfordshire Minerals and Waste Local Plan (1996) identified areas for sand and gravel working to meet the expected requirement over the period to 2006 plus a contingency allowance of 6.6 million tonnes. Of the areas identified for future working, only approximately 1 million tonnes of sand and gravel resource remains without planning permission, within small areas at Sutton Wick, Cassington – Yarnton and in the Lower Windrush Valley.

Cherwell Local Plan

4.5.11 Development guidance for Cherwell District is provided by the Non-Statutory Cherwell Local Plan 2011. This document was approved as interim planning policy in December 2004 following the Council's decision to discontinue work on the draft Cherwell Local Plan 2011. The policies and proposals do not have statutory development plan status, but are accepted as an important material consideration alongside other relevant considerations in deciding planning applications. Policies relating to flooding contained in the previously adopted 1996 Cherwell Local Plan are no longer saved.

4.5.12 The Cherwell Local Plan will be replaced following completion of the LDF process.

4.5.13 Policy EN14 of the Non-Statutory Local Plan states that areas at risk from flooding, new development or land raising will not be permitted if the proposals would:

- Result in a net loss of flood plain storage;
- Impede the flow of flood water; or,
- Increase the risk of flooding elsewhere.

4.5.14 The Non-Statutory Local Plan states the Flood Risk Assessments, appropriate to the scale and nature of the development proposed, should be submitted to accompany planning applications in flood risk areas. The Local Plan also states that in addition to the risk of flooding to the proposed development itself, development in such locations may increase the risk of flooding elsewhere by reducing the storage capacity of the floodplain and/or by impeding the flow of floodwater.

4.5.15 Consequently the Local Plan adds that the Council will not normally permit development in such locations, while redevelopment of existing sites will only be considered where the Council, in consultation with the EA, is satisfied that the developer will provide appropriate mitigation measures.

4.5.16 Policy EN15 requires that new development generating increased surface water run-off likely to result in an adverse impact to surface drains and watercourses, such as an increased risk of flooding, river channel instability or damage to habitats, will not be permitted unless the proposals include appropriate source control and / or attenuation measures. Developers will be expected to cover the costs of assessing the impact of development on run-off generation and of any appropriate mitigation works, including long term management.

West Oxfordshire Local Plan

4.5.17 Development in West Oxfordshire is guided by the West Oxfordshire Local Plan 2011 (Adopted 2006).

4.5.18 Relevant policies include NE7 which states that development should not have an adverse impact on the water environment and encourages initiatives which seek to restore or enhance the natural elements of the environment. Policy NE8 adds that new development or intensification of existing development will not be permitted within areas at risk from flooding which is likely to:

- Impede the flow of water;
- Result in the net loss of flood plain storage; or,
- Increase the risk of flooding elsewhere.

4.5.19 Policy NE8 further states that, within areas at risk of flooding, an appropriate Flood Risk Assessment must be undertaken when preparing development proposals. Flood Plains within the District are indicated in Figure 3.7 of the West Oxfordshire Local Plan 2011.

4.5.20 Policy NE9 states that new development or intensification of existing development will not be permitted where the additional surface water run-off would result in adverse impacts such as an increased risk of flooding unless appropriate attenuation and pollution control measures are provided.

4.5.21 The West Oxfordshire Design Guide was adopted as a Supplementary Planning Document in September 2006 and contains guidance on sustainable building including flooding related issues.

4.6 Local Development Schemes for the Emerging LDFs

4.6.1 In order to understand how the SFRA will feed into the LDF for each council, it is helpful to highlight the individual Council LDF programmes – known as the Local Development Scheme (LDS). As the SFRA directly informs aspects of the LDF process in each authority, in particular land allocation and the assessment of development proposals, it is important that the consequences of the SFRA can be considered thereby providing the robust evidence base necessary to assess proposals.

Oxfordshire County Council

4.6.2 In February 2007 the Preferred Options consultation document for the Minerals and Waste Core Strategy DPD was published and consultation has since finished. Responses to the consultation have confirmed that changes will be required.

4.6.3 In April 2007 the County Council produced an Issues and Options Consultation document for the Minerals Site Proposals and Policies DPD which included a significant number of possible sites for future mineral extraction and secondary aggregate production. A preferred options consultation was expected to commence in the summer of 2008, but this timetable is being revised. Further consultation on this document cannot take place until there has been a revised preferred options consultation on the Core Strategy, which will almost certainly need to give consideration to the question of strategic site allocations.

4.6.4 Issues and Options consultation for the Waste Site Proposals and Policies DPD took place during February 2007 and this document also included a significant number of possible sites – for waste management purposes. A Preferred Options consultation was also expected to take place in the summer of 2008 but this too will need to await revised consultation on the Core Strategy, particularly as the issue of strategic waste sites is also likely to be raised in the context of this document.

4.6.5 Discussion is currently taking place with GOSE on revisions to the Minerals and Waste LDS as a result of changes to the plan making system recently introduced by the Government. These discussions should also establish a revised timetable for consultation on revised proposals for the Core Strategy to take account of comments made on the Core Strategy Preferred Options Consultation Paper in February 2007. It is also likely that the Core Strategy will make strategic site allocations for both minerals and waste and that the Sites' Development Plan Documents may no longer be required.

Cherwell

4.6.6 A Core Strategy Issues and Options Paper was published in 2006. An Options for Growth Paper on directions of growth and strategic sites at Banbury and Bicester was published for consultation in September 2008. Issues and Options Papers containing possible site allocations for Banbury and North Cherwell, and Bicester and Central Oxfordshire have also been consulted on.

4.6.7 The Core Strategy DPD, which will include strategic site allocations and planning policies for the local authority, is expected to be adopted mid 2010. The Delivery DPD (containing non-strategic site allocations and development control policies) is expected to be adopted in September 2011. However, the LDF programme is currently being reviewed.

West Oxfordshire

4.6.8 The West Oxfordshire Local Plan was published relatively recently (2006) and the LDF is not at an advanced stage. However, Issues and Options consultation took place during March/ May 2008 for both the Core Strategy and Site Allocations DPD's, with subsequent consultation on additional sites suggested to the Council (in July/August). The LDF programme is currently being reviewed in the light of evidence to date and in response to the latest PPS12 published by the Government in June 2008.

4.7 Development Pressures in Cherwell and West Oxfordshire Districts

4.7.1 The following section indicates targets for growth and change as identified in the current and emerging RSS and Local Development Plans.

Regional Spatial Strategy Targets for Growth

Employment

4.7.2 The Panel Report states that there is surprisingly little quantification of the amount of new employment space that might be required within the draft South East Plan despite a good practice guidance that employment land forecasts should be prepared by RPBs. The Panel Report also adds that, whilst understanding the Assembly's fear about identifying new strategic employment sites, that some strategic context should be drawn together from the sub-regional strategies. Therefore Recommendations 6.1 and 6.2 of the Panel Report states the policy RE2 should be amended to strengthen the guidance on the criteria for identifying the location new employment land. In addition, it states that a table should be included showing a job and employment floor space estimate for each sub-region and the remainder of the region.

4.7.3 The Secretary of State agrees with the Panel on the importance of including quantitative guidance on employment in the RSS and notes inconsistencies in the approaches underpinning these job forecasts, and in particular the Panels reservation about the supply constrained aspects of these forecasts. The lack of robustness in these figures and, in particular, the lack of a consistent approach to these job numbers has lead the Secretary of State to take the view that these figures can only be presented as interim numbers /guide figures. Her view is also influenced by the decision to propose an early review on employment land provision to incorporate the Panel's recommendation.

4.7.4 Furthermore, whilst the South East RSS is expected to supersede the Oxfordshire Structure Plan 2001-2016 (Adopted October 2005) once it is published, the guidance provided by this development plan is still valid until then and has already informed other existing and some future development documents in both Cherwell and West Oxfordshire local authorities.

Housing

4.7.5 The draft South East Plan proposes a 578,080 net increase in dwellings in the period 2006-2026 across the region. This equates to 28,900 dwellings per annum and includes 590 per year in Cherwell and 335 in West Oxfordshire – totalling 11,800 and 6,700 respectively over the Plan period.

4.7.6 It also states that at least 60% of these should be on previously developed land.

4.7.7 At the time of the Examination in Public (EiP) the Government's national objective was to increase the net number of homes additionally by 200,000 per annum. Therefore the Panel Report concludes that the draft Plan's housing provision figures are too low, particularly as a result of economic factors having been given insufficient weight. It also states that too much weight has been given to the setting of Oxford and the Green Belt.

4.7.8 The Central Oxfordshire sub-region's proposed annual dwelling provision in the draft South East Plan is considered in the Panel Report to be too low at 1,700 dwellings per annum and they recommend adding 305 extra homes to this figure. In addition, the Panel Report recommends increasing the annual net dwellings in the rest of Oxfordshire from 660 to 725.

4.7.9 Broken down by local authority, the Draft South East Plan recommends Cherwell's annual new home provision to increase from 590 to 640 and for West Oxfordshire to increase from 335 to 365 dwellings.

4.7.10 Whilst the Secretary of State agrees in principle on the need to increase the regional housing provision above the 28,000 dwellings per annum proposed within the Draft South-East Plan, but is mindful that the 32,000 dpa proposed by the panel as being 'right at the bottom end' of what the analysis of strategic factors would suggest. Based on a reassessment of strategic factors the Secretary of State proposes and increase in strategic housing provision of 33,125 dpa.

4.7.11 Based upon this reassessment the Draft South East Plan recommends Cherwell's annual new home provision to increase from 590 to 670, however West Oxfordshire increase would remain 335 to 365 dwellings as recommended by the Panel.

Minerals & Waste

4.7.12 The Government published new guidelines for aggregates provision in June 2003. Based on these, RPG9 (policy M3) says Oxfordshire should make provision for the supply of 1.82 million tonnes a year of sand and gravel and 1.0 million tonnes a year of crushed rock from local land-won sources over the mineral plan period.

4.7.13 However, the department for Communities and Local Government (DGLG) has recently consulted on draft revised national and regional guidelines for sand and gravel for the period 2005 – 2020, and this may affect the provisions to be made for the resource in the Minerals and Waste Framework (MWFD). Monitoring for 2007 has indicated a modest decline in forecast national demand for aggregates between 2005 and 2020, with a more pronounced decline in some regions – particularly in the south east. Consequently, a reduced regional guideline figure for the South East has been proposed by DCLG.

4.7.14 At the same time, the South East Regional Assembly (SEERA) is carrying out a review of the sub-regional apportionment for land-won aggregates through a partial review of RPG9 and the emerging South East Plan. The consultation seeks to identify a different methodology for calculating the sub-regional appointment. Consultation has been carried out on options based on demand, on environmental constraints and on a combination of demand and natural resources. Oxfordshire's appointment would be likely to increase significantly under the latter two options due to the presence of relatively large areas of river terrace gravels in areas that are relatively unconstrained by national environmental designations.

4.7.15 It is therefore possible that, despite the likelihood of a slight reduction on the south east in the DCLG's guidelines for the national apportionment, Oxfordshire's sub-regional apportionment will actually increase. Any change in the Oxfordshire apportionment will need to be considered in the MWDF.

Oxfordshire Structure Plan Targets for Growth

4.7.16 The South East RSS will supersede most of the policies of the Oxfordshire Structure Plan when it is finally adopted by the SoS. In the interim, the Structure Plan's saved policies are still relevant and some may continue to inform the preparation of local development frameworks for a period after the adoption of the RSS.

Employment

4.7.17 The Structure Plan states that development for employment uses will be expected to take place primarily on previously developed land or in conjunction with redevelopment schemes for mixed uses incorporating housing. Banbury, Bicester, Didcot and Witney are the main centres proposed for provision of employment land, where despite land being available for employment, new provision through new allocations may be required.

Housing

4.7.18 The Structure Plan states that between April 2001 and March 2016, provision for approximately 37,300 additional dwellings (net) should be made across Oxfordshire, with 9,350 in Cherwell and 6,800 in West Oxfordshire. This equates to an annual net additional provision of approximately 623 and 453 respectively.

4.7.19 The Structure Plan states that the main locations for new housing in the county over the Plan period should be within Oxford (6,500 dwellings), Banbury (3,700 dwellings), Bicester (3,300 dwellings) Didcot (4,500 dwellings), Witney (3,000 dwellings) and Grove (2,100 dwellings).

Cherwell Targets for Growth

Employment

4.7.20 The vast majority of the employment land allocations are located in and around Banbury and Bicester, much of this has been distribution and warehousing facilities in recent years. Since 2005, 67% of the business floorspace constructed has been in Bicester.

Housing

4.7.21 For the years 2004-2007, CDC exceeded its housing provision targets as set out by the Oxfordshire Structure Plan where an average of 623 dwellings per annum are required. Average completions over the past eleven years has been 633 dwellings per annum.

4.7.22 Since April 2001 when the Oxfordshire Structure Plan came into effect the total net dwelling completions in the local authority has been 3975 which is marginally above the requirement set out in the Structure Plan. Future housing development is expected mainly in Banbury, Bicester and Upper Heyford (1000 dwellings).

West Oxfordshire Targets for Growth

Employment

4.7.23 A major part of West Oxfordshire's economic policy has been to concentrate new business development within the larger service centres of Witney, Carterton and Chipping Norton and with only small scale development elsewhere. There are no official target figures but in

2006/2007 over 80% of new business floor space was constructed on allocated Greenfield land at Witney.

Housing

4.7.24 Dwelling provision is on target and even slightly exceeding the Oxfordshire Structure Plan targets with the 2006/7 net dwelling construction over 80% above that required annually (450/year) at 810 dwellings. However this figure is expected to reduce and stabilise over the coming years. In the first six years of the Structure Plan period 2001-2007, 3580 dwellings were constructed in the local authority leaving about 3200 homes to be built by 2016 (although this figure may change on adoption of the South East RSS that will supersede that Structure Plan). Of these, approximately half are projected to be built in Witney with the bulk of the rest being built in Carterton, Chipping Norton, Eynsham and Woodstock.

OCC – Current Waste Management Situation

4.7.25 According to the OCC AMR, Oxfordshire manages approximately 2.0 million tonnes of waste each year, of this, 42% is construction and demolition waste, 43% is commercial and industrial waste and 15% is municipal waste. Most construction and demolition waste is recycled (36%) or recovered (32%) (mainly for use in restoration of mineral workings and landfills, land improvement and engineering works), and about 32% is disposed to landfill. About 32% of commercial and industrial waste is recycled, with 47% being disposed to landfill and a further 21% being treated some other way. Of just over 320,000 tonnes of municipal waste produced in Oxfordshire in 2006/07, about 37% was recycled (25%) or composted (12%), with 63% being disposed, almost all by landfill. For household waste only, the rate of recycling or composting in 2006/07 increased to 38.56%, an increase of 5.20% from 2005/06 and exceeding the 38% Local Area Agreement target for March 2009.

4.7.26 In addition, Oxfordshire has for many years received waste (mainly by rail) from London, which at present does not have sufficient facilities to deal with all its own waste. To move towards a more sustainable approach to waste management will require substantial changes according to the Annual Monitoring Report 2007.

4.7.27 Planning permissions have been given for a number of new waste management facilities in the study area, and further applications continue to be submitted. In the financial year 2006-07 temporary permission for the recycling and transfer of 30,000 tonnes per annum of inert waste was approved in Oxfordshire; temporary permission for the composting of 17,000 tonnes of green waste was granted and full permission for the recycling of 3,400 tonnes of wood. Consent was also granted for a landfill facility of 500.000 cubic metres for the disposal of pulverised fuel ash.

4.7.28 It is envisaged that significant new capacity for waste treatment will be needed in order to meet regional targets for recovery, recycling and composting of waste and reduction in land filling of waste and the emerging MWDF will need to make provision for this. A waste needs assessment has been undertaken for the County by consultants ERM that partly supports this expectation, and the County Council are presently examining this.

4.7.29 The County Council advertised a contract for treatment of municipal solid waste in March 2007 and a number of companies entered the bidding process. A final decision on the award of a contract should be made in 2009 but any new facility is not likely to be operational until 2012 at the earliest. All of the participants who entered the bidding process advocated 'Energy from

Waste' (involving incineration and energy recovery) as the best solution for treating residual waste. The County Council has selected two bidders to develop detailed proposals on sites at Ardley Quarry and Sutton Courtenay landfill.

4.7.30 The County Council has also advertised a contract for food waste processing. A contract has been let and a facility should begin to operate during the financial year 2009-10.

Oxfordshire County Council – Current Minerals Situation

4.7.31 The main minerals worked in Oxfordshire are sharp sand and gravel, soft sand, limestone and ironstone, all mainly for aggregate use. Chalk, clay and fullers earth have also been worked. These minerals are worked predominantly to supply local markets, except for fullers earth which is a nationally scarce mineral. Aggregate minerals account for most of Oxfordshire's production: in 2006 the County produced 1.2 million tonnes of sand and gravel and 0.5 million tonnes of crushed rock (limestone and ironstone). These levels are significantly lower than the sub-regional apportionments for Oxfordshire included in the Regional Spatial Strategy (1.82 million tonnes per annum for sand and gravel and 1.0 million tones per annum for crushed rock).

4.7.32 Permission was granted in the year 1 April 2006 to 31 March 2007 for only 836,000 tonnes of sharp sand and gravel and 351,000 tonnes of crushed rock. The land banks of permitted reserves of soft sand and sharp sand and gravel at the end of 2006 were 1.5 and 3.4 years respectively, both being substantially below the government policy level of at least 7 years; but for crushed rock the land bank was 13.2 years, above the government policy level of at least 10 years.

Locations for the Extraction of Sand and Gravel

4.7.33 The County Council states that current land banks for both soft sand and sharp sand and gravel are substantially below the government guidance level of at least 7 years. This reflects, but may not be solely due to, the lack of remaining provision for these minerals in the development plan.

4.7.34 Over the period from 2003 to 2005 average annual production was 1.46 million tonnes of sand and gravel (including soft sand) and 0.58 million tonnes of crushed rock (limestone and ironstone).

4.7.35 The Minerals and Waste Core Strategy (Preferred Options) Consultation Paper (Feb 2007) suggested that provision for minerals should be through site specific allocations where possible or, if not, through the identification of broad areas of search. For the assessment of areas that may be suitable for sand and gravel extraction, the County Council has sub-divided the Thames Valley resource area to the west of Oxford into a number of sub-areas , and commentary on their characteristics from a flooding perspective is contained in Appendix D.

4.7.36 The previous Oxfordshire Structure Plan 2011 identified four areas: Sutton Courtenay; Sutton Wick; Stanton Harcourt (Lower Windrush Valley); and Eynsham – Cassington – Yarnton, where the principle of sharp sand and gravel working was accepted. Areas for working are no longer identified in the current Oxfordshire Structure Plan 2016. This plan instead includes a new policy (M2) which states that locations for sand and gravel working will be identified in the Minerals and Waste Development Framework Site Allocations DPD which has not yet been published.

4.7.37 Of the four former Structure Plan areas, production from Sutton Courtenay and Sutton Wick has declined and most of Oxfordshire's sharp sand and gravel production (80% in 2005) is now from the Lower Windrush Valley and Eynsham – Cassington – Yarnton areas.

4.7.38 The Minerals and Waste Consultation (Preferred Options) Consultation Paper (February 2007) suggested a strategy which included the identification of new sites, or extensions to existing sites, in West Oxfordshire. A more detailed assessment of this area was included in the Minerals Sites (Issues and Options) Consultation Paper (April 2007). Further consultation on strategy is yet to take place (see paragraph 4.6.5).

Locations for the Extraction of Aggregates and Building Stone

4.7.39 Over the period 2001 to 2005 production of crushed rock in Oxfordshire has averaged 0.74 mtpa, comprising about 60% limestone and 40% ironstone. Most of the limestone production comes from the limestone resources in the Oxford – Bicester / Ardley area and the Witney – Burford area. Limestone is also produced from the soft sand quarries near Faringdon. Both the Witney – Burford and Oxford – Bicester / Ardley areas are well located to meet needs for crushed rock arising in the central Oxfordshire area and can be accessed from strategic routes. Also, the Oxford – Bicester / Ardley area and the Witney – Burford area to the south of the A40 both lie outside the Cotswolds Area of Outstanding Natural Beauty, which covers much of the limestone resource of Oxfordshire.

4.7.40 The consultation Documents produced in connection with the Minerals and Waste Development Framework to date (see above) have suggested that any additional provision required for working limestone for aggregates are the Burford – Witney area to the south of the A40 and the limestone resource area east of the Area of Outstanding Natural Beauty (mainly east / northeast of a line from Woodstock to Chipping Norton, across the county to Ardley and Finmere).

5 The PPS25 Sequential Test

5.1 The Sequential Approach

5.1.1 The sequential approach is a simple 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 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.

5.1.2 The Sequential Test 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 5.2 definition of Flood Zones, Table 5.3 Vulnerability and Tables 7.1 and 9.1, Historic Flood Events). Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3. Additionally, within each Flood Zone development should be directed to the areas of least flood risk as identified within this SFRA.

5.1.3 PPS25 acknowledges that some areas will be at risk of flooding from flood sources other than fluvial or tidal systems. All sources of flooding must be considered when looking to locate new development. Other sources of flooding that require consideration when situating new development allocations include:

- Flooding from the Land - Surface Water;
- Flooding from Groundwater;
- Flooding from Sewers and Drains; and,
- Flooding from Manmade or Artificial Sources.

5.1.4 The LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and the EA and has applied the Sequential Test in the site allocation process. Where necessary, the LPA may also need to demonstrate the acceptability of a site through the Exception Test based on location and proposed use and vulnerability (see Appendix D of PPS25).

5.1.5 LPAs are required to identify specific deliverable and developable sites to meet their housing targets and ensure 15 years of continuous delivery post adoption. Where this cannot be achieved broad areas for future growth should be indicated. A windfall allowance should only be included where there is robust evidence of genuine local circumstances that prevent specific sites being identified.

5.1.6 Any proposed development on a windfall site will by definition differ to a site allocated in the LPAs development plan that has been sequentially tested. Therefore, the sequential test will need to be applied at the planning application stage and should be subject to the same consideration of flood risk as other development sites..

5.1.7 A flow diagram for application of the Sequential Test from the Practice Guide Companion to PPS25 is provided in Figure 5-1 overleaf.

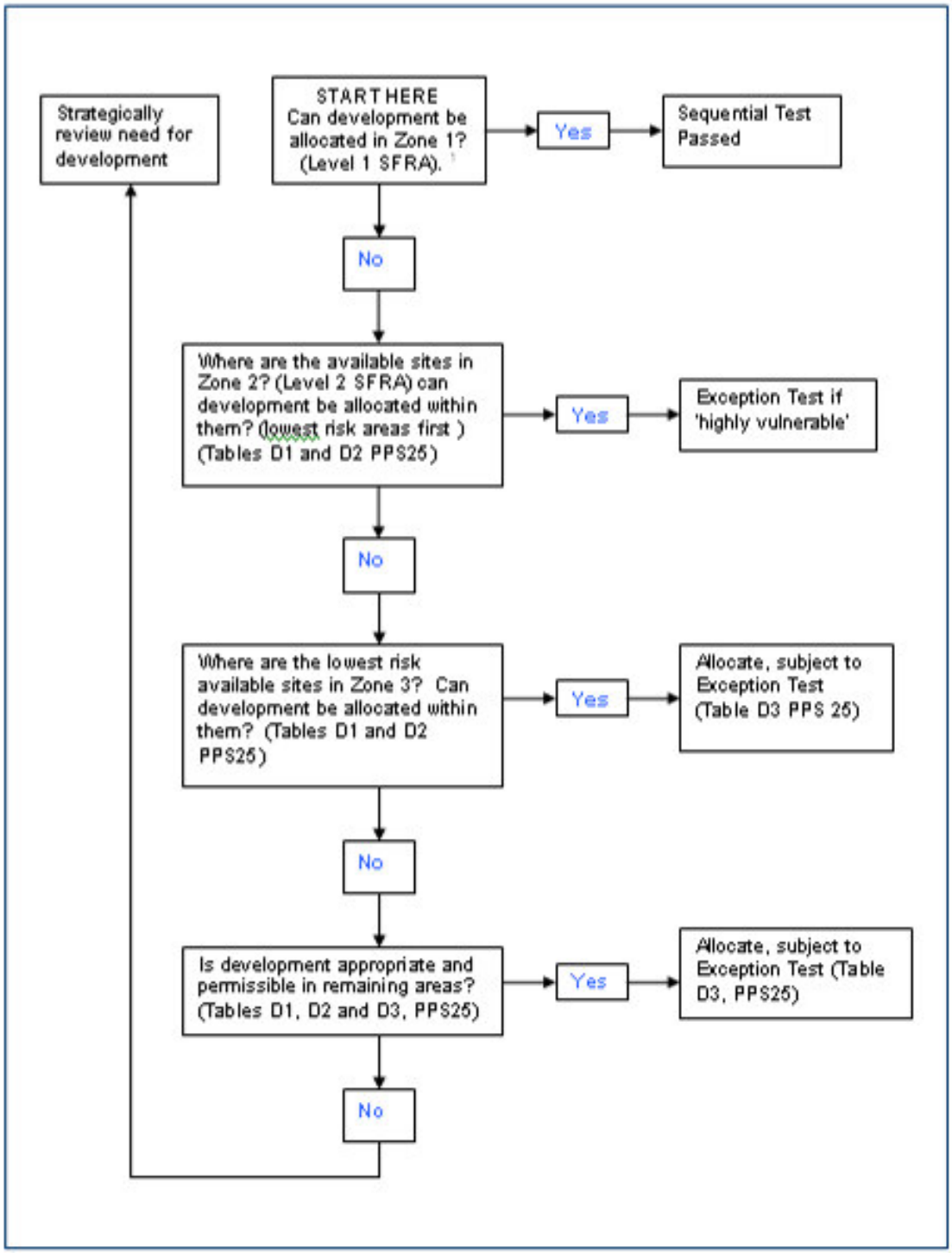

Figure 5-1: Flow diagram illustrating the application of the Sequential Test at the Local Level for LDF preparation (from PPS25 Practice Guidance – June 2008 p73)

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

5.2 Using the SFRA to Apply the Sequential Test

5.2.1 The Sequential Test should be undertaken by the LPA and accurately documented to ensure decision processes are consistent and transparent. The Sequential Test should be carried out on potential development sites, with a view to balancing the flood probability and development vulnerability of sites throughout the LPA area.

5.2.2 The recommended steps required in undertaking the Sequential Test are detailed in Section 5.1. The recommendations are based on the Flood Zone and Flood Risk Vulnerability, summarised in Table 5.2 and 5.3 below:

Table 5-2: Flood Zones as defined in Table D1, Annex D of PPS25 (full description provided in Appendix D of PPS25).

FLOOD ZONE	DEFINITION		PROBABILITY OF FLOODING
	FLUVIAL	TIDAL	
Flood Zone 1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
Flood Zone 2	Between 1 in 1000 year (< 0.1%) and 1 in 100 year (1%)	Between 1 in 1000 year (< 0.1%) and 1 in 200 year (0.5%)	Medium Probability
Flood Zone 3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
Flood Zone 3b	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Functional Floodplain

Percentages refer to the annual probability if a flood event occurring in one year

Table 5-3: Flood Risk Vulnerability and Flood Zone 'Compatibility' from PPS25, Appendix D, Table D.3 (✓ - Development is appropriate, × - Development should not be permitted)

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

5.2.3 The use of SFRA maps in the application of the Sequential Test is detailed in Sections 5.2, 5.3 and 5.4 on the following pages, to include table 5.4 which seeks to highlight what development is appropriate in each Flood Zone.

Table 5-4: Flood Risk Vulnerability and Flood Zone Compatibility
To be read in conjunction with Table 5.2 and Table 5.3 above. Table seeks to highlight what development is appropriate in Flood Zones.

Use Category	Development	FLOOD ZONE			
		1	2	3a	3b
Essential Infrastructure	Essential Transport Infrastructure, Strategic Utility Infrastructure, Electricity Generating Power Stations	✓	S ⇩ ✓	S ⇩ E ⇩ ✓	S ⇩ E ⇩ ✓
Highly Vulnerable	Police Stations, Ambulance Stations, Fire Stations, Command Centres and telecoms installations required to be operational during flooding, Emergency dispersal points, Basement dwellings, Caravans, mobile homes and park homes intended for permanent residential use, Installations requiring hazardous substances consent	✓	S ⇩ E ⇩ ✓	✗	✗
More Vulnerable	Hospitals, Residential institutions (care homes, children's homes, social services homes, prisons and hostels), Dwelling houses, Student halls of residence, Drinking establishments, Nightclubs, Hotels, Non-residential health services, Nurseries, Educational establishments, Landfill sites, 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)	✓	S ⇩ ✓	S ⇩ E ⇩ ✓	✗
Less Vulnerable	Shops, Buildings used for financial, professional and other services, Restaurants and cafes, Hot food takeaways, Offices, General Industry, Storage and distribution, Non-residential institutions (unless identified as more vulnerable), Assembly and Leisure, Land and buildings used for agriculture and forestry, Waste treatment (except landfill and hazardous waste), Minerals working and processing (except for sand and gravel workings), Water treatment plants, Sewage treatment plants (if adequate pollution control measures are in place)	✓	S ⇩ ✓	S ⇩ ✓	✗
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, 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, Essential facilities such as changing rooms, Essential ancillary sleeping or residential accommodation for staff required for water compatible development (subject to a specific warning and evacuation plan)	✓	S ⇩ ✓	S ⇩ ✓	S ⇩ ✓

✓ *: Appropriate use*

✗ *: Use should not be permitted*

S *: Use only appropriate if it passes the sequential test*

E *: Use only appropriate if it passes the exception test*

⇩ *: If passed proceed*

Note: Even where development is found to be acceptable through the application of the Sequential and Exception Tests further flood resistance/resilience may be required in the design and construction of specific developments. Such a test should be based on the SFRA.

Sequential Test: Development should be steered first towards the lowest risk areas. Only where there are no reasonably available sites should development on suitable available sites in higher risk areas be considered taking into account flood risk vulnerability and applying the Exception Test where required.

Exception Test: Exceptionally, development whose benefits outweigh the risk from flooding may be acceptable. For this test to be passed, the development should demonstrably provide wider sustainable benefits to the community, should be on developable previously-developed land (unless there are no reasonably available sites on developable previously-developed land), and should be demonstrably safe without increasing flood risk elsewhere and where possible reducing flood risk overall.

5.2.4 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 regardless of any requirement for the Exception Test. This should be discussed with the EA to establish the appropriate time for the assessment to be undertaken, (i.e. Exception Test through a Level 2 SFRA or assess through a site specific flood risk assessment).

5.2.5 The maps presented in Appendices A, B, C and D are designed to assist the Councils in determining the flood risk classification for each site and in completing the Sequential Test. This will aid the determination of the most suitable type of development for each site based on development vulnerability and flood risk. Certain sites have been identified as lying within Flood Zones 2 and 3 and, if suitable alternatives can not be found, in many cases it will be necessary to undertake the Exception Test (see table 5.4).

Using the SFRA Maps, Data and GIS Layers

5.2.6 Table 5.5 below highlights which GIS layers and SFRA data should be used in carrying out the sequential test. The table poses some example questions that are not exhaustive, but should provide some guidance for a user of the SFRA.

Table 5-5: Sequential Test Key - A Guide to using the GIS Layers

Category	GIS Layer	Example Questions
Development Vulnerability	Not applicable refer to Table D2 in PPS25	**Question 1** – Is the proposed development defined as 'highly vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 2 - Is the proposed development defined as 'more vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 3 - Is the proposed development defined as 'less vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 4 - Is the proposed development defined as 'essential infrastructure according to Table D2 in Planning Policy Statement 25?
		Question 5 - Is the proposed development defined as 'water compatible development' according to Table D2 in Planning Policy Statement 25?
Flood Zone Classification	SFRA fluvial FZ2, FZ3a & FZ3b layers. Also examine historical floodplain and take into consideration climate change outlines.	**Question 6** – Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 1?
		Question 7 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 2?
		Question 8 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 3a?
		Question 9 - Through consultation of the EA's Flood Zone maps, is the development site located in Flood Zone 3b?
		Question 10 - Can the development be located in Flood Zone 1?
		Question 11 - Can the development be located in Flood Zone 2?
		Question 12 - Can the development be located in Flood Zone 3a?
	EA main river maps.	**Question 13 -** Is the site located near a watercourse?

Table 5.5 (cont): Sequential Test Key - A Guide to using the GIS Layers (continued)

Category	GIS Layer	Example Questions
Other Flood Sources	SFRA fluvial FZ3 & FZ2 outlines plus climate change	**Question 14 –** Is the site impacted by the effects of climate change
	Sewer Flood & Layer Historical Flood Outlines	**Question 15** - Is the site in an area potentially at risk from sewer flooding?
	Historical Flood data, Outlines, Parish Council groundwater vulnerability maps	**Question 16** - Is the site in an area potentially at risk from overland flow flooding?
		Question 17 - Is the site located in an area of rising groundwater levels?
		Question 18 - Does the site have a history of flooding from any other source?
Flood Risk Management	Flood Defence Layer (NFCDD), Flood Warning Layer, Areas Benefiting from Flood Defences Layer, Parish Council data	**Question 19** - Does the site benefit from flood risk management measures?
		Question 20 - Can the development be relocated to an area benefiting from flood risk management measures or of lower flood risk?

5.2.7 As identified in Section 3, some watercourses in the study area do not have Flood Zones associated with them or do not have all Flood Zones defined. This is not to suggest these watercourses do not flood, moreover that modelled data is not currently available. Therefore, allocations adjacent to un-modelled watercourses or watercourses where all Flood Zones have not been defined cannot be assessed against all aspects of the Sequential Test using the existing data.

5.2.8 To overcome this deficiency in the data and to enable the Councils to proceed with application of the Sequential test the following criteria should be considered:

- For watercourses where no Flood Zones have been defined – If a site is within 8m of a watercourse and promoted for development further investigation should be undertaken to determine the suitability of the site for the proposed development. For application of the Sequential Test the site should be considered as lying within Flood Zone 3a until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the policies presented in PPS25;
- For watercourses where Flood Zone 3b (functional floodplain) has not been defined – If a proposed development site is located in Flood Zone 3, there is a possibility it may also fall within Flood Zone 3b. Further investigation should be undertaken to define Flood Zone 3b for the local water course(s). According to the PPS25 Practice Guide Companion when applying the Sequential Test the site should be considered as lying within Flood Zone 3b until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in PPS25;
- For watercourses where the effect of climate change on Flood Zones has not been defined – For any development located in or adjacent to a Flood Zone boundary, there is a possibility that when considering the effects of climate change the site may be at greater flood risk. For example if a site is clearly identified to be in Flood Zone 3a (and not within 3b), when the effects of climate change are considered the site may be found to lie within Flood Zone 3b. For application of the Sequential test, for sites located in Flood Zone 3 or at the boundary of Flood Zone 2 and 3, where the effects of climate change are not defined, the sites can be considered to lie within the higher risk Flood Zone, however the effects of climate change should be investigated further. If following further investigation the site is found to lie within a different Flood Zone the Sequential Test should be reapplied to determine if the proposed development is appropriate.

5.2.9 It should be noted that adopting this approach requires the LPAs to accept an element of risk when reviewing and allocating their development sites. For example, should the LPAs identify a site in Flood Zone 2 as acceptable for more vulnerable development, when considering the effects of climate change on Flood Zone definition the site may be found to be located in Flood Zone 3 and therefore require application of the Exception Test. Similarly location of more vulnerable development in Flood Zone 3a may be inappropriate if further work identifies those parts of 3a to be redefined as 3b with consideration of climate change.

6 The Exception Test & Level 2 SFRAs

6.1 When is the Exception Test Required?

6.1.1 The application of the Sequential Test should ensure that more vulnerable types of development, such as landfill sites or residential care homes (in reference to table D.2, of PPS25), are not allocated in areas at high risk of flooding.

6.1.2 For large development sites that lie within different Flood Zones, the sequential approach should be applied. If following the sequential test the site can be re-arranged so that flood risk and vulnerability classification of the development is deemed to be appropriate (in line with PPS 25 guidelines), the exception test will not be required.

6.1.3 From time to time, there may be particularly good reasons why a development that is not entirely compatible with its assessed level of flood risk (see Table 5- and Table 5-) should not be excluded from further consideration on flooding grounds alone. In these circumstances, it will be necessary for the planning authority to demonstrate that the site qualifies for development by passing all elements of the Exception Test.

6.1.4 It may be necessary to apply the Exception Test where the Sequential Test alone cannot deliver acceptable sites, and where some continuing development is necessary for wider sustainable development reasons, taking into account the need to avoid social or economic blight and the need for essential civil infrastructure to remain operational during floods.

6.1.5 Where the use of the Exception Test is required, decision makers should apply it at the earliest stage possible in the planning process to all the potential allocations for development and all planning applications other than for minor development.

6.2 The Exception Test Process

6.2.1 The Exception Test process is detailed in paragraph D9 of PPS25 and should only be applied following application of the Sequential Test. There are three stringent conditions (parts), all of which must be fulfilled before the Exception Test can be passed. These conditions are as follows:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk;

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

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

6.2.2 An assessment has been made prior to sequential testing to highlight sites that will require a site specific FRA to satisfy the Exception Test process. These sites are highlighted in tables included in Appendix K.

6.2.3 Where the Level 1 SFRA demonstrates the potential need to apply the Exception Test, either due to current levels of flood risk or due to increases in flood risk resulting from climate change,

further data collection and/or analysis may need to be carried out in a Level 2 SFRA to assist answering part c) of the Exception Test. Where a Level 2 SFRA has not been completed, a site specific FRA will be required to answer part c of the Exception Test.

6.3 What is a Level 2 SFRA?

1.1.2 Where decision makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test using the Level 1 SFRA, it will be necessary to increase the scope of the SFRA to provide the information necessary for application of the Exception Test.

6.3.1 A Level 2 SFRA will assess the nature of the flood in more detail to include hazard and depth mapping including the presence of flood defence measures. This will allow a sequential approach to development within the flood zone, as areas with lower hazard and depth can be highlighted and developed ahead of areas at higher risk with regard to hazard and depth of water.

6.4 When is a Level 2 SFRA Required?

6.4.1 The more detailed Level 2 SFRA will be required in ***areas*** where there is high development pressure at medium or high risk and the sequential test has highlighted that there are no suitable alternative locations for development.

6.4.2 The difference between a Level 2 SFRA and a site specific FRA is on the scale of the study, The Level 2 SFRA covers an ***area*** that potentially encompasses many sites or individual developments that require more refinement with regard to flood risk e.g. eastern Bicester. Figure 6.1 below outlines the Hierarchical approach to Flood Risk Assessment.

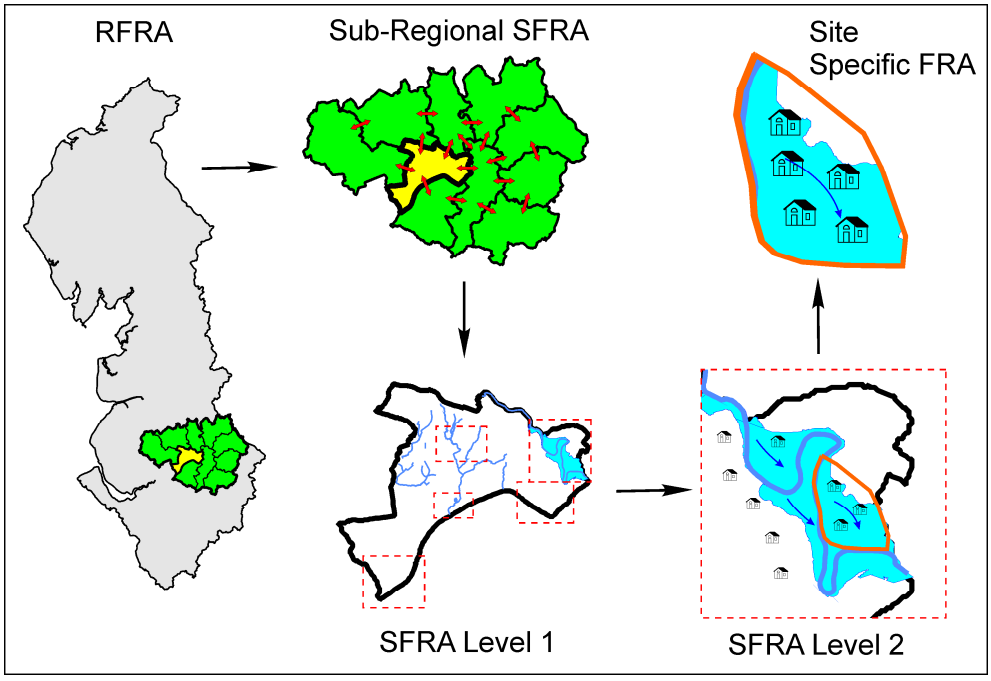

Figure 6-1 Hierarchical approach to Flood Risk Assessment.

6.5 Potential Areas where a Level 2 SFRA may be Required

6.5.1 It should be noted that the Sequential Test has not yet been completed by The Councils. However, based on existing and proposed development locations available at the time of writing, the following comments can be made regarding potential Level 2 SFRAs.

Cherwell District Council

6.5.2 Within the Cherwell District, Level 2 SFRAs may be required for Bicester and Kidlington as outlined below:

6.5.3 At Lords Lane Bicester, there are two watercourses flowing through areas of potential development. Flood risk is defined for the Northern watercourse through EA broad-scale mapping, but there are no Flood Zones defined for the western watercourse. The Level 2 SFRA would address this data gap.

6.5.4 SE Bicester – there are a number of potential development sites that could be at risk of flooding from the Langford Brook in SE Bicester. EA broad-scale river modelling defines the Flood Zones in this area however, more detail may be required in order to undertake a sequential approach to allocating development within Flood Zones. This is again something a Level 2 SFRA could address.

6.5.5 East Kidlington – Detailed EA river modelling is available for this area. In order to undertake a sequential approach to allocating development within Flood Zones, results from existing EA modelling could be used to create depth and hazard mapping forming the Level 2 SFRA.

6.5.6 West Kidlington – EA Flood Zones in this area are defined by broad-scale mapping. A level 2 would refine this data and additional hydraulic modelling to provide a more accurate reflection of the floodplain.

West Oxfordshire District Council

6.5.7 There are fewer obvious areas that may require a Level 2 SFRA within the WODC boundary as there are fewer areas of proposed development in conflict with Flood Zones.

6.5.8 A Level 2 SFRA could be provided to present more detailed information regarding flood risk and development within Witney, to include both surface water and fluvial flooding.

6.5.9 Within the parish of Eynsham there are some potential conflicts with regard to flood risk and development. A Level 2 SFRA could be used to refine flood zones in this location to enable a sequential approach to development allocation.

6.5.10 Appendix L contains a framework for choosing where and when a Level 2 SFRA may be required and information and guidance on specifying Level 2 SFRAs. The requirement for completion of the Exception Test and Level 2 SFRA is to be determined by The Councils on completion of the Sequential Test.

Minerals and Waste

6.5.11 A large proportion of the area's sand and gravel deposits occur in the valley bottom of the Thames and its tributaries and many of the sites so far identified for possible developments have areas that lie within Flood Zones 2 and 3. Sand and gravel quarries are classified as 'water compatible development' (see Table 5.4); although the County Council should apply the Sequential Test in the allocation of sites for development, it is not required to apply the Exception Test. It is therefore not expected that a Level 2 SFRA study will need to be undertaken for the assessment of sand and gravel sites (see also para 11.1.5) and other forms of minerals are generally not affected by flood risk considerations.

6.5.12 Most waste management uses are classified as 'Less Vulnerable' development in terms of flood risk (see table 5.4) and the Exception Test again does not apply. Only in the case of landfill sites or facilities dealing with hazardous waste does the need to apply the Exception Test arise. Although specific waste uses for the various sites identified are not yet known, the general location of the various sites relative to each other and to flood risk areas suggests that the need for a level 2 study is unlikely to arise for waste sites allocations. However, this should be kept under review, particularly if additional sites are proposed for consideration during the preparation of the Minerals and Waste Development Framework.

7 Flood Risk Review in Cherwell District

7.1.1 This section reviews all available flood risk data in terms of it relevance to the study area. The SFRA has extensively made use of data provided in the CDC SFRA dated December 2007. The history of flooding in Cherwell District is reviewed and then the potential sources of flooding are highlighted. The current flood risk management and flood warning measures are also summarised for the District.

7.2 Historical Flooding

7.2.1 There have been numerous historical flood events in the Cherwell study area. The EA have been contacted regarding historic flood events and have provided a lot of detail for the Banbury area to include risk from the Oxford Canal and River Cherwell. EA data including the Thames CFMP, British Hydrological Society Chronology of British Hydrological Events (BHS CBHE) database[1], Banbury Flood Alleviation Scheme Modelling Report and flood level information recorded at Spiceball Park has been summarised in Table 7-1 below. The cause and effects have been presented where available.

7.2.2 The most severe flood event recorded in Cherwell District, in terms of danger to life and property occurred in April 1998 when flood levels reached what were at the time considered to have a return period of greater than 1 in 100 years. However, other events approaching the same level have occurred on several occasions over the last 25 years (as outlined in Table 7.1) indicating that severe flooding (in terms of danger to life and property) could be becoming more frequent.

7.2.3 A gauging station at Banbury was installed in December 1966 and the largest flood event on record was in 1998 with a level of 2.75m (91.45m AOD). Records from July 2007 show that the maximum water level occurred on the 21st July and was 2.39m (91.09m AOD). Therefore the April 1998 remains the largest flood on record at Banbury.

7.2.4 It is difficult to make an assessment of the magnitudes of these floods especially when the Cherwell Valley would historically have been far less developed making it likely that historical flood levels were lower than for the same rainfall event today.

7.2.5 CDC has also provided details of properties recorded as suffering from internal flooding following the flood event of July 2007 and January 2008, included in Table 7.1 below. This shows that wide scale flooding was experienced across the District although it should be noted that this is the number of properties recorded as suffering internal flooding; the actual number may be greater than this as some residents may have chosen not to report flooding for fear of impact on household insurance.

[1] British Hydrological Society, Chronology of British hydrological Events, Online database, University of Dundee, http://www.dundee.ac.uk/geography/cbhe/

Date	Location	Source	Impact	Data Source
October 1852	River Cherwell Corridor	Fluvial	The EA Banbury Flood Alleviation Scheme made the following judgement ' The October 1852 event was probably less severe (in terms of danger to life and property) than the April 1998 flood which in terms of its peak discharge was probably the second largest flood to have passed through Banbury during the last 150 years.'	Banbury Flood Alleviation Modelling Report
December 1872	River Cherwell, Banbury	Fluvial	Houses were inundated, and outbuildings swept away. The flood ran through the station of the Great Western Railway and the water was upwards of two feet deep. The Oxford and Birmingham Canal flooded over the wharves and boat building yards.	BHS
October 1875	River Cherwell Corridor, Adderbury	Fluvial	Adderbury East was cut off from Adderbury West, the high road being flooded for several yards. The EA Banbury Flood Alleviation Scheme made the following judgement "The flood on 10th October 1875 was almost certainly the most severe event (in terms of danger to life and property)to have affected the Cherwell Valley in the vicinity of Banbury during the last 150 years."	BHS (Adderbury account), Banbury Flood Alleviation Modelling Report
November 1875	River Cherwell Corridor	Fluvial	The EA Banbury Flood Alleviation Scheme made the following judgement ' The November 1875 event was probably less severe (in terms of danger to life and property) than the April 1998 flood which in terms of its peak discharge was probably the second largest flood to have passed through Banbury during the last 150 years.'	Banbury Flood Alleviation Modelling Report
April 1908	Islip	Fluvial	The heavy snow storm and the sudden thaw afterwards with torrents of rain caused a serious flood in the Cherwell river.	BHS
May 1932	River Cherwell Corridor	Fluvial	The EA Banbury Flood Alleviation Scheme made the following judgement ' The May 1932 event was probably less severe (in terms of danger to life and property) than the April 1998 flood which in terms of its peak discharge was probably the second largest flood to have passed through Banbury during the last 150 years.'	Banbury Flood Alleviation Modelling Report
March 1974	River Cherwell Corridor	Fluvial	The EA Banbury Flood Alleviation Scheme made the following judgement 'The rain and snowmelt flood of March 1974 probably had a lesser peak discharge than the October 1875 and April 1998 events, but was possibly more significant in terms of the total volume of flood runoff over a period of several days'.	Banbury Flood Alleviation Modelling Report
March 1975	River Cherwell Corridor Spiceball Park	Fluvial	Levels of 90.01 mAOD recorded	Spiceball Park Gauging Station
December 1979	River Cherwell Corridor	Fluvial	Levels of 89.89mAOD recorded at Spiceball Park Gauging Station	Banbury Flood Alleviation Modelling Report
September 1992	River Cherwell Corridor	Fluvial	Levels of 90.29mAOD recorded at Spiceball Park Gauging Station	Spiceball Park Gauging Station
April 1998	River Cherwell Corridor	Fluvial	Most severe fluvial flood event recorded in Cherwell District. Return period >100 years. Levels of 91.37mAOD recorded at Spiceball Park Gauging Station	EA, CDC, Press
July 2007	River Cherwell Corridor	Fluvial	Levels of 91.09mAOD recorded at Spiceball Park Gauging Station. CDC records show flooding of property at the following locations: Banbury (16), Bloxham (15), Islip (11), Adderbury (9), Wendlebury (5), Launton (5), Kidlington (4), Yarnton (4), Cropredy (3), Lower Tadmarton (3), Lower Heyford (1), North Aston (1), Fringford (1), Wiggington (1), Begbroke (1), Shutford (1), Hook Norton (1), Hornton (1), Swalcliffe (1)	Spiceball Park Gauging Station
January 2008	River Cherwell Corridor	Fluvial	Levels of 89.56mAOD recorded at Spiceball Park Gauging Station. CDC records show flooding of property in the following locations: Launton (2), Yarnton (1).	Spiceball Park Gauging Station

Table 7.1: Summary of Historic Flood Events in Cherwell District Council

7.2.6 Many services were disrupted during the 1998 and 2007 flood events including the Oxford to Birmingham railway line. Banbury station, located on the eastern side of the River Cherwell flood plain was inundated on both occasions to a similar extent as show in Figure 7.1 and 7.2 below:

Figure 7-7-1: Extent of flooding at Banbury Railway Station during April 1998

Source: EA Banbury flood alleviation scheme report 2005

Figure 7-7-2: Extent of flooding at Banbury railway station during July 2007

Source: photo by Greg Scott. http://therailwaystationgallery.fotopic.net/p43396908.html

7.3 Flooding from Rivers

7.3.1 The predominant risk of flooding within the Cherwell District Boundary is from Rivers – fluvial flooding. The majority of the District falls within three major river catchments:

- The River Thames Catchment;
- The Great Ouse Catchment; and,
- The Warwickshire Avon Catchment.

7.3.2 The Thames catchment comprises approximately 80% of the District by area and all of the Districts major urban and rural development areas are located within this catchment.

7.3.3 The Great Ouse catchment comprises about 15% of the district by area and the Warwickshire Avon comprises about 5% of the district by area.

The River Cherwell

7.3.4 The River Cherwell rises at Charwelton in Northamptonshire. Its general course is flowing from north to south through the centre of the District passing through Banbury, Upper Heyford, and Kidlington before flowing to Oxford where the Cherwell meets the River Thames. The river drains a total catchment area of 906 km^2 with a mean annual rainfall of 682 mm. (Acreman 2003).

7.3.5 Tributaries that flow to the River Cherwell include the Hanwell Brook, the Sor Brook, the Bloxham Brook and the River Swere all flowing from the West and the River Ray flowing from the East. The confluence of the River Cherwell with the River Thames is located about 5km beyond the Cherwell District southern boundary.

7.3.6 Land use across the catchment is predominately rural (less than 2% of the catchment is classified as 'urban') and includes the two main urban centres of Banbury and Bicester.

Padbury Brook

7.3.7 Padbury Brook rises in the east of the District and flows towards the River Ouse which it joins once in Buckinghamshire. Much of the Great Ouse catchment falling within the District is under the control of the Buckingham Internal Drainage Board.

The River Stour

7.3.8 The Stour catchment extends into the north west of the Cherwell District. This section of the Stour flows for a short distance before flowing into the Warwickshire Avon.

The River Ouse and The River Twin

7.3.9 The River Twin and the River Ouse are located along the north eastern margin of the Cherwell District. The catchment of the River Twin includes part of the eastern Cherwell District, however, the watercourse lies beyond the Cherwell District and Study Area boundary. A section of the River Ouse forms part of the Cherwell District Eastern Boundary and therefore, a section of the Study Area drains to the River Ouse.

The River Ray

7.3.10 The River Ray is a major tributary to the Cherwell. The Ray flows generally in a north east to south west direction through the study area. The catchment is located in the east of the study area, bordering with the River Twin catchment to the north and the River Cherwell to the West. Tributaries to the Ray within the study area include, Piddington Brook, River Bure and Panshill Brook.

7.4 Flooding from Land (Pluvial/Surface Water Flooding and Overland Flow)

7.4.1 During periods of prolonged rainfall events and sudden intense downpours, overland flow from adjacent higher ground may 'pond' in low-lying areas of land without draining into watercourses, surface water drainage systems or the ground. The settlements of Kidlington, Launton, Ambrosden, Arncott, Blackthorn, Charlton-on-Otmoor, Fencott, Mercott, Wendlebury, Weston-on-the-Green, Caulcot, Noke and Oddington are all located on low lying impervious ground where there may be limited surface water drainage and therefore may be at increased risk of flooding from overland flow.

7.4.2 One of the main issues with pluvial flooding is that in areas with no history, relatively small changes to hard surfacing and surface gradients can cause flooding (garden loss and reuse of brownfield sites for example). As a result, continuing development could mean that pluvial and surface water flooding can become more frequent and, although not on the same scale as fluvial flooding, it can still cause significant disruption.

7.5 Flooding from Groundwater

7.5.1 The underlying superficial geology of the area is predominantly Clay, particularly in the north. This results in flashy runoff and rapid responses of fluvial systems to rainfall events. In the locality of Bicester there are outcrops of shale which are more permeable.

7.5.2 There are locations within the District that are affected by high water tables and are susceptible to seasonal spring fed activity such as Mollington. This may result in standing water on low lying ground that is unable to reach a ditch or watercourse and is unable to percolate through the ground due to seasonally high water perched groundwater levels.

7.5.3 Settlements at most risk of groundwater flooding are those that lie at the base of steep sided valleys such as Bodicote, Hook Norton and Steeple Aston where the potential for receiving and passing on ground water likely to cause flooding is the greatest.

7.5.4 Flood record information is included on Settlement Plans included in Appendix B, C and D. These include reference to groundwater flooding where relevant.

7.6 Flooding from Sewers

7.6.1 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding can also occur as a result of blockage, poor maintenance or structural failure.

7.6.2 It should be noted that much of the sewer network dates back to Victorian times, some of which is of unknown capacity and condition. More recent sewers are likely to have been designed to the guidelines in 'Sewers for Adoption' (WRC, 2006). These sewers tend to have a design standard of up to the 1 in 30 year storm event (equating to approximately a 1 in 5 year flood flow), although in many cases, it is thought that this design standard is not achieved, especially in privately owned systems.

7.6.3 It is therefore likely that parts of the sewer system will surcharge during large, high intensity rainstorm events resulting in frequent flooding, particularly if the systems are combined and if climate change forecasts are correct. Due to the limited capacities and design standards, the level of risk posed by and probability of sewer flooding is therefore greater than that of fluvial flooding, where the SFRA examines the 1 in 100 and 1 in 1000 year return periods.

7.6.4 In addition, as towns and villages expand to accommodate growth, the original sewer systems are rarely upgraded, eventually becoming overloaded and reducing their efficiency. Compounding this problem are the effects of climate change. Climate change is forecast to result in milder and wetter winters and more thunderstorms in summer months. This combination will increase the pressure on existing sewer systems effectively reducing their capacity, leading to more frequent flooding.

7.6.5 Developments within Cherwell have historically been piped to watercourses due to the local geology. Discharges from older (generally preceding 1970) development are often un-attenuated exacerbating the flashy responsiveness of the Districts fluvial systems to rainfall.

7.7 Flooding from Reservoirs, Canals and Other Artificial Sources

Oxford Canal

7.7.1 The Oxford Canal runs parallel to the River Cherwell and merges with it at two points within the District, sharing the same channel for 1.5km within the middle reach. A series of locks control water levels along the Oxford Canal with a series of overflow weirs ensuring any excess flows in the canals are diverted to the River Cherwell. During flood conditions the River Cherwell and the Oxford Canal are largely co-joined and therefore comments regarding the surcharging of the canal and the scope for flood protection and compensation are as for main rivers.

7.7.2 British Waterways have provided locations of points along the Oxford Canal where breaching occurred during the Summer 2007 flood event.

7.7.3 Should any proposed development be located near the canal or one of the breach points, a detailed site specific FRA should be undertaken to determine residual risks from breaching or overtopping. If the development proposals are of a significant scale, then a Level 2 SFRA should be considered for the area that will also address the residual risks of breaching or overtopping.

Redundant Industrial Processes

7.7.4 Operational and redundant industrial processes such as mining, quarrying and sand and gravel extraction can pose a flood risk when pumping ceases and groundwater returns to its natural level.

7.7.5 The locations of all minerals sites are included in Appendix D.

Reservoirs

7.7.6 Cherwell District has two main reservoirs being Clattercote reservoir (which used to feed the Oxford Canal) and Grimsbury Reservoir.

7.7.7 There is currently no flood risk data available for the reservoirs. However, the residual risks of overtopping or failure of the reservoirs needs to be taken into account when specifying development downstream.

Infrastructure Failure

7.7.8 Flooding may result from the failure of engineering installations such as flood defence, land drainage pumps, sluice gates and floodgates. Hard defences may fail through the slow deterioration of structural components such as the rusting of sheet piling, erosion of concrete reinforcement and toe protection or the failure of ground anchors. Such deterioration is often difficult to detect, so that failure, when it occurs, is often sudden and unexpected. Failure is more likely when the structure is under maximum stress, such as extreme fluvial events when pressures on the structure are at its most extreme.

7.7.9 In Cherwell District, the EA have major flood defence assets at Grimsbury (in Banbury) and Kidlington. The council presume as a principal that they are maintained effectively but will consider for each of them the effect of a catastrophic structural failure resulting in rapid inundation of protected areas. It is considered that overtopping of such structures during conditions more severe than for which they have been designed would not itself lead to rapid inundation.

7.8 Flood Risk Management in Cherwell District

Existing Flood Defences in the Study Area

7.8.1 The National Flood and Coastal Defence Database (NFCDD) identifies a significant number of flood defences throughout the study area, which are classified as fluvial defences. These include major defence assets at Grimsbury in Banbury, which is built to a 1:200 year protection and Kidlington, which is built to a 1:100 year protection.

7.8.2 The defences in the Cherwell District use a range of methods of protection including embankments, walls, culverts and gabions with the standard of protection of these defences varying from 2 to 200 years.

7.8.3 Many of the fluvial defences have a design standard less than 5 years (excluding major defences listed in 7.8.1) therefore a flood event of a larger magnitude would be expected to result in flooding despite the presence of a flood defence.

7.8.4 With this in mind the efficient operation of channels and culverts is paramount if the existing standard of flood defence is to be maintained for the Study Area. This requires maintenance by the defence owners which include Local Authorities and private owners or by the responsible drainage authority where appropriate remedial action does not take place.

7.8.5 The Otmoor SSSI is an area of managed flooding where the EA operate a weir structure holding water back at the confluence of the River Ray and the River Cherwell. The perched levels on Otmoor itself are prevented from draining by a series of weir boards and other structures.

Future Proposals for Flood Defence in the Study Area

7.8.6 Following the Easter 1998 floods, the EA undertook flood defence works which provides an increased standard of protection of 1 in 200 years for 437 residential properties.

7.8.7 Due to funding issues, the Banbury Flood Alleviation Scheme which proposes a combination of flood storage upstream of Banbury and localised flood defences within the town has been on hold. However, Cherwell has committed £2m in last year's budget (2007) to start fundraising and the EA propose a further £9m for the scheme. The scheme will now commence in the spring of 2009 with an 18 month building programme.

7.8.8 The EA has completed the Thames Catchment Flood Management Plan (CFMP), which covers the area of Cherwell. The action plan has developed specific approaches for the different areas across the Thames catchment. The District of Cherwell is included within the section 'Undeveloped natural flood plain'. The plan provides the basis of the work that the EA aspire to achieve.

7.8.9 Throughout this part of the catchment it has been noted that flood defences cannot be built to protect everything. With this in mind future proposals are to maximise the capacity of the floodplain as the floodplain is the best natural defence to combat flooding. This will include managed flooding of some areas and preventing development that compromises the capacity of the flood plain to retain water. To reduce the impact of low order flooding, defences up to a 1 in 5 year return period are proposed to be maintained and improved up to a 1 in 10 year return period. These options will include more appropriate use of the floodplain, making space for water, better flood awareness and flood-preparedness and improved emergency planning and response measures.

7.9 Flood Warning Areas

7.9.1 Flood warning codes apply principally to flooding from rivers and the sea. Each river is divided into Flood Warning Areas by the EA, each described with River name – upstream to downstream description – city/town/village. EA flood warning areas have been illustrated on settlement plans included in Appendix B, C and D. As an example, coverage of flood warning areas for River Cherwell catchment include:

- River Cherwell and its tributaries from Charwelton to Lower Heyford;
- River Cherwell and its tributaries from Lower Heyford to Oxford;
- The Sor and Bloxham Brooks from Edgehill to Adderbury including Bloxham.

7.9.2 The EA also have two flood warning areas to cover properties which are protected by the Kidlington and Grimbury Flood Alleviation Schemes. These areas would be sent a message if the Flood Alleviation Schemes were expected to fail or overtop.

7.9.3 Information on flood warnings on force and flood warning areas can be found from the EA website, under flood warning and Thames Region.

8 Potential Development Pressures in Cherwell

8.1.1 A suitable level 1 SFRA will collate and review existing information on flooding sources and flood risk to assist the Local Planning Authority in its obligation to consider flood risk in strategic land allocations and in developing future policies. The Level 1 SFRA will achieve this by providing sufficient information to enable Local Planning Authorities to apply the Sequential Test (as set out in PPS25).

8.1.2 In accordance with PPS25 and its companion guide, if there are no reasonably available sites in Flood Zone 1, it may be necessary to locate development in Flood Zone 2, potentially through the successful application of the Exception Test. Only where there are no reasonably available sites in Flood Zone 1 and 2 should development be located in Flood Zone 3 and where necessary, successful application of the Exception Test will require information to be provided in a Level 2 SFRA (see Appendix L).

8.2 Focused Settlement Assessments

8.2.1 Broad-scale information received from stakeholders that are of use to CDC in applying the Sequential Test at a District Level is presented in Appendix B. The broad scale assessment has been based on the GIS layers discussed in Section 3 and is presented as a series of plans to cover each settlement with potential to receive development as outlined in the current Local Plan.

8.2.2 The Non-Statutory Cherwell Local Plan (NSCLP) 2011 seeks to focus the majority of development in the urban areas of Banbury and Bicester, together with a proposed new settlement at the former RAF Upper Heyford. With the exception of Green Belt Villages, rural settlements are divided into three categories classified according to their size, location and range of services and facilities:

- Category 1 Villages (12 villages) where the most significant development is likely to be permitted in a rural setting;
- Category 2 Villages (51 villages) where limited development comprising infilling and conversion is likely to be acceptable;
- Category 3 Villages where there is little potential for development other than conversions or dwellings essential for agriculture.

8.2.3 The sustainability of the District's villages and the approach to development within them is being reviewed as part of the LDF. Villages have been provisionally divided into three broad categories;

- Type A Villages (high level of sustainability),
- Type B Villages (medium level of sustainability),
- Type C Villages (low level of sustainability).

8.2.4 The review is looking at the possibility of clustering some villages in recognition of existing physical, social and economic linkages. A Settlement Plan for each of the Category 1 Villages as outlined in the NSCLP is included in Appendix B along with the potential LDF categorisation and village cluster. This is tabulated below in Table 8.1 below.

Table 8.1: NSCLP Category 1 villages with potential LDF categorisation

Site	Existing NSCLP Categorisation	Potential LDF Categorisation	Potential LDF Village Cluster
Adderbury	Category 1	Type A	Adderbury
Ambrosden	Category 1	Type A	Ambrosden
Bloxham	Category 1	Type A	Bloxham
Bodicote	Category 1	Type A	N/A
Cropredy	Category 1	Type A	Cropredy
Deddington	Category 1	Type A	Deddington
Hook Norton	Category 1	Type A	N/A
Kidlington	Category 1	Type A	N/A
Kirtlington	Category 1	Type B	Kirtlington
Launton	Category 1	Type A	N/A
Steeple Aston	Category 1	Type B	Steeple Aston
Yarnton	Category 1	Type A	Yarnton

8.2.5 A Settlement Plan for each of the NSCLP Category 2 Villages along with the potential LDF categorisation and village cluster as outlined in Table 8.2 below is included in Appendix B. It is worth noting that some villages have no development currently proposed and as such no development plan is required at this stage to facilitate the sequential test. These include Claydon, Hethe, Mixbury, Shutford and Souldern.

Table 8.2: NSCLP Category 2 villages with potential LDF categorisation

Site	Existing NSCLP Categorisation	Potential LDF Categorisation	Potential LDF Village Cluster
Ardley and Fewcott	Category 2	Type C	N/A
Arncott	Category 2	Type B	Ambrosden
Balscote	Category 2	Type C	N/A
Barford St Michael & Barford St John	Category 2	Type C	N/A
Begbroke (East)	Category 2	Type B	Yarnton
Bucknell	Category 2	Type C	N/A
Chesterton	Category 2	Type B	N/A
Clifton	Category 2	Type C	Deddington
Drayton	Category 2	Type C	N/A
Duns Tew	Category 2	Type C	N/A
Epwell	Category 2	Type C	N/A
Finmere	Category 2	Type B	N/A
Fringford	Category 2	Type B	N/A
Fritwell	Category 2	Type B	N/A
Great Bourton	Category 2	Type C	Cropredy
Hanwell	Category 2	Type B	N/A
Hempton	Category 2	Type C	Deddington
Horley	Category 2	Type C	N/A
Little Bourton	Category 2	Type C	N/A
Lower Heyford	Category 2	Type C	Steeple Aston
Merton	Category 2	Type C	Charlton on Otmoor
Middleton Stoney	Category 2	Type B	N/A
Milcombe	Category 2	Type C	Bloxham

Table 8.2: NSCLP Category 2 villages with potential LDF categorisation

Site	Existing NSCLP Categorisation	Potential LDF Categorisation	Potential LDF Village Cluster
Mollington	Category 2	Type C	Cropredy
Murcott	Category 2	Type C	Charlton on Otmoor
North Newington	Category 2	Type C	N/A
Piddington	Category 2	Type C	N/A
Shenington	Category 2	Type B	N/A
Sibford Ferris	Category 2	Type B	Sibford Ferris
Sibford Gower	Category 2	Type B	Sibford Gower
Somerton	Category 2	Type C	N/A
Stoke Lyne	Category 2	Type C	N/A
South Newington	Category 2	Type C	Bloxham
Stratton Audley	Category 2	Type C	N/A
Swalcliffe	Category 2	Type C	N/A
Upper Heyford	Category 2	Type C	N/A
Upper Tadmarton	Category 2	Type C	N/A
Wardington	Category 2	Type C	Cropredy
Wendlebury	Category 2	Type B	N/A
Weston on the Green	Category 2	Type B	N/A
Wiggington	Category 2	Type C	N/A
Wroxton	Category 2	Type B	N/A

8.2.6 A Settlement Plan for each of the NSCLP Category 3 Villages along with the potential LDF categorisation and village cluster as outlined in Table 8.3 below is included in Appendix B. It is worth noting that some villages have no development currently proposed and as such no development plan is required at this stage to facilitate the sequential test. These include Godlington, Hardwick, Juniper Hill and Newton Purcell.

Table 8.3: NSCLP Category 3 villages with potential LDF categorisation

Site	Existing NSCLP Categorisation	Potential LDF Categorisation	Potential LDF Village Cluster
Alkerton	Category 3	Type C	N/A
Blackthorn	Category 3	Type C	Ambrosden
Broughton	Category 3	Type C	N/A
Burdrop	Category 3	Type C	Sibford
Caulcott	Category 3	Type C	N/A
Caversfield	Category 3	Type C	N/A
Cottisford	Category 3	Type C	N/A
Enslow	Category 3	Type C	N/A
Heathfield	Category 3	Type C	N/A
Hornton	Category 3	Type C	N/A
Lower Tadmarton	Category 3	Type C	N/A
Middle Aston	Category 3	Type C	Steeple Aston
Milton	Category 3	Type C	Adderbury
North Aston	Category 3	Type C	N/A
Prescote	Category 3	Type C	N/A
Williamscot	Category 3	Type C	N/A

8.2.7 A Settlement Plan for each of the NSCLP Green Belt Villages along with the potential LDF categorisation and village cluster as outlined in Table 8.4 below is included in Appendix B.

Table 8.4: NSCLP Green Belt villages with potential LDF categorisation

Site	Existing NSCLP Categorisation	Potential LDF Categorisation	Potential LDF Village Cluster
Begbroke (West)	Green Belt Village	Type C	N/A
Bletchingdon	Green Belt Village	Type B and C	Kirtlington
Charlton on Otmoor	Green Belt Village	Type C	Charlton on Otmoor
Fencott	Green Belt Village	Type C	Charlton on Otmoor
Gosford	Green Belt Village	Type C	N/A
Hampton Gay	Green Belt Village	Type C	N/A
Hampton Poyle	Green Belt Village	Type C	N/A
Hornton-cum-Studley	Green Belt Village	Type C	N/A
Islip	Green Belt Village	Type C	N/A
Noke	Green Belt Village	Type C	N/A
Oddington	Green Belt Village	Type C	Charlton on Otmoor
Shipton on Cherwell	Green Belt Village	Type C	N/A
Thrupp	Green Belt Village	Type C	N/A
Water Eaton	Green Belt Village	Type C	N/A

8.2.8 Appendix K includes details of each potential development with information on development use, flood risk zone and FRA requirements. This table should be used by CDC to identify those sites at risk of flooding located in Flood Zones 2 and 3.

9 Flood Risk Review in West Oxfordshire

9.1.1 This section reviews the available flood risk data in terms of it relevance to the study area. The history of flooding in West Oxfordshire District is reviewed and then the potential sources of flooding are highlighted. The current flood risk management and flood warning measures are also summarised for the District.

9.2 Historical Flooding

9.2.1 There have been numerous historical flood events in the West Oxfordshire study area. The EA have been contacted regarding historic flood events and provided a lot of detail for the River Windrush catchment. EA data including the Thames CFMP and British Hydrological Society Chronology of British Hydrological Events (BHS CBHE) database[2] information has been summarised by catchment illustrated in

9.2.2 Table 9-1 below. The cause and effects have been presented where available.

9.2.3 On July 20th 2007 extensive areas of the District were affected by flooding as a result of a number of intensive rainfall events which commenced in the morning and subsided in the evening. A daily total rainfall measurement of 126.2mm was recorded at RAF Brize Norton on 20th July. Prior to this event, the largest recorded rainfall event was 79.5mm recorded in 1968.

9.2.4 The nature of the event meant that there was little warning and widespread flooding of highways and property resulted. Over 1600 homes were directly affected internally with many others suffering damage to sheds, garages and gardens. Some 103 businesses were also flooded.[3] A number of properties were affected by flooding for the first time.

9.2.5 In response to the flood event, WODC issued an Interim Flood Report and are currently completing Flood Defence Reports for Parishes affected by flooding.

[2] British Hydrological Society, Chronology of British hydrological Events, Online database, University of Dundee, http://www.dundee.ac.uk/geography/cbhe/
[3] WODC Interim Report:2007 Summer Floods

Table 9-1: Historical Flooding in West Oxfordshire

Date	Location	Source	Impact	Data Source
1894	Windrush catchment at Witney	Fluvial	Properties flooded	BHS
January 1877	Windrush catchment at Witney	Fluvial	Properties flooded	BHS
1894	Flood water very high at Bleddington Bridge, Bledington, River Evenlode. Water too high for crossing at Ascott -under-Wychwood, River Evenlode catchment- & very high at Shipton -under-Wychwood	Fluvial	River crossings impassable	BHS
December 1907	Woodstock	Fluvial	Flooding of Woodstock village	BHS
November 1909	Cherwell catchment, Woodstock	Fluvial	Flooding of Woodstock – businesses affected	BHS
June 1910	Chipping Norton and Stow-on-the-Wold, R. Evenlode catchment	Surface water flooding	Intense rainfall	BHS
March 1947	R Windrush at Witney Bridge	Fluvial	80.94mAOD recorded at the bridge	BHS
July 1947	Evenlode catchment, River Dorn at Standford	Surface water flooding	Intense rainfall. 3.50 in. fell during a thunderstorm in an hour and forty-five minutes.	BHS
1959	Woodstock	Surface water flooding	Intense rainfall a 'remarkable' fall occurred on the 9th when 1.80 in. of rain was recorded in 45 minutes.	BHS
December 1960	Flooding of R Windrush at Witney Bridge	Fluvial	Bridge impassible	BHS
February 1990	Flooding of R Windrush at Witney Bridge	Fluvial	80.27 mAOD recorded at the bridge	BHS
January 1998	Flooding of R Windrush at Witney Bridge	Fluvial	80.33 mAOD recorded at the bridge	BHS
July 2007	Widescale flooding across District	Numerous sources	Numerous homes, businesses and transport links flooded. Refer to WODC Flood Defence Reports for further information.	WODC, EA, local press.

9.3 Flooding from Rivers

9.3.1 The West Oxfordshire District falls into the catchment of the following watercourses:

Thames Catchment

9.3.2 The largest threat to flood risk across the area comes from the River Thames. The Thames catchment covers a large area of approximately 12,935 km^2, incorporating the majority of the river catchments across the West Oxfordshire District.

Evenlode Catchment

9.3.3 Flowing through the centre of the West Oxfordshire District, the River Evenlode catchment has borders with the Cherwell catchment to the north and west and the Windrush and Thames catchments to the south. The Evenlode is a major tributary to the Thames, flowing in a south east direction from its source in Moreton in Marsh in the Cotswold Hills passing the Wychwoods and Charlbury before joining the Thames approximately 5km north west of Oxford.

9.3.4 The Evenlode experiences higher flows than would be expected due to the many years of straightening, widening and dredging the channel. This has been the case through Blenheim Park at Woodstock where the river channel was widened and deepened to drain the surrounding floodplain so that the land could be farmed. The larger, more uniform channel has produced faster-flowing water, which affords fewer places for aquatic plants to grow, fewer areas for wildlife to shelter or breed, and ultimately a greatly reduced ecological diversity.

9.3.5 Following concerns voiced by the Red Spinners Angling Society which leases a 12 mile stretch of the River Evenlode through Blenheim Park, a £90,000 restoration project was launched in September 2005 to include 1.5m high gravel bars on straight sections of the river and 'point bars' which extend to the bank on the inside of some bends. Together these produce a more varied water flow, allowing wildlife, including young fish, to shelter in slower moving sections. The bars also help narrow the river, forcing water out onto the natural floodplain at times of higher flow.

9.3.6 The project also includes a 'recharge area' – a 100 m upstream stretch, with 300 mm of new gravel laid uniformly over the river bed. This provides a source of gravel that the river will naturally move and deposit downstream. This is necessary as the new gravel bars will naturally erode over time. The EA have also created two 30 metre-long backwaters, lowering the banks by one metre to temporarily provide an area of slack water away from the high flows, where the young fish can rest.

9.3.7 These enhancements as well as greatly improving the ecological condition of the river will encourage the river to spill onto its natural floodplain at times of higher flow potentially reducing flood risk to towns and villages downstream. [4]

[4] EA Website 'River Evenlode'

Windrush Catchment

9.3.8 A smaller catchment within the study area, the Windrush catchment is located south of the Evenlode catchment and North of the Thames. The Windrush flows south eastwards across the West Oxfordshire District through Burford, Swinbrook, Asthall, Minster Lovell and Witney from where it turns southwards to its confluence with the Thames at Newbridge, upstream of Oxford. The total catchment area of the Windrush is 362.6 km^2 from its source in the Cotswold Hills.

9.3.9 The River Windrush flows through the centre of Witney where some of the area now identified as floodplain was developed in the past. There is a large capacity within the floodplain upstream of Witney in areas of smaller development such as Crawley and Minster Lovell which acts as a natural defence protecting Witney. The Bridge Street crossing in the centre of Witney and buildings downstream heavily restrict the River Windrush at Witney.[5]

9.3.10 The River Windrush has a very rich ecology and is host to a large number of fish including trout, grayling, perch, chub, roach and dace.

9.3.11 The River Windrush catchment has been extensively affected by the construction of mills along the watercourse and gravel extraction from the floodplain.

9.4 Flooding from Land (Pluvial/Surface Water Flooding and Overland Flow)

9.4.1 Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run off land quickly and result in local flooding. During such rainfall events, flow from adjacent higher ground may 'pond' in low-lying areas of land without draining into watercourses, surface water drainage systems or the ground.

9.4.2 One of the main issues with pluvial flooding is that in areas with no history of flooding relatively small changes to hard surfacing and surface gradients can cause flooding (garden loss and reuse of brownfield sites for example). As a result, continuing development could mean that pluvial and surface water flooding can become more frequent and, although not on the same scale as fluvial flooding, it can still cause significant disruption.

9.4.3 WODC is largely rural although it still experiences flooding from overland flow, highlighted by the flood event of July 2007. Rural roads can become impassable due to overland flow and properties have been flooded directly. Changes in farming practices can exacerbate overland flow due to the removal of hedgerows and trees and the issue is likely to become increasingly important due to climate change.

9.5 Flooding from Groundwater

9.5.1 There are locations within the District that are affected by high water tables and are susceptible to spring fed activity. This may result in standing water on low lying ground that is unable to reach a ditch or watercourse and is unable to percolate through the ground due to seasonally high water perched groundwater levels.

[5] Witney Flood Review July 2007, EA

9.5.2 Settlements at most risk of groundwater flooding are those at the bases of hilly outcrops embankments.

9.6 Flooding from Sewers

9.6.1 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding can also occur as a result of blockage, poor maintenance or structural failure.

9.6.2 It should be noted that much of the sewer network dates back to Victorian times, some of which is of unknown capacity and condition. More recent sewers are likely to have been designed to the guidelines in 'Sewers for Adoption' (WRC, 2006). These sewers tend to have a design standard of up to the 1 in 30 year storm event (equating to approximately a 1 in 5 year flood flow), although in many cases, it is thought that this design standard is not achieved, especially in privately owned systems.

9.6.3 It is therefore likely that parts of the sewer system will surcharge during large, high intensity rainstorm events resulting in frequent flooding, particularly if the systems are combined and if climate change forecasts are correct. Due to the limited capacities and design standards, the level of risk posed by and probability of sewer flooding is therefore greater than that of fluvial flooding, where the SFRA examines the 1 in 100 and 1 in 1000 year return periods.

9.6.4 In addition, as towns and villages expand to accommodate growth, the original sewer systems are rarely upgraded, eventually becoming overloaded and reducing their efficiency. A number of Parishes in West Oxfordshire regularly experience sewer flooding due to surface water connections to foul water systems. These problems have been documented in individual Parish Flood Defence Reports produced by WODC as a response to the flooding of Summer 2007.

9.6.5 Compounding this problem are the effects of climate change. Climate change is forecast to result in milder and wetter winters and more thunderstorms in summer months. This combination will increase the pressure on existing sewer systems effectively reducing their capacity, leading to more frequent flooding.

9.7 Flooding from Reservoirs, Canals and other Artificial Sources

Infrastructure Failure

9.7.1 Flooding may result from the failure of engineering installations such as flood defence, land drainage pumps, sluice gates and floodgates. Hard defences may fail through the slow deterioration of structural components such as the rusting of sheet piling, erosion of concrete reinforcement and toe protection or the failure of ground anchors. Such deterioration is often difficult to detect, so that failure when it occurs is often sudden and unexpected. Failure is more likely when the structure is under maximum stress, such as extreme fluvial events when pressures on the structure are at its most extreme.

Redundant Industrial Processes

9.7.2 Operational and redundant industrial processes such as mining, quarrying and sand and gravel extraction can pose a flood risk when pumping ceases and groundwater returns to its natural level. The locations of all minerals sites are included in Appendix D.

9.8 Flood Risk Management in West Oxfordshire

Existing Flood Defences in the Study Area

9.8.1 The EA have provided details of a significant number of flood defences throughout the study area, which are classified as fluvial flood defences. The locations of these defences have been illustrated on settlement plans included in Appendix C.

9.8.2 The defences in West Oxfordshire offer a standard of protection ranging from 2 to 100 years, with the majority of defences across the district designed to a standard of protection of between 2 and 5 years.

9.8.3 Defences designed to a 100 year standard are found along the Upper Thames and are maintained by the EA, such defences include flood walls, embankments and stone revetments.

9.8.4 Many of the fluvial defences have a design standard less than 50 years, therefore a flood event of this magnitude would be expected to result in flooding despite the presence of a flood defence.

9.8.5 With this in mind the efficient operation of channels and culverts is paramount if the existing standard of flood defence is to be maintained for the Study Area. This requires maintenance by the defence owners which include the EA, Local Authorities and riparian owners or by the responsible drainage authority where appropriate remedial action does not take place.

Future Proposals for Flood Defence in the Study Area

9.8.6 The EA's Thames CFMP has developed specific approaches for the different areas across the Thames catchment. West Oxfordshire is included within the section 'Undeveloped natural flood plain'. The plan provides the basis of the work that the EA aspire to achieve by 2012.

9.8.7 Throughout this part of the catchment it has been noted that flood defences cannot be built to protect everything. With this in mind future proposals are to maximise the capacity of the floodplain as the floodplain is the best natural defence to combat flooding. This will include managed flooding of some areas and preventing development that compromises the capacity of the flood plain to retain water. To reduce the impact of low order flooding, defences up to a 1 in 5 year return period are proposed to be maintained and improved up to a 1 in 10 year return period. These options will include more appropriate use of the floodplain, making space for water, better flood awareness and flood-preparedness and improved emergency planning and response measures.

9.9 Flood Warning Areas

9.9.1 Flood warning codes apply principally to flooding from rivers and the sea. Each river is divided into Flood Warning Areas by the EA, each described with 'River name – upstream to downstream description – city/town/village'. EA flood warning areas have been illustrated on settlement plans included in Appendix C. As an example, coverage of flood warning areas for River Windrush and River Evenlode catchment include:

- River Windrush and its tributaries from Worsham to Newbridge including Witney, Hardwick and Standlake;
- River Evenlode and its tributaries from Moreton-in-Marsh to Shipton-under-Wychwood, including Bledington and Milton-under-Wychwood.

9.9.2 Information on flood warnings on force and flood warning areas can be found from the EA website, under flood warning and Thames Region and by phoning floodline.

10 Potential Development Pressures in West Oxfordshire

10.1.1 A suitable Level 1 SFRA will collate and review existing information on flooding sources and flood risk to assist the Local Planning Authority in its obligation to consider flood risk in strategic land allocations and in developing future policies. The Level 1 SFRA will achieve this by providing sufficient information to enable Local Planning Authorities to apply the Sequential Test (as set out in PPS25).

10.1.2 In accordance with PPS25 and its companion guide, if there are no reasonably available sites in Flood Zone 1, it may be necessary to locate development in Flood Zone 2, potentially through the successful application of the Exception Test. Only where there are no reasonably available sites in Flood Zone 1 and 2 should development be located in Flood Zone 3 and where necessary, successful application of the Exception Test will require information to be provided in a Level 2 SFRA (see Section 15).

10.2 Focused Settlement Assessments

10.2.1 Broad-scale information received from stakeholders of use to WODC in applying the Sequential Test at a District Level is presented in Appendix C. The broad scale assessment has been based on the GIS layers discussed in Section 3 and is presented as a series of plans to cover the main settlements currently being assessed in terms of their potential to receive development.

10.2.2 West Oxfordshire has provided GIS layers to show sites submitted to the Council by landowners/developers for assessment through the LDF process. Eleven main areas have been identified (see Table 10.1 below). The sites for consideration have been mapped against flood risk on Settlement Plans included in Appendix C.

Table 10.1: West Oxfordshire Settlement Plan Locations

Settlement Plan Locations	
Witney	Long Hanborough
Carterton	Woodstock
Chipping Norton	Standlake
Bampton	Milton-Under-Wychwood
Burford	Shipton-Under-Wychwood
Charlbury	Ascot-Under-Wychwood
Eynsham	

10.2.3 Appendix K includes details of each potential development site with information on development use, flood risk zone and FRA requirements. This table should be used by WODC to identify those sites at risk of flooding located in Flood Zones 2 and 3.

11 Minerals and Waste Development

11.1.1 The primary purpose of Minerals and Waste Development Plan documents is to make informed decisions with regards to identifying where Minerals and Waste sites should be located within the study area for a period to at least 2019.

11.1.2 The new Minerals and Waste Plan will emerge from a number of prior consultation stages which include Issues and Options Consultation Papers for both Minerals and Waste Sites (completed in April 2007 and February 2007) and a study of sites that may have potential to accommodate a strategic waste treatment facility.

11.1.3 Local operators, landowners and other interested parties have been invited to nominate sites that might be considered for future minerals extraction and for future waste management purposes. All of these sites are shown and appraised in this study (see plans in Appendix D and table in Appendix K). The list of sites also includes possible areas for the production of secondary and recycled aggregate and rail depots. These sites will be considered as part of a county-wide extension to the Minerals and Waste SFRA due to commence in the summer of 2009.

11.1.4 In the case of possible waste sites, areas have been identified that are additional to those nominated by operators and landowners. All sites known to be in active waste management have been included, together with a number of areas identified as being suitable for industrial processes in District Local Plans and land believed to be derelict or un-used.

11.1.5 In accordance with PPS25, a sequential risk based approach should be used to ensure that the highest risk development is located in the area at lowest risk of flooding. The sequential test uses the EA and SFRA flood maps as a basis for measuring flood risk, this is discussed in more detail in Chapter 5. Tables D.1 and D.2 of PPS25 identify the types of development appropriate for each flood risk zone. Table 11-1 below enlarges on this and displays the vulnerability classification for the different forms of minerals and waste developments that can be envisaged.

Table 11-1: Vulnerability Classification for Minerals and Waste Sites

Development Type	Vulnerability Classification	Acceptable Flood Zone
Landfill and hazardous waste facilities	More Vulnerable	Flood Zone 1 and 2
Sewage Treatment Plants	Less Vulnerable	Flood Zones 1, 2 and 3a
Waste treatment (except landfill and hazardous waste facilities)	Less Vulnerable	Flood Zones 1, 2 and 3a
Waste recycling and composting uses (except hazardous waste)	Less Vulnerable	Flood Zones 1, 2 and 3a
Minerals working and processing (excluding sand and gravel)	Less Vulnerable	Flood Zones 1, 2 and 3a
Sand and gravel	Water Compatible	Flood Zones 1, 2 and 3a and 3b
Secondary aggregate re-cycling	Less Vulnerable	Flood Zones 1, 2 and 3a
Concrete block manufacture	Less Vulnerable	Flood Zones 1, 2 and 3a
Concrete batching plant	Less Vulnerable	Flood Zones 1, 2 and 3a

11.1.6 As shown in Table 11.1, sand and gravel working is classed as 'water-compatible development' in PPS25. However, steps should be taken wherever possible to ensure that where these workings are sited in the floodplain, ancillary facilities such as offices or stock piles do not increase the risk of flooding elsewhere. Site specific FRAs submitted at the application stage can ensure that sites are designed, worked and restored accordingly. The fact that workings may still result in some increased flood risk elsewhere justifies application of the sequential test when considering site allocations through the Development Framework. However, such workings are classified as waster compatible development and it is not expected that a Level 2 SFRA will need to be undertaken for such sites. Sequential working and restoration can be designed to reduce flood risk by providing flood storage and attenuation.

11.2 Minerals Extraction and Flood Risk

Flooding from Rivers

11.2.1 The spatial strategy for minerals development is primarily driven by geology as minerals can only be worked where they naturally occur. This has implications when carrying out the sequential test in accordance with PPS25 (steering development to lowest flood risk) as reasonable alternative sites may not always be available. This is particularly the case with deposits of sand and gravel as many of the deposits are located within natural river floodplains which are often inundated during flood events, therefore not 'preferred' in accordance with the sequential test.

11.2.2 Stockpiles and ancillary buildings can reduce the storage capacity of the floodplain. In addition, the stockpiles and ancillary buildings could alter the natural flow of the flood water by blocking flow paths and increasing flood risk to adjacent land. Typically in floodplain quarries, sand and gravel extracted in the spring and summer months are sold directly leading to small stockpiles. However, stockpiles are often increased in late summer and autumn to provide sales during the winter months when pumps are switched off and excavation is inhibited. This leads to a larger potential impact in the winter months. In order to mitigate against this, the sequential approach should be applied on a site level to ensure that stockpiles and ancillary offices are located in areas at lowest flood risk.

11.2.3 Appendix D shows that the majority of the sand and gravel sites are located in Flood Zones 2 and 3. In the absence of the 1 in 20 year modelled Flood Zone 3b (functional floodplain) all sites located within Flood Zone 3a are automatically reclassified as being located within Flood Zones 3b. Although minerals extraction sites are classified as water compatible in PPS25, ancillary and supporting infrastructure and buildings should be located in areas of least flood risk to avoid being adversely affected by flooding or increasing flood risk elsewhere.

11.2.4 It has been agreed with OCC that the Secondary and Recycled Aggregates sites and Rail Depot sites identified in the brief will be assessed as part of a county-wide extension to this study to include Minerals and Waste sites in the City, and South Oxfordshire and Vale. This is due to commence in summer 2009.

Flooding from Land (Pluvial/Surface Water Flooding and Overland Flow)

11.2.5 Intense periods of rainfall over a short duration or periods of prolonged rainfall can lead to overland flow as rainwater may be unable to infiltrate into the ground or enter drainage systems.

11.2.6 One of the main issues with pluvial flooding is that relatively small changes to hard surface and surface gradients can cause flooding. As a result, development for minerals sites including the stockpiles and ancillary buildings could lead to more frequent surface water flooding which can cause disruption to the site and surrounding land. However, any problems encountered from pluvial flooding are more likely to inconvenience the operator and are unlikely to be significant in assessing the suitability of sites.

Flooding from Groundwater

11.2.7 Groundwater flooding is described in PPS25 as occurring when water levels in the ground rise above surface elevation, which is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

11.2.8 Minerals workings in most cases excavate below the natural water table, which during periods of heavy rainfall may rise. Mineral workings often operate a pumped system and can therefore interfere with groundwater flow. These issues would be most appropriately addressed in a FRA at the planning application stage.

Flooding from Sewers

11.2.9 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding can also occur as a result of blockage, poor maintenance or structural failure.

11.2.10 Thames Water are the statutory water undertaker for the section of the study area which includes all proposed minerals sites. Thames Water maintain a register of historical sewer flooding events (DG5 register), which has been provided as part of the SFRA study. Section 3.8 of this report discusses the available sewer flooding data in more detail with a position statement regarding limitation and uncertainties of the data.

11.2.11 Any incidents of sewer flooding highlighted by Thames Water and both Cherwell and West Oxfordshire DC have been illustrated on the minerals course assessment table included in Appendix D.

11.2.12 Minerals sites are generally located in rural areas remote from settlements and scattered housing, therefore, sewer flooding is not thought to be a large issue with regard to flood risk at proposed minerals sites.

Flooding from Reservoirs, Canals and other Artificial Sources

11.2.13 The Oxford Canal will not impact on any proposed minerals sites.

11.2.14 OCC have provided details of all nomination sites that may be considered for future minerals extraction. The Course Assessment table included in Appendix D provides a review of all potential site allocations for Mineral extractions and associated works considered to date.

Sequential Working and Restoration of Minerals Sites

11.2.15 Research carried out by Symonds Group on behalf of DEFRA, the Mineral Industry Sustainable Technology and the Mineral Industry Research Organisation looked into the influence of aggregate quarrying in floodplains on flood risk and has highlighted some flood risk issues, as discussed above.

11.2.16 The results also showed that sand and gravel extraction in a floodplain will create a void that can be used to provide potential storage during a flood event, generally reducing flow and water levels in the vicinity of the extraction. However, long term benefits will only accrue where larger workings up-stream of a valuable settlement are restored to an open water environment; it is also thought that any benefits are diminished where workings are more than 2km upstream of a settlement.

11.2.17 This potential sequential working and restoration is likely to be most effective at a strategic (county) scale and is suggested in PPS25 Practice Guide.

11.2.18 It should also be noted that while restoration of minerals sites can be designed to provide flood storage during flood events, areas of open water also provide wildlife benefits and are a method of sustainable flood management.

11.2.19 There are a large number of water filled mineral extraction sites located in the Cherwell and West Oxfordshire Districts that are valuable stopping off points for migrating wildfowl. Where marginal vegetation is present they can also provide nesting sites and a good habitat for invertebrates. The following restored minerals sites are now water filled providing valuable habitats:[6]

- Balscote Quarry – owned and managed as a nature reserve by Banbury Ornithological Society;
- Merton Borrow Pit was dug during the construction of the M40 and is managed as a nature reserve for recreation;
- Shipton-on-Cherwell Quarry – a disused limestone quarry with water filled pools at its base;
- Stratton Audley Quarries – recently re-excavated limestone quarries;
- Yarnton Gravel Pits (also known as Cassington Gravel Pits);
- Wolvercote Pit – an old gravel pit owned by the EA;
- Lower Windrush Valley in West Oxfordshire.

11.3 Waste Management and Flood Risk

11.3.1 Historically landfill was the most common method of waste management throughout the UK. However, in order to come into line with EU legislation and government targets ways must be found to reduce the current dependence on landfill and move towards more sustainable methods of managing waste. These methods include recycling, composting and energy recovery through various technologies such as anaerobic digestion, combustion or gasification.

[6] Cherwell Biodiversity Action Plan 2005-2010

11.3.2 The Waste Sites (Issues and Options) Consultation Paper (Feb 2007) identified a number of possible waste sites located across the Study Area. Further sites have been added following consultation and these are assessed in Appendix D. There are a number of non-hazardous and inert landfill sites in both Cherwell and West Oxfordshire Districts based on quarry areas. There is also a spread of waste management facilities (waste transfer stations, household waste recycling centres etc) across the area.

11.3.3 PPS25 Table D.2 and Table 9.1 in this report classify landfill sites as 'more vulnerable' developments, and are therefore restricted to Flood Zones 1 and 2 (prior to the application of the sequential test). All other sites are classified as 'less vulnerable' (excluding hazardous waste) and are allowed in Flood Zones 1,2 and 3a.

Flooding from Rivers

11.3.4 The spread of waste sites across the study area means that flooding from all river catchments within the study area may be relevant including:

- The River Thames Catchment;
- The Great Ouse Catchment;
- The Warwickshire Avon Catchment;
- The River Evenlode Catchment;
- The River Windrush Catchment.

11.3.5 Section 7 and 9 outline the nature of each river catchment

11.3.6 The Course Assessment Table included in Appendix D provides a review of the potential waste site allocations with regard to EA Flood Zones.

11.3.7 Appendix D shows that only 3 of the 33 possible waste sites located in WODC are located in Flood Zones 2 or 3 and 9 sites out of a potential 58 sites in CDC are located in Flood Zones 2 or 3.

Flooding from Land (Pluvial/Surface Water Flooding and Overland Flow)

11.3.8 Intense periods of rainfall over a short duration or periods of prolonged rainfall can lead to overland flow as rainwater may be unable to infiltrate into the ground or enter drainage systems.

11.3.9 One of the main issues with pluvial flooding is that relatively small changes to hard surface and surface gradients can cause flooding. Waste treatment plants may increase the percentage of impermeable surfaces increasing the risk of flooding from surface water. Flood risk is increased at low points in the catchment. Historic surface water flooding incidents provided by both Cherwell and west Oxfordshire District have been plotted on course assessment plans included in Appendix D.

Flooding from Groundwater

11.3.10 Groundwater flooding is described in PPS25 as occurring when water levels in the ground rise above surface elevation, which is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

11.3.11 A number of waste sites in the study area are located in redundant mineral site excavations. The relation of groundwater and potential contamination needs to be investigated prior to approval of any landfill.

Flooding from Sewers

11.3.12 Sewer flooding generally results in localised short term flooding caused by intense rainfall events overloading the capacity of sewers. Flooding can also occur as a result of blockage, poor maintenance or structural failure.

11.3.13 Thames Water are the statutory water undertaker for the section of the study area which includes all proposed waste management sites. Thames Water maintain a register of historical sewer flooding events (DG5 register), which has been provided as part of the SFRA study. Section 3.8 of this report discusses the available sewer flooding data in more detail with a position statement regarding limitation and uncertainties of the data.

11.3.14 Any incidents of sewer flooding highlighted by Thames Water and both Cherwell and West Oxfordshire DC have been illustrated on the Waste Settlement Plans included in Appendix D.

Flooding from Reservoirs, Canals and other Artificial Sources

11.3.15 The Oxford Canal runs parallel to the River Cherwell and merges with it at two points within the district, sharing the same channel for 1.5km within the middle reach. A series of locks control water levels along the Oxford Canal with a series of overflow weirs ensuring any excess flows in the canals are diverted to the River Cherwell. During flood conditions the River Cherwell and the Oxford Canal are largely co-joined and therefore comments regarding the surcharging of the canal and the scope for flood protection and compensation are as for main rivers

11.3.16 British waterways has provided locations of points along the Oxford Canal where breaching occurred during the summer 2007 flood event.

11.3.17 Seven potential waste sites have been identified as being located adjacent to the Oxford Canal or other artificial sources and are therefore at a greater risk of flooding from artificial sources. These include:

- Site 79a, 79b and 107 which are located adjacent to the Oxford Canal in Banbury;
- Site 37 located on land immediately downstream of Grimsbury Reservoir;
- Site 90 located adjacent to the Oxford Canal at the Banbury Business Park;
- Sites 36 and 30 located adjacent to the Oxford Canal in Enslow.

11.3.18 Residual risks to these sites should be considered in a more detailed site specific FRA to determine residual risks from breaching or overtopping.

11.4 Strategic Waste Treatment

11.4.1 The Minerals and Waste Development Framework is likely to need to make allocations for a number of strategic waste facilities, including sizeable waste treatment plant capable of treating up to 300,000 tonnes of residual waste per annum. The question therefore arises as to whether, for the purpose of this study, such a facility should be categorised as 'less vulnerable' development or whether it should be regarded as 'essential infrastructure' – to which a different flood risk assessment would apply.

11.4.2 It is possible that the new Planning Bill will identify some waste facilities as nationally significant infrastructure. However, for the purposes of this report and in accordance with PPS25, waste treatment (except landfill and hazardous waste facilities) should be classified as Less Vulnerable and landfill sites used for waste management facilities for hazardous waste should be classified as More Vulnerable. See table 11.1 above for vulnerability and Flood Zone compatibility.

12 Future Flood Risk Management Options

12.1.1 Evidence collected through the Level 1 SFRA suggests that flood risk throughout the study area is exacerbated by poor conveyance of numerous structures (bridges and culverts – for example the small bridges in Eynsham). With the impact of climate change, flooding as a result of poor capacity structures would be expected to increase. The Level 1 SFRA also suggests that flood risk in specific areas may have been exacerbated by developments taking place within the natural floodplains of watercourses. Banbury, Bicester and Witney contain development located in natural river floodplains.

12.1.2 All new development should have flood risk management factored in at the planning stage to include the rigorous application of PPS25 with the use of Sustainable Flood Management measures encouraged where possible. This chapter describes how flood risk management can be applied within the districts of Cherwell and West Oxfordshire.

In order to mitigate against increased flood risk, the councils should seek opportunities to:

- Safeguard floodplains from development, ensuring the maximum possible capacity is available to attenuate floodwater and thereby safeguard existing property. Where development in the floodplain is unavoidable and flood plain storage is removed, the development should provide compensatory storage on a level for level basis to ensure that there is no loss in floodplain storage capacity.
- Restore natural river forms and floodplains (through managed retreat where possible) and in so doing restore river corridors and floodplains as areas of biodiversity and increasing their amenity value.

12.2 Sustainable Flood Risk Management

12.2.1 Traditional flood risk management measures have used hard engineering, the building of flood walls, embankments and large concrete bridges and culverts. Rivers have been straightened and floodplains drained to allow for farming and urban development. The result of these activities is that rivers flow faster and over smaller, more restricted areas than they would under natural conditions. This restricts the flow of water and can increase flood risk in other areas of the catchment. Climate change is threatening to make the situation worse and, with a large number of properties already located on the floodplain within the Cherwell and West Oxfordshire Districts, a more sustainable solution is required.

12.2.2 Sustainable Flood Risk Management promotes a catchment wide approach to flooding that uses natural processes and systems (such as floodplains and wetlands) to slow down and store water. The use of softer engineering techniques is also promoted as is flood risk mapping, flood warning, education and emergency response.

12.2.3 The EA Catchment Flood Management Plan for Upper Thames cites the floodplain as the 'most important asset in managing risk' and opportunities exist for floodplain creation and restoration. For example, land adjacent to the Merton Brook, north of Merton could be opened up as floodplain. These fields are already in the floodplain, however, a spoil bank currently prevents this land from flooding.

12.2.4 The Oxfordshire Conservation Target Areas Mapping Project Report, July 2006 aimed to map the most important areas for wildlife conservation where targeted conservation will have the greatest benefit. Within Cherwell District, there are 9 conservation target areas identified, and 7 within West Oxfordshire as listed below:

Cherwell

- Brill and Muswell Hill;
- Kirklington and Bletchingdon Parks and Woods;
- Lower Cherwell Vallye;
- Northern Valleys;
- Otmoor;
- Ray;
- Swere Valley and Upper Stour;
- Tusmore and Shellswell Park;
- Upper Cherwell.

West Oxfordshire

- Blenheim and Ditchley Parks;
- Glyme;
- Lower Windrush Valley;
- North Evenlode Valleys;
- South Cotswold Valleys;
- Upper Windrush Valleys;
- Wychwood and LowerEvenlode.

12.2.5 The Cherwell Biodiversity Action Plan outlines the District's strategy towards biodiversity between 2005 and 2010. It outlines nine priority habitats and associated species which include Grazing Marsh/ Wet Grassland, Wetlands and Aquatic Habitats.

12.2.6 There are opportunities with sustainable flood risk management techniques to enhance or create these priority habitats.

Grazing Marsh/ Wet Grassland

12.2.7 This habitat is predominantly grassy habitat where the water level is controlled by ditches. Areas in Cherwell that meet this definition include Otmoor and Bicester Wetland Reserve.

These areas are particularly important for birds, beetles and dragonflys. Grazing marsh often forms part of the floodplain (functional floodplain in many cases).

12.2.8 In other areas of wet grassland located on river floodplains, flooding may occur attracting wading birds and wildfowl whilst also providing valuable flood storage. The Cherwell Valley between Somerton and Nell Bridge is particularly important for this habitat.

12.2.9 CDC have the following specific actions regarding grazing marsh and wet grassland:

- Continue management of Kings End in Bicester to maintain wet grassland habitat;
- Look on projects targeting wetland and wet grassland in the Cherwell Valley between Banbury and Upper Heyford favourably;
- Continue to grant aid the RSPB towards the Otmoor Reserve.

12.2.10 It is recommended that this SFRA should be taken into account for future biodiversity policy schemes to enhance or create grazing marsh/wet grassland to ensure that sustainable flood risk management is promoted.

Wetland Habitat

12.2.11 This habitat includes areas of fenland, flushes, reedbeds and swamps. There is only one fenland in Cherwell at Weston-on-the-Green. Wetland habitat can also provide attenuation to flood flows, which can help to reduce flood levels elsewhere.

12.2.12 Flushes are found on or at the base of valley slopes in the north west of the district. Locations include;

- The Swere Valley;
- The valley south of Alkerton;
- Hangland Railway cutting near to Chacombe;
- The County Wildlife Site of Wroxton and Balscote Mills;
- Rye Hill Golf Course;
- Shipton-on-Cherwell Quarry.

12.2.13 There are five areas of reedbed of notable size in Cherwell being:

- Dukes Lock Pond near Yarnton;
- A Lake within Kirtlington Park;
- RSPB reserve at Otmoor;
- Woodland trust site at Stratfield Brake;
- Lake at Kidlington Meadows County Wildlife Site.

12.2.14 Swamp habitat is dominated by large sedges and other reeds. The following list outlines areas of swamp habitat in the Cherwell District:

- The largest area of this habitat is found at Enslow Marsh Sedgebed;
- Adjacent to the River Cherwell at Bletchington Quarry;

- Rush Spinney near Upper Heyford;
- Otmoor;
- Horley Pond;
- Borrow pits adjacent to the railway south of Yarnton.

12.2.15 CDC have the following specific actions regarding wetland areas:

- Seek to ensure development proposals at Shipton-on Cherwell Quarry protect and enhance wetland habitat;
- Protect wetlands from hydrological change due to development and land use change;
- Use expert advice when restoring or creating ponds in wetland areas;
- Continue work with relevant organisations to improve management at Enslow Marsh sedgebed.

12.2.16 It is recommended that this SFRA should be taken into account for future biodiversity policy and schemes to enhance or create wetlands to ensure that sustainable flood risk management is promoted.

Aquatic Habitat

12.2.17 The UK biodiversity Action Plan includes the category of eutrophic standing waters. Cherwell has eutrophic standing waters, ponds and rivers in the district. The term aquatic habitat covers rivers and ditches, reservoirs, ponds, gravel pits and canals.

12.2.18 The EA is responsible for the management of the main rivers and streams within the Cherwell District. Their aim is to protect and enhance the value of watercourses through the appropriate management and implementation of appropriate policies. There are a number of specific actions for CDC within the Cherwell BAP including:

- Work closely with British Waterways to protect canal side habitats;
- Publicise and promote the wildlife value of canals;
- Continue providing grant aid for pond restoration and creation;
- Ensure that any planning permission given for lakes or ponds will maximise benefits to wildlife;
- Work with relevant organisations to implement habitat improvements at Trow Pool;
- Seek to ensure that development proposals at Shipton-on-Cherwell Quarry protect and enhance the open water habitat.

12.2.19 It should be noted that aquatic habitat areas often have minimal flood storage capacity as they are already filled with water. Therefore, the potential flood risk management options using aquatic habitat may be limited.

12.2.20 Conservation Target Areas have been identified where targeted conservation action will have the greatest benefit through restoration and management of habitats. These include nine areas within Cherwell and ten areas within west Oxfordshire Districts. Within each area different habitats are identified including floodplain, grazing marsh, reed beds, wet grassland etc. Sustainable flood risk management techniques should be applied with conservation targets in mind to provide habitats and flood storage areas. Further details on conservation target Areas can be found on OCC website, under Environment and Planning, Countryside, Ecology.

12.3 Emergency Planning & Flood Risk

12.3.1 Local Authorities are classified as Category 1 responders in the context of the Civil Contingencies Act 2004. As such their responsibilities include risk assessment, emergency planning and warning and informing the public. Emergency plans are in place in Oxfordshire County Council and in the district councils of Cherwell and West Oxfordshire. The local authorities would work closely with other Category 1 Responders, such as the Emergency Services, to minimise the impact of flooding.

12.3.2 When dealing with flood risk the multi-agency approach is as follows:

- **Preparation** – raising flood awareness, ensuring no inappropriate use of the floodplain, ensuring emergency access and egress routes are available, protecting vital infrastructure, ensuring adequate flood resilience measures are employed;
- **Response** – The emergency services would be responsible for rescuing operations with local authorities taking responsibility for providing safe refuge and short term accommodation;
- **Recovery** – A Local Authority led Recovery Working Group would co-ordinate efforts to provide support to the community providing longer term temporary accommodation where appropriate.

12.3.3 PPS25 classifies buildings used by the Emergency Services including police stations, ambulance stations, fire stations and command centres as Highly Vulnerable buildings. It is essential that all establishments related to these services are located in the lowest flood risk zones to ensure that In the event of an emergency those services vital to the rescue operation are not impacted by flood water.

12.3.4 Allied to this, rest and reception centres identified in Emergency Plans within the study area should be compared with the outputs of this SFRA to ensure that these allocated centres are not at high risk of flooding, so that evacuees will be safe during a flood event. Developments that are suitable for such uses normally include:

- Leisure centres;
- Churches;
- Schools; and,
- Community Centres.

12.3.5 In response to flooding experienced in July 2007, WODC has asked each Parish Council in their District affected by flooding to create a flood warning and evacuation plan for use in conjunction with the EA's flood warnings. Guidelines and support have been provided to each affected

Parish by WODC engineers in order to minimise the risk to people and properties in a future flood event.

The councils should seek opportunities to::

- *Ensure that all new developments that are located within Flood Warning Areas create a Flood Emergency and Evacuation Plan using information provided by site specific flood risk assessments in order that the risk to people and property is minimised in a flood event.*
- *Ensure that the SFRA is used to inform the local emergency plans with regards to access and egress routes, temporary shelter and accommodation and control and command locations.*
- *Through the planning process, ensure that future strategic or critical infrastructure is located in areas at least risk of flooding.*

12.3.6 It should be noted that PPS25 currently indicates that some critical infrastructure is classed as water compatible development as it may have to be located in flood risk areas. A revision to PPS25 is to be published in spring 2009 and it is anticipated that guidance with regard to flood risk and infrastructure will be revised. In the mean time it is recommended that, in light of flooding experienced in Gloucester July 2007 during which critical infrastructure was severely affected, the Councils take a precautionary approach, with advice from the EA, when making their decisions regarding critical infrastructure and flood risk.

12.4 Sustainable Drainage Systems (SuDS)

12.4.1 An overview of SUDS and why they should be used is included below. Further detail on SUDS including techniques and a map showing where they can be utilised is included in Appendix I.

What are SuDS?

12.4.2 SuDS are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible.

12.4.3 Wherever possible, SuDS techniques should seek to contribute to each of the three goals identified below, with the preferred system contributing significantly to each objective. SuDS solutions for specific sites should seek to:

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

12.4.4 These goals can be achieved by utilising a management plan incorporating a chain of techniques, (as outlined in Interim Code of Practice for Sustainable Drainage Systems 2004), 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, pervious pavements);
- Site control: water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site);
- Regional control: integrate runoff manage from a number of sites (e.g. into a detention pond).

Why use SuDS?

12.4.5 Traditionally, built developments have utilised piped drainage systems to manage surface water and convey surface water run-off away from developed areas as quickly as possible. Typically these systems connect to the public sewer system for treatment and/or disposal to local watercourses. Whilst this approach rapidly transfers surface water from developed areas, the alteration of natural drainage processes can potentially impact on downstream areas by increasing flood risk and reducing water quality.

12.4.6 Due to the difficulties associated with upgrading sewer systems it is uncommon for sewer and drainage systems to keep pace with the rate of development/re-development and the increasingly stringent drainage discharge restrictions that are being placed upon them. As development continues and/or urban areas expand these systems can become inadequate to deal with the volumes of surface water that is generated, resulting in increased flood risk and/or pollution to watercourses. Allied to this are the implications of climate change and increasing rainfall intensities.

13 Site Specific Flood Risk Assessment Guidance

13.1 Introduction

13.1.1 The assessment of flood risk is a fundamental consideration for new development or redevelopment regardless of its scale or end-use. Understanding the flood risk posed to and by a development is key to managing the risk to people and property thereby reducing injury, property damage or even death.

13.1.2 The effects of climate change may exacerbate future flood risk. Current predictions indicate that milder, wetter winters and hotter, drier summers will be experienced in the future and there will be a continued rise in sea levels. These changes will potentially lead to changes in the magnitude, frequency and intensity of flood events. Some areas currently defended from flooding may be at greater risk in the future due to the effects of climate change or as the defence condition deteriorates with age.

13.1.3 Opportunities to manage flood risk posed to and from development exist through understanding and mitigating against the risk. The location, layout and design of developments should be considered to enable the management of flood risk through positive planning. This positive planning approach must consider the risks to a development from local flood sources and the consequences a development may have on increasing flood risk to the surrounding areas. Early identification of flood risk constraints can ensure developments are sustainable whilst maximising development potential.

13.1.4 A Level 1 SFRA should present sufficient information to assist Local Planning Authorities to apply the Sequential Test and identify where the Exception Test may be required. These documents are predominately based on existing data. The scale of assessment undertaken for an SFRA is typically inadequate to accurately assess the risks at individual sites within the study area as, for example, the EA and SFRA Flood Zone Mapping do not account for all watercourses within the study area.

13.1.5 Therefore, there are requirements for site specific FRAs to be submitted with many planning applications for individual development proposals. FRA Guidance Table included in Appendix K should be used by planners to establish the scope and requirements of a FRA for different development types.

13.1.6 For the sites currently under consideration by the councils in the preparation of their Development Frameworks, recommendations are made in Appendix K as to the circumstances where a FRA would be expected to be submitted with a planning application, irrespective of whether the site has been identified as appropriate for development in the Development Framework. This is because the need for a FRA does not automatically infer that a Level 2 SFRA will have been undertaken prior to the inclusion of the site in the Development Framework.

13.1.7 Site-specific flood risk assessments are required to assess the flood risk posed to and by proposed developments and to ensure that, where necessary, appropriate mitigation measures are included in the development.

13.1.8 The guidance presented in the following Chapter has been based on:

- The recommendations presented in PPS25 and the consultation draft of the Practice Guide Companion;
- The information contained within this Level 1 SFRA report.

13.2 When is a Flood Risk Assessment Necessary?

13.2.1 When deciding if a FRA is required the piper networking site http://www.pipernetworking.com/floodrisk/ should be referred to as this outlines when the EA should be consulted. A flood risk assessment Guidance Table to guide planners with relation to development in Cherwell and West Oxfordshire Districts is included in Appendix K. This table is designed as a wall chart for planners to use as a quick reference on Flood Risk Assessment requirements.

13.2.2 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.

13.2.3 In the following situations a Flood Risk Assessment should always be provided with a planning application:

- Development sites located in Flood Zone 2 or 3;
- Proposed development that is classed as a major development and located in Flood Zone 1. 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 m2. Since the risk of fluvial or tidal flooding is minimal such FRAs should focus on the management of surface water;
- Development sites located in an area known to have experienced flooding problems from any flood source;
- Development sites located within 9m (water environment) of any watercourse regardless of Flood Zone classification.

13.2.4 FRA Guidance for specific sites is provided in settlement tables (Appendix K) including: possible development sites in Cherwell, West Oxfordshire, Minerals and Waste sites

13.3 What are the Requirements of a Flood Risk Assessment?

13.3.1 Annex E of PPS25 presents the minimum requirements for FRAs. These include:

- The 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;

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

13.4 FRA Staged Approach

13.4.1 The Practice Guide Companion to PPS25 (June 2008) advocates a staged approach to site-specific FRAs with the findings from each stage informing the next and site master plans, iteratively throughout the development process.

13.4.2 The staged approach comprises of three stages outlined below:

Level 1 - Screening Study

13.4.3 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 can be undertaken by a 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 Development Control Officer could advise a developer of any flooding issues affecting the site. A developer can use this information to further their understanding of how flood risk could affect a development.

Level 2 - Scoping Study

13.4.4 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 they affect the 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

13.4.5 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 a flood risk assessment 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 incorporates appropriate mitigation measures.

13.4.6 The Staged approach is a flexible system as every FRA does not need to go through all three stages. Where sites are located next to a watercourse and it is known that modelling is required

just a level 3 FRA can be completed. At sites where less data is available a screening study may be required to establish if a Level 3 study is required.

13.4.7 At all stages, the Local Planning Authority, and where necessary the EA and/or the Statutory Water Undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for Planning Applications.

13.5 Flood Zone 1

13.5.1 A FRA is required within Flood Zone 1 if the proposed development is vulnerable to any type of flood source or the site area is greater than 1.0ha. This is to ensure storm water generated by the site is managed in a sustainable manner and does not increase the burden on existing infrastructure and/or flood risk to neighbouring property. The FRA can be brief unless the factors above or local considerations require particular attention. Minimum requirements for a FRA can be found at Appendix E of PPS25.

13.5.2 The PPS25 policy aim for Flood Zone 1 is 'developers and local authorities should seek opportunities to reduce the overall level of flood risk to the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques'.

13.6 Flood Zone 2

13.6.1 All developments proposed within Flood Zone 2 require a FRA. The minimum requirements can be found at Annex E of PPS25. The land use appropriate for this Flood Zone, as classified by Table D2 of PPS25 are water compatible, less vulnerable, more vulnerable and essential infrastructure. Highly vulnerable types of land use are only appropriate in Flood Zone 2 if the Exception Test is passed.

13.6.2 With regard to Flood Zones 1 and 2, the aim of PPS25 is for developers to seek opportunities to reduce the overall level of flood risk to the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

13.7 Flood Zone 3a

13.7.1 All developments proposed within Flood Zone 3a require a FRA. The minimum requirements can be found in Annex E of PPS25. The PPS25 policy aims for this zone are:

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

13.7.2 The water compatible and less vulnerable uses of land as classified by Table D2 of PPS25 are permitted in this zone. The highly vulnerable uses in Table D2 should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for use in times of flood.

13.8 Flood Zone 3b

13.8.1 All developments proposed within Flood Zone 3b require a FRA. The minimum requirements can be found in Annex E of PPS25. The PPS25 policy aims for this zone are:

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

13.8.2 The water compatible uses and essential infrastructure listed in Table D2 of PPS25 that are permitted in this zone should be designed and constructed to:

- Remain operational and safe for use in times of flood;
- Result in no net loss of floodplain storage;
- Not impede flood risk elsewhere.

13.8.3 At all stages, the LPA and, where necessary, the EA and statutory water undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

To achieve the aims of PPS25 with regard to Flood Risk Assessments, the Councils should:

- Ensure the PPS25 Sequential Test is undertaken for all occasions and windfall sites promoted for development within their administrative areas;
- Have regard to the vulnerability classification of developments and local emergency planning issues when determining suitable locations for development;
- Have regard to the cumulative impact of development on flood risk;
- Determine decisions for windfall development through application of the Sequential Test. Where this is not practical the Councils should balance the flood risk at an individual site, the type of development proposed, emergency planning and the contribution the development would make to the wider sustainability of the area before determining a decision;
- Consider flood risk as one of a number of policies that in tandem can provide mechanisms to deliver sustainable developments with multiple benefits;
- Engage with developers and local regulators throughout the development process to develop and instigate initiatives for the reduction of flood risk;
- Require flood risk assessments in accordance with PPS25 guidelines.

13.9 Site Specific Flood Risk Assessments at Potential Development Allocations in Cherwell

13.9.1 The requirements for site specific FRAs across the Cherwell District will vary depending on the location of the site. The settlement tables included in Appendix K outline if a site specific FRA is required. Table 13-1 below gives more detail on site specific FRA requirements in areas where there are known flooding issue.

Flooding from Rivers, Land, Groundwater and Artificial Sources

Table 13-1: FRA Guidance for potentially 'at risk' sites in Cherwell

Settlement	Background	Site Specific FRA requirement
Banbury	Until the Banbury Flood Alleviation Scheme is implemented there is little scope for consenting development within the arterial flood envelope without conflicting with the EA. In practice there is little scope for flood compensation schemes. Development within the floodplain of the River Cherwell would only be permitted where a robust flood compensation scheme is provided. Overtopping and breach of the Oxford Canal is required for development sites in the vicinity of the canal. Ground water issues at the base of Crouch Hill.	A detailed level 3 FRA is required for development within the River Cherwell Floodplain to include flood compensation. Where a site is in close proximity of the Oxford Canal, the Level 3 FRA should include breach analysis. Groundwater risk to be highlighted at Crouch Hill. Defended areas will require a FRA to include assessment of risk from catastrophic failure of defences.
Bicester NE Quadrant	The modelled floodplain of the Langford Brook presents an absolute obstruction to development unless a robust compensation scheme can be delivered.	A level 2 FRA using existing data can be applied.
Bicester SE Quadrant	Refinement of the existing hydraulic modelling of the inter-relation of the Pingle Stream, River Bure and Langford Brook will be required before development will be permitted in vicinities of these watercourses.	A level 3 FRA including hydraulic modelling will be required in the vicinities of these watercourses.
Kidlington	The EA indicative floodplain map in Kidlington is based on the 1998 event. It is considered as a principle that none of these areas are suitable for development unless they have since been protected. The potential to add robust flood defence or compensation schemes in Kidlington is low. The council requires developers to consider the risk posed by breaching of the Oxford Canal for sites in close proximity. Located on flat impervious ground with limited drainage – widely affected by groundwater flooding.	Where EA modelled data is available a level 2 FRA can be completed using existing modelled flood levels. Where no data is available a Level 3 FRA including hydraulic modelling may be required for sites in close proximity to the Rowell Brook or the River Cherwell. Where a site is in close proximity of the Oxford Canal, the Level 3 FRA should include breach analysis. A level 2 FRA to include detailed assessment of groundwater flood risk should be included at all sites. Defended areas will require a FRA to include assessment of risk from catastrophic failure of defences.

Table 13-1: FRA Guidance for potentially 'at risk' sites in Cherwell (cont)

Settlement	Background	FRA requirement
Cropredy	There is generally limited scope for acceptable flood compensation schemes in Cropredy. Overtopping and breach of the Oxford Canal could lead to discharges to the fluvial floodplain.	Level 3 FRA required to establish the extent of flood plains. The Level 3 FRA should consider how any discharges from the Oxford Canal could affect subject development.
Shipton on Cherwell	Overtopping and breaches of the Oxford Canal would lead to discharges to the fluvial flood plain.	Where future development could be affected by a breach a detailed FRA should be included. A level 1 may be applied to agree the scope with the EA, then a Level 3 using modelling be submitted.
Somerton	As it passes through Somerton and Thrupp the Oxford Canal contains some perched sections with side ditches which if breached could cause some local flooding.	Where future development could be affected by a breach a detailed FRA should be included. A level 1 may be applied to agree the scope with the EA, then a Level 3 using modelling be submitted.
Hook Norton Bodicote Steeple Aston	Hook Norton has limited scope for flood compensation schemes. Parts of these settlements lie in steep sided valleys with the potential for groundwater flooding and land drainage issues.	At Hook Norton a level 3 FRA is required to establish extent of flood plains. This should include an assessment of groundwater flooding. Bodicote and Steeple Aston should include a level 2 FRA with detail on groundwater flooding and land drainage.
Ambrosden Launton Fencott Murcott Wendlebury Weston on the Green Noke Oddington	There is generally limited scope for acceptable flood compensation schemes in these villages. Located on low lying impervious ground, there may be limited land drainage and a presumption against the use of soak aways unless there is justification through robust design.	Level 3 FRA required to establish the extent of flood plains. Detailed groundwater and land drainage assessment required as part of the FRA.
Adderbury Bloxham Yarnton Islip Lower Heyford Tadmarton	There is generally limited scope for acceptable flood compensation schemes in these villages.	Level 3 FRA required to establish the extent of flood plains.
All settlements	All settlements that contain non-main rivers or ditches could incur flooding.	The greater the potential flood risk assessed by potential flows etc the greater the level of detail required in a FRA. A level 1 scoping study should be used to detail scope of full FRA required in agreement with the EA.

Table 13-1: FRA Guidance for potentially 'at risk' sites in Cherwell (cont)

Settlement	Background	FRA requirement
Stoke Lyne Godington Fringford	These sites fall within the jurisdiction of the Internal Drainage Board. The council expects a FRA for any proposed development within the Internal Drainage Board Area.	The level of FRA required should be agreed with the IDB.
Upper Heyford	Geology of porous shale leading to potential land drainage issues.	A level 2 FRA to include details of land drainage infrastructure should be included.
Arncott Blcakthorn Charlton on Otmoor Caulcott	Located on low lying impervious ground, there may be limited land drainage and a presumption against the use of soak aways unless there is justification through robust design.	A level 2 FRA to include details of land drainage infrastructure should be included.
Mollington	There is considerable spring activity in Mollington.	A level 2 FRA to include details assessment of how springs could affect the development or how the development could impact on spring activity is required.

Flooding from Sewers

13.9.2 All developments will require an assessment of the residual capacity of the surface water system that they propose to discharge to. It needs to be shown that the system has sufficient residual capacity so as not to surcharge up to the 1 in 30 year event and for events of higher severity the council will expect there to be confirmed overland flow routes so that surcharged waters can flow at no detriment to existing or proposed development before returning to an adequate drainage system.

1.1.3 All developments will require an assessment of the residual capacity under flood conditions of any foul sewerage system to which it is proposed the development may be connected. Such assessment will have regard to any recorded flooding as well as a hydraulic analysis of the systems concerned.

13.10 Site Specific Flood Risk Assessments at Potential Development Allocations in West Oxfordshire

13.10.1 The requirements for site specific FRAs across the West Oxfordshire District will vary depending on the location of the site. The settlement tables included in Appendix K outline if a site specific FRA is required. Table 13.2 below gives more detail on specific FRA requirements in areas where there are known flooding issue.

Table 13.2: FRA Guidance for potentially 'at risk' sites in West Oxfordshire

Settlement	Background	FRA requirement
Witney	Development within the floodplain of the River Windrush would only be permitted where a robust flood compensation scheme is provided.	For development sites located adjacent to the River Windrush and its tributaries a Level 2 or 3 FRA will be required, to establish the extent of floodplains depending on the availability of modelled data from the EA.
Carterton	Carterton has experienced surface water flooding throughout the town. The Shill Brook flowing along the western border has flooding issues downstream.	Development sites adjacent to the Shil Brook require a Level 3 FRA with hydraulic modelling to establish the extent of flood zones. An assessment of surface water flood risk should be made at all development sites as part of a Level 2 FRA.
Charlbury	The majority of Charlbury is located in Flood Zone 1. However, flooding of the River Evenlode has been experienced at Dyers Hill Bridge. Flood records show that surface water flooding has been an issue in Charbury, especially in July 2007 when a number of properties across Charlbury were affected. The steep gradients of the land in Charlbury have exacerbated this problem.	For development sites located adjacent to the River Evenlode a Level 2 or 3 FRA will be required, to establish the extent of floodplains depending on the availability of modelled data from the EA. FRAs in Charlbury should include an assessment of surface water flooding and impact in increased impermeable area.
Chipping Norton	The majority of Chipping Norton is located in Flood Zone 1.	FRA should include assessment of surface water flooding and impact in increased impermeable area.
Eynsham	Barnard Gate, Station Road and the recreation ground have experienced flooding due to the Chil Brook. Groundwater flooding has not been noted. There are some instances of surface water flooding in the village but none that have inundated property.	Development sites adjacent to the Chil Brook and Eynsham Mead Ditch will require a Level 3 FRA with modelling of the watercourse to establish floodplain extents. At development sites located between the village and watercourses, an assessment of the potential impact on flow paths of surface water from existing development should be made.
Woodstock	Majority of the parish is located in Flood Zone 1. The River Glyme is located to the west of the parish. There are 3 instances of sewer flooding recorded by TW over the last 10 years.	A Level 2 qualitative FRA should be carried out to include an assessment of flood risk from surface water, groundwater and foul water systems.
Standlake	Rack End has experienced flooding from The River Windrush and some surface water flooding. There have been issues with the local foul water pumping station at Rack End. Properties on the High Street have been affected by groundwater flooding.	Sites located adjacent to the River Windrush should include a Level 3 detailed assessment of the extent of the floodplain. All development should include assessment of surface water, groundwater and foul water systems.
Long Hanborough	The River Evenlode borders Long Hanborough to the North and to the East. WODC have one record of a property claiming flood grant aid in 2007 which was	A Level 2 qualitative assessment should be carried out for development sites to include assessment of risk from surface

Table 13.2: FRA Guidance for potentially 'at risk' sites in West Oxfordshire

Settlement	Background	FRA requirement
	located in Flood Zone 1.	water, potential impact on flow paths, groundwater and foul water systems.
Milton under Wychwood	Properties in the Heath have been affected by flooding from the Littlestock Brook. There have also been some instances of surface water flooding at the pub on the green and by the petrol station where flooding of the road occurs.	Development sites adjacent to the Little Stock Brook will require a Level 3 FRA to include modelling to establish the extent of the floodplain. An assessment of surface water flooding should be made at all sites as this is a sensitive catchment. Reference to the parish flood defence report should be made.
Shipton Under Wychwood	Shipton under Wychwood has experienced wide scale flooding from the River Evenlode. There has also been instances of surface water flooding along Church Street and at Blenheim Cottages. Issues regarding the foul water capacity exist.	Development sites need to include a Level 2 FRA with assessment of foul water capacity and surface water flooding with regard to potential flow paths. Reference should be made to the parish flood defence report and historical records of flood extents in the July 2007 flood.
Ascott Under Wychwood	Ascott under Wychwood has experienced wide scale flooding from the River Evenlode. Surface water flooding has been an issue along the High Street and London Road.	Development sites should include a FRA with reference to the WODC parish flood defence report. Particular reference should be made to surface water flooding, and impact on flow routes and any increase to impermeable areas in a sensitive catchment.

Flooding from Sewers

13.10.2 All developments will require an assessment of the residual capacity of the surface water system that they propose to discharge to. It needs to be shown that the system has sufficient residual capacity so as not to surcharge up to the 1 in 30 year event and for events of higher severity the council will expect there to be confirmed overland flow routes so that surcharged waters can flow at no detriment to existing or proposed development before returning to an adequate drainage system.

13.10.3 All developments will require an assessment of the residual capacity under flood conditions of any foul sewerage system to which it is proposed the development may be connected. Such assessment will have regard to any recorded flooding as well as a hydraulic analysis of the systems concerned.

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Appendix A: Maps – Constraints Overviews

Appendix B: Detailed Mapping - CDC Settlements

Appendix C: Detailed Mapping– WODC Settlements

Appendix D: Detailed Mapping - Minerals & Waste Sites

Appendix E: Upper Thames Policy Unit CFMP

Appendix F: Data Record

Appendix G: Principal Contacts

Appendix H: GIS Layers

Appendix I: SuDS Review

Appendix J: How to Maintain and Update the SFRA

Appendix K: Proposed Development Tables

Appendix L: Level 2 SFRAs