South Derbyshire District Council
Level 1 Strategic Flood Risk Assessment

Final Report
November 2008




Prepared for:

South Derbyshire District Council

Revision Schedule

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Rev	Date	Details	Prepared by	Reviewed by	Approved by
D01	16/06/08	Interim Draft	**Gemma Costin** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Damon O'Brien** Technical Director
D02	21/07/08	Draft	**Gemma Costin** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Damon O'Brien** Technical Director
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Abbreviations

AA	Appropriate Assessment
AAP	Area Action Plan
ABI	Association of British Insurers
AMR	Annual Monitoring Report
ASCCUE	Adaptation Strategies for Climate Change in the Urban Environment
AVDC	Amber Valley District Council
BHS	British Hydrological Society
BW	British Waterways
CAMS	Catchment Abstraction Management Strategy
CBHE	Chronology of British Hydrological Events
CFMP	Catchment Flood Management Plan
DC_IC	Derby City Council
DC_OC	Derbyshire County Council
DCLG	Department of Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EMRA	East Midlands Regional Assembly
EU	European Union
FRA	Flood Risk Assessment
FZ	Flood Zone
GIS	Geographical Information System
HA	Highways Agency
HMA	Housing Market Area
HMSO	Her Majesty's Stationary Office
LDD	Local Development Document
LDF	Local Development Framework
LDS	Local Development Scheme
LPA	Local Planning Authority
MDSF	Modelling and Decision Support Framework
MOD	Ministry of Defence
OFWAT	Office of Water Services
PCPA	Planning and Compulsory Purchase Act 2004
PDL	Previously Developed Land
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
PUA	Principal Urban Area

RBD	River Basin District
RBMP	River Basin Management Plan
RDDLP	Revised Deposit Draft Local Plan
RFRA	Regional Flood Risk Appraisal
RPG	Regional Planning Guidance
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SCP	Sustainable Communities Plan
SDDC	South Derbyshire District Council
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SFRM	Strategic Flood Risk Mapping
SoP	Standard of Protection
SPG	Supplementary Planning Guidance
SRS	Sub Regional Strategy
STW	Severn Trent Water
SuDS	Sustainable Drainage Systems
SW	Scott Wilson
SWMP	Surface Water Management Plan
TCSA	Three Cities Sub Area
UDP	Unitary Development Plan
UKCIP	United Kingdom Climate Impacts Programme
WAG	Welsh Assembly Government
WRc	Water Research Centre
WCS	Water Cycle Study
WFD	Water Framework Directive

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 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 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) recommend 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 this 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 'Level 1' of the South Derbyshire SFRA, which has been commissioned by South Derbyshire District Council (SDDC).

Flood related planning policy at national, regional and district levels has been collated and tabulated. This serves to highlight the fact that flood risk is taken into account at every hierarchical level within the planning process and also helps to demonstrate how the SFRA will feed into SDDC's LDF process. SDDC have not yet identified specific strategic development locations and the SFRA is designed to inform this decision-making process.

The main source of flood risk policy and strategy within the sub-region are Catchment Flood Management Plans (CFMPs). As well as highlighting the flood risks within a catchment, CFMPs also outline policies for dealing with flood risk management at various locations within a catchment.

PPS25 requires that, as part of any SFRA, all sources of flooding are identified. In order to assess the risk of flooding, the Environment Agency (EA) has provided data and has been closely involved with the SDDC SFRA. In addition, other key stakeholders have been consulted and those that have provided data include Severn Trent Water (STW), Derbyshire County Council (DCoC), and local parish councils. From historical flood records, and using other sources of flood risk information, five main sources of flood risk were identified: fluvial flooding, sewer flooding, surface water flooding, groundwater flooding and flooding from artificial sources.

The catchments of the River Trent, River Dove, and River Derwent are the main hydrological influences of the study area.

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. 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 all areas that fall outside of Zones 2 and Flood Zone 3a and b. Whilst fluvial and tidal flooding is not a major 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 flood event and is based upon a combination of broadscale modelling provided by the EA and detailed modelling.

Flood Zone 3a is the outline for the 1 in 100 year fluvial flood event and is the part of Flood Zone 3 that is outside Flood Zone 3b (the functional floodplain). It is based upon broadscale and detailed modelling.

Flood Zone 3a has been determined with an allowance for climate change. 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.

Flood Zone 3b is the area of land falling within the 1 in 20 year floodplain (or 1 in 25 year agreed in conjunction with the EA and LPA) or land that is designed to flood within an extreme event and is termed functional floodplain (FFP). The 1 in 25 flood outline has been used to define the FFP where available. For reaches where this is not available, the 1 in 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, moreover that the boundary of the FFP falls somewhere within that area as recommended by the EA.

Approximately 21% of the administrative area of SDDC falls within Flood Zones 2 and 3 (with 18% in Flood Zone 3 alone). The SFRA Flood Zones show that the areas that are potentially at risk of flooding are along the River Trent corridor and narrow strips of land immediately adjacent to other watercourses, which is due to the well-defined channels of the watercourses in the study area and their relatively small size. The majority of flood zones are rural areas, and therefore in general the flood risk within South Derbyshire is not considered to be significant. However, urban locations within the study area that are potentially affected by flooding include Shardlow, Findern, Hilton, Hatton and Scropton. In addition, there are numerous other settlements in the study area that have smaller areas at risk of fluvial flooding.

Sewer flooding was identified using historical records from the STW sewer flooding DG5 database detailing the total number of flood events that affected both internal and external property. The number of recorded sewer flooding events varies across the region and due to the rural nature of the study area and the format in which data was provided (4/5 digit postcode areas), it is difficult to pin-point specific areas in which sewer flooding is a particular issue. The DG5 data supplied by STW when displayed graphically, indicates that approximately 90% of the study area has experienced sewer flooding, based on the 4/5 digit postcode data.

No records of groundwater flooding were found during the course of the study. However, there are minor aquifers with more permeable superficial deposits overlying them within the study area. Following periods of sustained rainfall, there may be a potential for groundwater flooding to occur.

Consultation with the EA, and SDDC, along with other flood risk studies has revealed that there are structures and embankments (either purpose built or natural) that contribute to flood risk management, although these may not all be depicted graphically on the mapping carried out for this SFRA, as NFCDD (and hence the EA Defences GIS layer) is continuously being updated. The EA maintain and keep records of many of the defences in the district, though it should be noted that there are a great deal more "private" or "non-maintained" structures and embankments that may provide a level of protection to areas. The standard of protection for defences within the study area varies markedly specific schemes having a Standard of Protection (SoP) of between 1 in 25 years to 1 in 100 years.

CFMPs have identified an increased level of flood risk to the district 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 the United Kingdom Climate Impacts Programme (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. These areas can sometimes be most effective when placed alongside development in water corridors (e.g. along canals). Groundwater Vulnerability (GWV) data was collected for this study. GWV refers to the potential for contamination of groundwater, rather than groundwater flooding, and can be used to identify areas suitable for particular SuDS techniques.

Using information and analysis gathered during the planning policy and flood risk reviews, a strategic overview of flood risk was carried out to identify potential conflicts between development pressures and flood risk now and in the future. The draft Regional Spatial Strategy (RSS8) outlines the housing provision targets for South Derbyshire and suggests an increase of 605 units per annum between 2001 and 2026. The draft RSS stipulates that at least 60 % of housing is located on previously developed (brownfield) land.

Maps were produced to undertake local level assessments by 'zooming in' on areas or settlements as requested by SDDC. These assessments present all of the available flood risk information for a local area. The maps and main issues in each area are presented as summaries to the side of the maps. The purpose of the local assessments is to identify where future strategic level development sites could potentially be located. In addition, the maps can be used to identify the requirements for, and also inform, site-specific FRAs for future development. Guidance on undertaking site-specific FRAs is provided in the report.

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 South Derbyshire 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 (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.

1 Introduction

1.1 Background

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.

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

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 and to use their findings to inform land use planning. In June 2008, the Planning Policy Statement 25: Development and Flood Risk Practice guide was released, and supersedes the Planning Policy Statement 25: Development and Flood Risk a "Living Draft". The new PPS 25 Practice Guide sets out the requirements of an SFRA and their recommended approach and has been adhered to by this SFRA.

To assist LPAs in their strategic land use planning, SFRAs should present sufficient information to enable LPAs to apply the Sequential Test to their proposed development sites:

> "The Strategic Flood Risk Assessment is at the core of the PPS25 approach. It provides essential information on flood risk, taking climate change into account, that allows the local planning authority (LPA) to understand the risk across its area so that the Sequential Test can be properly applied.".*"*
> *(PPS25, 2008, 43*)

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 should be widened. This increased scope SFRA is referred to as a Level 2 SFRA. ..."*
> (*PPS25, 2008:45*)

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

1.2 The South Derbyshire SFRA

South Derbyshire is a predominantly rural district located to the south west of Derby and north east of Burton upon Trent). The main urban area within South Derbyshire is Swadlincote, with other key settlements including Aston-on-Trent, Etwall, Hatton, Hilton, Melbourne, Repton and Willington. In total the administrative area of South Derbyshire covers 337 km^2. The majority of the area in close proximity to Swadlincote falls within the National Forest, with large areas of the forest classed as Green Belt.

South Derbyshire is covered by the Three Cities Sub Regional Strategy (SRS) and falls within the Derby Housing Market Area (HMA). South Derbyshire is the "fastest growing district in Derbyshire"[1], with major development proposed for Swadlincote and on the south western fringes of the City of Derby

The spatial planning of any proposed development must be considered with regard to the current and future risk of flooding from a number of sources, including fluvial, surface water, artificial sources and groundwater. 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 The SFRA Structure

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 and SFRA process sufficient to inform and update decisions regarding development sites. The two stages are:

- Level 1 SFRA – Enables application of the Sequential Test,
- Level 2 SFRA – Increases scope of SFRA for sites where the Exception Test is required.

The results of the SFRA will enable SDDC to review the potential development sites and to inform the scope of the Sustainability Appraisal (SA).

1.3.1 Level 1 SFRA

The Level 1 SFRA (this report), should present sufficient information to enable the LPA to apply the Sequential Test to potential development sites and assist in identifying whether the application of the Exception Test will be necessary.

The objective of the Level 1 SFRA is to collate and review available information on flood risk for the study area. Information has been sought from a variety of stakeholders including the Environment Agency (EA), SDDC, Derbyshire County Council (DCC), Highways Agency (HA), British Waterways (BW) and Severn Trent Water (STW). In addition to the review of data and consultation with local stakeholders, the Level 1 SRFA also considers any available data needed to meet the requirements of a Level 2 SFRA. Where necessary the report identifies works beyond the critical scope that may benefit the assessment.

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 LPA and relevant stakeholders, within the timeframe available. The Level 2 SFRA will enable the contacts and relationships

[1] East Midlands RSS, March 2005

with key stakeholders developed in the undertaking of the Level 1 SFRA to continue to assist in providing data and information for the Level 2 SFRA.

The Level 1 SFRA should be used by the LPA, together with other evidential documents to undertake Sequential Testing. This will help to identify where sites can be located in areas with lesser flood risk and this may require further investigation through a Level 2 SFRA.

1.3.2 Level 2 SFRA

The Level 2 SFRA will provide sufficient information to facilitate the application of the Exception Test, where required. This will be based on information collected for the Level 1 SFRA and additional works where necessary.

1.4 The SFRA Aims & Purpose

The main aims and purpose of the South Derbyshire SFRA as set out in the brief dated January 2008 are:

1. To identify areas that are at risk of flooding from all sources for all Flood Zones now and under climate change scenarios,
2. To identify variations in the actual flood risk in a given area, according to land use, with particular attention to tree planting within the national forest, now and under climate change scenarios,
3. To identify the effect of the increase in surface water run off from proposed developments, for all zones identified in PPS25, and any areas where the receiving system is known to be inadequate, now and under climate change scenarios, and to identify area of potential use of SuDS,
4. To identify opportunities to restore the natural floodplain through removal of redundant structures and for habitat enhancement opportunities,
5. To assess the standard of defence, condition and maintenance regime of flood defence structures in the district and any flood warning area and emergency planning procedures,
6. Assess the impact of any defence failures and identify any rapid inundation zones,
7. To assist in the production of policy regarding windfall sites, Brownfield development adjacent to watercourses and guidance on the Sequential and Exception Tests.

This Level 1 SFRA and other planning policy requirements will be used to identify future development sites. Any additional sites that require further investigation, following this SFRA, may need to be considered with site specific FRAs.

2 Study Area

The study area comprises the administrative area of SDDC and covers a total area of 337 km^2. The main land use within the district is agriculture. This occupies 71% of district land use and reflects the districts predominantly rural nature. The district is at the heart of The National Forest where, in just ten years, almost seven million trees have already been planted. Approximately 38% of the district falls within the national forest, and much of that land is subsequently classed as Green Belt (approximately 7.1% of the district). The district is characterised by extensive tracts of countryside interspersed with a number of villages and hamlets. Melbourne is one of the larger villages along with Etwall, Linton, Hatton and Willington, with Swadlincote being the major urban area.

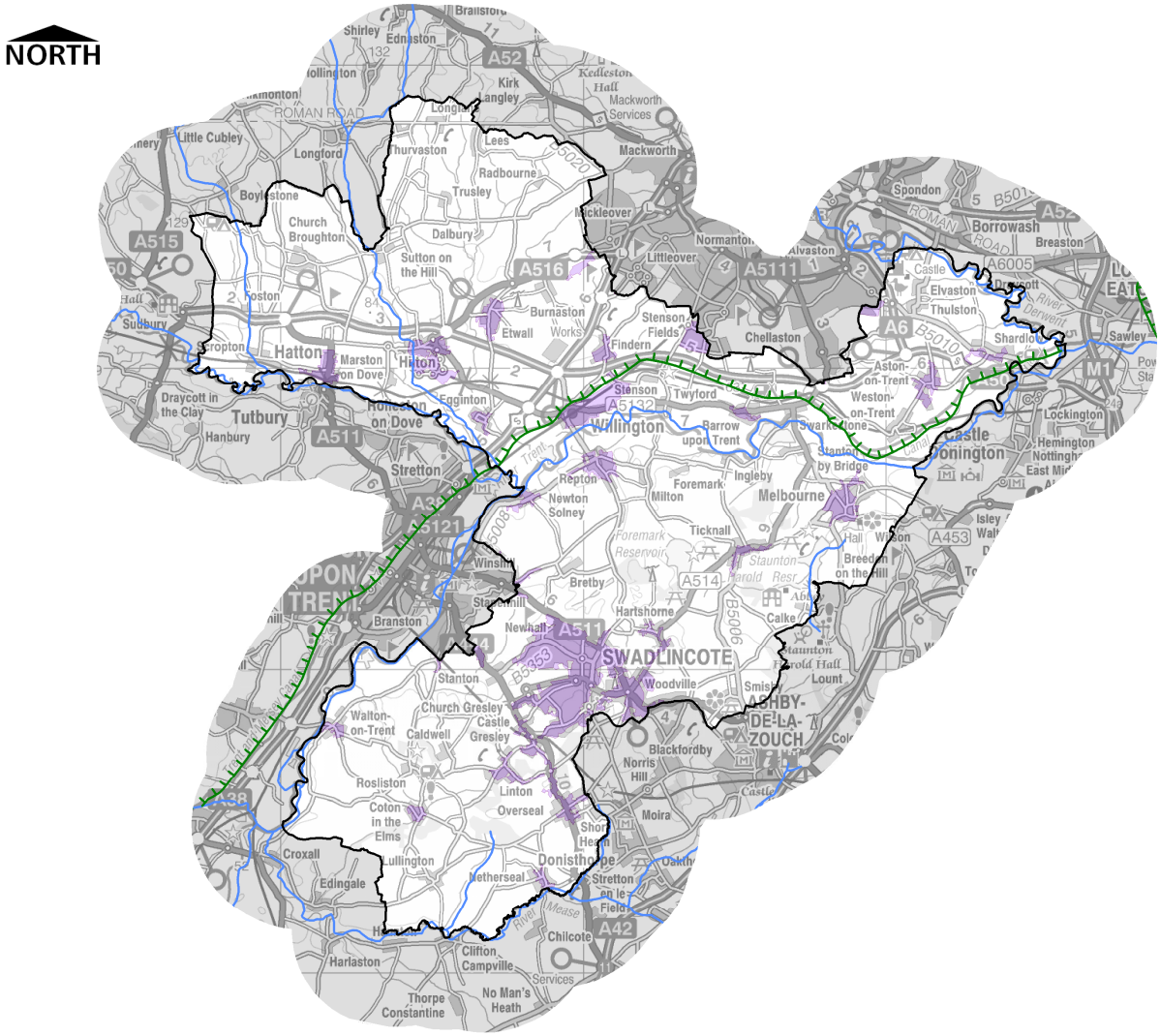

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Figure 2-1: Study Area

2.1 Historical Flooding

There have been numerous historical flood events in the South Derbyshire study area. These events are summarised by catchment in Table 2-1 with the causes and effects presented (where available). The EA were contacted regarding historic flood events and supplied their historic flood map. SDDC supplied numerous detailed maps showing key locations where flooding has been recorded, with dates unspecified. SDDC also supplied a number of FRAs which contained information regarding previous flood events. The aforementioned data, together with data from the River Trent Catchment Flood Management Plan (CFMP) and British Hydrological Society Chronology of British Hydrological Events (BHS CBHE) database[2], were used to produce Table 2-1.

Flooding from other sources is also important, with responses from STW indicating flooding hotspots across the study area. These hotspots have been provided to SDDC as a spreadsheet.

Table 2-1: Historical Flooding

Date	Watercourse(s) and Location(s)	Source of Flooding and Impact	Source of information
Nov 1587	Trent and Derwent	Fluvial flooding, vast areas of floodplain inundated	CBHE
Jun 1754	Trent and Dove	Fluvial flooding, vast areas of floodplain and homes inundated	CBHE
Nov 1768	Trent, Derwent and Dove	Fluvial flooding, vast areas of floodplain inundated	CBHE
Feb 1795	Trent, Burton area	Extensive fluvial flooding effecting land and homes. Worst event on record (1:500yr)	Draft Trent CFMP
Oct 1875	Trent, Derwent and Dove including Burton	Fluvial 1:200 yr event. Extensive flooding	Draft Trent CFMP
Apr 1883	Derwent, Elvaston area	Fluvial	CBHE
Sep 1883	Derwent, Elvaston area	Fluvial	CBHE
Oct 1885	Derwent, Elvaston area	Fluvial	CBHE
Mar 1886	Derwent, Elvaston area	Fluvial	CBHE
May 1886	Derwent, Elvaston area	Fluvial	CBHE
Jan 1887	Derwent, Elvaston area	Fluvial	CBHE
Dec 1888	Derwent, Elvaston area	Fluvial	CBHE
Oct 1892	Derwent, Elvaston area	Fluvial	CBHE
May 1932	Trent, Derwent, including the Burton area	Fluvial	Draft Trent CFMP
Mar 1947	Trent, Burton area	Fluvial following thaw of ice and snow	Draft Trent CFMP
Nov 1957	Salt Brook, Hilton	Fluvial	Dove scoping study
Dec 1960	Trent, Burton area	Fluvial	Draft Trent CFMP
Jan 1982	Trent, Burton and surrounding villages	Fluvial	Draft Trent CFMP
Dec 1991	Dove	Fluvial	Dove Scoping study

[22]British Hydrological Society, Chronology of British Hydrological Events, Online Database, University of Dundee. http://www.dundee.ac.uk/geography/cbhe/[2]

Table 2-1: Historical Flooding (continued)

Date	Watercourse(s) and Location(s)	Source of Flooding and Impact	Source of information
Nov 2000	Trent, Salt Brook, Dove, Willington, Scropton, Hatton, Egginton, Hilton, Barrow on Trent, Swarkestone, Shardlow	Fluvial and surface water flooding. 182 homes flooded in Hilton 1:25yr to 1:50yr event	Draft Trent CFMP /local paper
Jul 2007	Trent, Swarkestone	Fluvial and surface water	Local paper
Mar 2007	Trent, Swarkestone	Fluvial and surface water	Local paper
Jan 2008	Trent, Swarkestone, Willington	Fluvial and surface water, Heavy rain led to flooding of ditch on B5008	Local paper, Willington Parish Council
-	Swadlincote Tennyson Avenue and Woodlands	Overland flow/surface water. Roads and properties flood.	SDDC
1981	Trent, Willington	Fluvial estimated 1:10yr to 1:25yr event	EA letter for FRA
-	Egginton	Major flooding occurred prior to the construction of flood banks in the 1960's. There is no evidence of major flooding since. However it is believed that there is potential for major flooding, and indeed roads are known to flood cutting of Egginton.	SDDC
-	Repton	Flooding at 'The Square' as a result of surface water runoff as highway drainage cannot cope.	SDDC
-	Barrow upon Trent / Twyford	Church Lane in Barrow on Trent floods adjacent to River Trent. Twyford has extensive history of flooding.	SDDC
-	Aston on Trent	Flooding to fields in Aston on Trent. Flooding to houses on eastern fringe caused by backing up watercourse. History of highway flooding.	SDDC
-	Findern	Flooding caused due to runoff at houses to south of Doles Brook. Highway flooding in south village.	SDDC
-	Melbourne	Houses adjacent to Robinsons Lane have flooded due to torrential rain. History of flooding from combined sewer on Station Road.	SDDC
-	Shardlow	Houses flood on 'The Wharf' (surface water flooding.	SDDC
-	Hatton	Flooding north of railway caused by Foston Brook, Scropton Brook and River Dove. Flooding to south of railway caused by River Dove alone.	SDDC
-	Scropton	River Dove causes residual risk of flooding in Scropton from Foston Brook.	SDDC
-	Rosliston	Flooding on Main Street.	SDDC
-	Weston on Trent	Highway flooding on Kings Mill Lane.	SDDC
-	Castle Gresley	Flooding at Toons Furniture caused by invert levels of railway culvert.	SDDC
-	Stanton by Newhall	Village Hall, two bungalows and a garage have previously flooded from the adjacent watercourse.	SDDC

Table 2-1: Historical Flooding (continued)

Date	Watercourse(s) and Location(s)	Source of Flooding and Impact	Source of information
-	Hartshorne	History of flooding on Brook Street, flooding attributed to both fluvial flooding and surface water runoff. History of surface water runoff causing flooding near Gosley Dale.	SDDC
-	Ticknall	Flooding caused by surface water runoff, with water collecting in a low spot on Main Street, with consequential flooding of houses on Main Street.	SDDC
-	Willington	Sands Brook causes flooding to Repton Road.	SDDC
Summer 2007	Burnaston, Etwall Lane	Highway flooding from runoff from fields	Burnaston Parish Council
Jun 2007	Calke Abbey	Flash flooding of highway, surface water flooding	Calke Parish Council
Jun/Jul 2007	Walton on Trent	Flooding from watercourse	Walton on Trent Parish Council
Sep 2004	Willington	Intense rainfall led to surface water and highway flooding	Willington Parish Council

2.2 Flood Sources and Flood Defences

2.2.1 Fluvial

The majority of the District is drained by the River Trent and its tributaries the River Dove and River Derwent. The northwest part of the District is drained by the River Dove, and the River Derwent flows along the extreme east of the District. The River Mease flows through a small section of the south of the study area near the village of Netherseal.

There are also numerous smaller watercourses in the district which are shown in Table 2-2.

Table 2-2: Local watercourses

Cuttle Brook	Hooborough Brook	Salt Brook
Doles Brook	Lee Beck	Sands Brook
Egginton Brook	Longford Brook	Sapperton Brook
Etwall Brook	Main Drain	Shardlow Brook
Foston Brook	Milton Brook	Stanton Brook
Hell Brook	Old Trent Water	Sutton Brook
Hilton Brook	Repton Brook	Twyford Brook

River Trent

The River Trent bisects the study area, flowing from west to east across the centre of the district. There is a major confluence in the study area at Newton Solney where the relatively fast flowing River Dove, joins the River Trent.

The underlying geology of the River Trent catchment in the study area is predominantly mudstone, with a small area of Millstone Grit in the east of the study area. The mudstone and Millstone Grit are classified as slowly permeable.

The catchment of the River Trent within South Derbyshire is predominantly rural, with the villages of Willington, Repton, Barrow-on-Trent and Swarkestone being the main settlements within the catchment.

River Dove

The River Dove is a major tributary of the River Trent and its confluence with the River Trent is in the west of the study area at Newton Solney. The River Dove has its source high in the Peak District and flows in a southerly direction. It has several significant tributaries joining it within the district including Foston Brook, Sutton Brook and Hilton Brook. The upper catchment of the River Dove is underlain by carboniferous limestone, which is moderately permeable and consequently is relatively well drained. Although steeply sloping, the River Dove is not a flashy river. It does however have the potential to respond quickly to prolonged wet weather.

The lower reaches of the River Dove are underlain by less permeable alluvial deposits. The River Dove is relatively fast flowing compared to the slower flowing River Trent and hence in the lower reaches and particularly at their confluence there tends to be rapid sediment deposition, particularly of gravel around Monks Bridge, which can lead to flow blockage and flooding is documented in sources (including the draft Trent CFMP) as being a problem. Flooding has been a particular problem in Scropton, Hatton and Egginton. The EAs River Dove Strategy scoping report explains that fluvial flooding problems in Egginton are compounded by three bridge crossings which may exacerbate sedimentation problems and be constrictions to flood flow.

River Derwent

The headwaters of the River Derwent rise in the Dark Peak area of the Peak District and flow southwards to its confluence with the River Trent at Great Wilne, in the far east of the study area. The River Derwent is underlain by Triassic mudstone and Sherwood Sandstone in the study area which tends to give a moderate response to runoff. At times of high flow, water is pumped from the River Derwent to the neighbouring River Dove catchments Carsington Reservoir to reduce the attenuate peak flood flows. The draft Trent CFMP suggests that flooding in the lower reaches if the River Derwent may have been exacerbated by aggregate extractions which have contributed to the problem of sedimentation and blockage.

2.2.2 Groundwater

The geology of the study area is varied. To the north of the River Trent, the underlying bedrock is predominantly mudstone. This is overlain in by river terrace deposits and alluvium. The River Trent corridor itself is fringed by a belt of alluvium.

To the south of the River Trent the bedrock is more varied. To the west and far east of the study area around Burton and Repton, the study area is underlain by sandstones. The area around and including Swadlincote is underlain by Lower Westphalian Coal measures which is in turn overlain by a till and diamicton mixture. There are also outcrops of limestone within the study area, particularly around Ticknall, and a large outcrop of Millstone Grit in the east of the study area around Melbourne. This area of Millstone Grit is overlain by a till and diamicton mixture.

The Defra Strategy for Flood and Coastal Erosion Risk Management study (2004)[3] did not show any recorded instances of groundwater flooding in the study area. This does not mean that it has not occurred, or that it will not occur, just that none has been recorded in the EA records.

2.2.3 Sewers and drainage

The majority of sewers built in the last 30 years are built to the guidelines within "Sewers for Adoption" (WRC, 2006). These sewers have a design standard to contain up to the 1 in 30 year rainfall event. Therefore the majority of sewer systems will surcharge during rainstorm events with a return period greater than 1 in 30 years (e.g. 100 years). Many sewers are however much older and date back to the Victorian era and are of an unknown capacity and condition. STW has provided DG5 data for the region, which is presented as a series of points in GIS format. This data shows sewer and drainage flooding to have occurred throughout the study area, with a particular clustering of events in Swadlincote. Sewer flooding is thought to be the most common cause of flooding in the UK and yet there is limited information available on the issue.

The interim findings of the Pitt Report (June 2008) highlight sewer and drainage flooding as a key issue requiring further investigation, this should be addressed in any future site specific flood risk assessments, or informed by any emerging Surface Water Management Plan (SWMP). Any relevant additional data should be incorporated into the SFRA when it is updated.

In addition, one of the recommendations of PPS 25 guidance is to undertake a Water Cycle Study (WCS). This would include an assessment of any potential issues with the sewer and drainage network such as flooding hotspots and network capacity, and would provide a more holistic view of water issues within a district.

2.2.4 Pluvial and Overland Flooding

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. Much of the flooding experienced in 2000 in the River Dove, River Trent and River Derwent catchments and summer month flooding can be attributed to pluvial/surface water flooding following prolonged intense rainstorms. 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 (i.e. garden loss and reuse of brownfield sites). As a result, continuing development could mean that pluvial/surface water flooding can become more frequent and although not on the same scale as fluvial flooding, it can still cause significant disruption.

2.2.5 Artificial Sources

The Trent and Mersey Canal runs parallel to the River Trent through the centre of the study area. There was one instance of flooding documented in February 2000, just east of Shardlow at the confluence of the canal, River Trent and River Derwent. The canal towpath was noted to be under several feet of water.

There are several balancing reservoirs and ponds in the study area including: Foremark Reservoir and Staunton Harold Reservoir. Reservoirs carry with them an inherent flood risk as they have a potential risk of breaching or overtopping. Further consideration of the residual risk of reservoir breach or overtopping

[3] Defra Strategy for Flood and Coastal Erosion Risk Management Groundwater Flooding Scoping Study (LDS 23) (May 2004)

should be considered as part of a Level 2 assessment or a site specific FRA (under review of a panel engineer), where SDDC are minded to allocate development to the downstream of reservoirs.

2.2.6 Flood Risk Management Infrastructure

There are several flood risk management schemes in operation throughout the study area. These offer varying standards of protection (SoP). There are currently flood risk management schemes in operation at Egginton, Scropton, Willington, Ambaston, on the River Derwent to the north of Elvaston, Shardlow, and the recently completed (2005) flood risk management scheme in Hatton, which offers a SoP of 1 in 100 years. Discussions with SDDC and the EA suggest that the SoP of defences in Egginton are notionally 1 in 25 years and in Scropton the River Dove defences are predominantly 1 in 100 years, with a SoP of 1 in 50 years in parts. The scheme at Hatton is on Salt Brook, a tributary of the River Dove and involved channel clearance and widening to a two stage profile and replacement of inadequate culverts. Defences can be seen in Figure 2-2 and on the broadscale mapping in Appendix E.

It should be noted that flood risk management schemes are built to a certain design standard and have a certain design life. As climate change increases peak flows, the SoP is likely to decrease alongside the natural deterioration in standard over the course of its life time due to wear and tear. In order to maximise the SoP, it is necessary to carry out regular maintenance and inspection of any flood risk management structures in the study area.

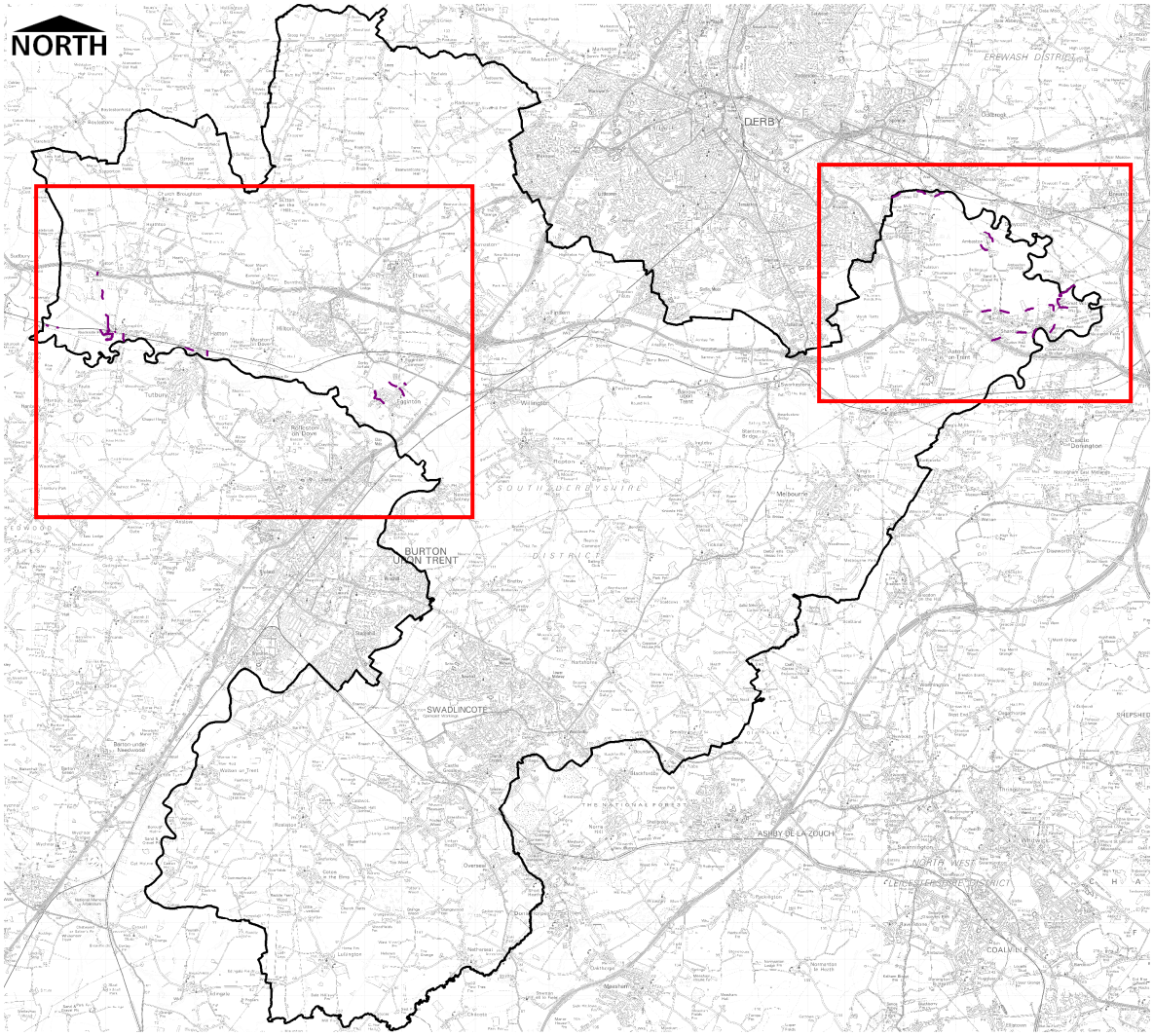

Figure 2-2: Flood Defences

2.2.7 Flood Warnings

The Civil Contingencies Bill requires that the EA 'maintain arrangements to warn the public of emergencies'. The EA are responsible for issuing flood warnings to the public based on 24 hour monitoring of rainfall, river levels and sea state (where applicable). This data is combined with weather data and tidal reports from the Met Office, including the use of radar to track storms and rainfall intensity, and data from the national tide gauge network. The warnings are issued by local radio, supplemented by direct dial telephone systems, (Floodline Warnings Direct), on www.environment-agency.gov.uk/floodwarnings which is updated every 15 minutes, and other local systems as appropriate. The EA also endeavours to raise awareness of flooding in areas prone to flooding and suggest that people living in vulnerable areas make preparations in advance.

The EA has general supervisory and other statutory duties for flood defence and flood warnings in South Derbyshire. The work carried out to meet these duties includes:

- Maintaining main river channels and flood risk management structures,
- Providing and operating a flood warning service.

The existing warning service provided by the EA applies only to flooding from rivers and the sea. Some parts of the country provide a nominal groundwater flood warning service. There is no obligation on water companies to provide warnings of flooding from sewers or drains.

The degree of advance warning that can be provided is critical to the amount of action that can be taken to prevent damage. A minimum of 2 hours advance warning is the standard currently used in England and Wales for river flooding. The ability to provide this depends on the geography of an area, the intensity of the rainfall and the type of weather systems causing the rain as these variables can act together to produce an unlikely and therefore unpredictable event.

When conditions require, the EA provide local forecasts on the possibility of flooding and determine which defences to operate and when, closing moveable defence features if necessary.

The role of flood warnings in flood risk and residual risk reduction can be either a standalone measure or in combination with built defences. Flood warning as a stand-alone measure can reduce the consequences of flooding to properties by enabling reactive action to protect life and reduce the effect of flooding on property. Flood warning in combination with built defences can protect life and reduce damage in the event of the defence level being exceeded by the severity of the flood.

The need for flood warnings in medium and highly populated areas, such as Shardlow and Newton Solney is particularly important, as the consequence of flooding in areas where people's perception of flood risk is low can be significant. In such cases flood warning needs to work closely with emergency planning to allocate potential evacuation routes and contingency plans following a flood event. The difficulties of issuing effective warnings of possible defence failure poses a significant challenge and in some cases it will not be practical to provide a reliable or timely flood warning service to an area because of the rapidity or unpredictable nature of flooding.

There are a number of flood warning areas in South Derbyshire, which aim to provide two hours lead time for flood warnings issued by the EA. However, the flashy nature of many of the smaller catchments in the area due to winter rainfall and high intensity summer thunderstorms make issuing warnings difficult. In the future, Flood Warning Areas and Flood Watch Areas will be targeted at a community or street level. This will see an increase in flood warning areas so that only communities at risk from individual events will be notified. EA flood warning areas are currently located at and are shown in Figure 2-3:

- The River Derwent from Borrowash to Church Wilne,
- The River Trent at Barrow,
- The River Trent at Repton and Ingleby,

- The River Trent at Shardlow,
- The River Trent at Stanton Bridge,
- The River Trent at Swarkestone,
- The River Trent at Twyford,
- The River Trent at Willington.

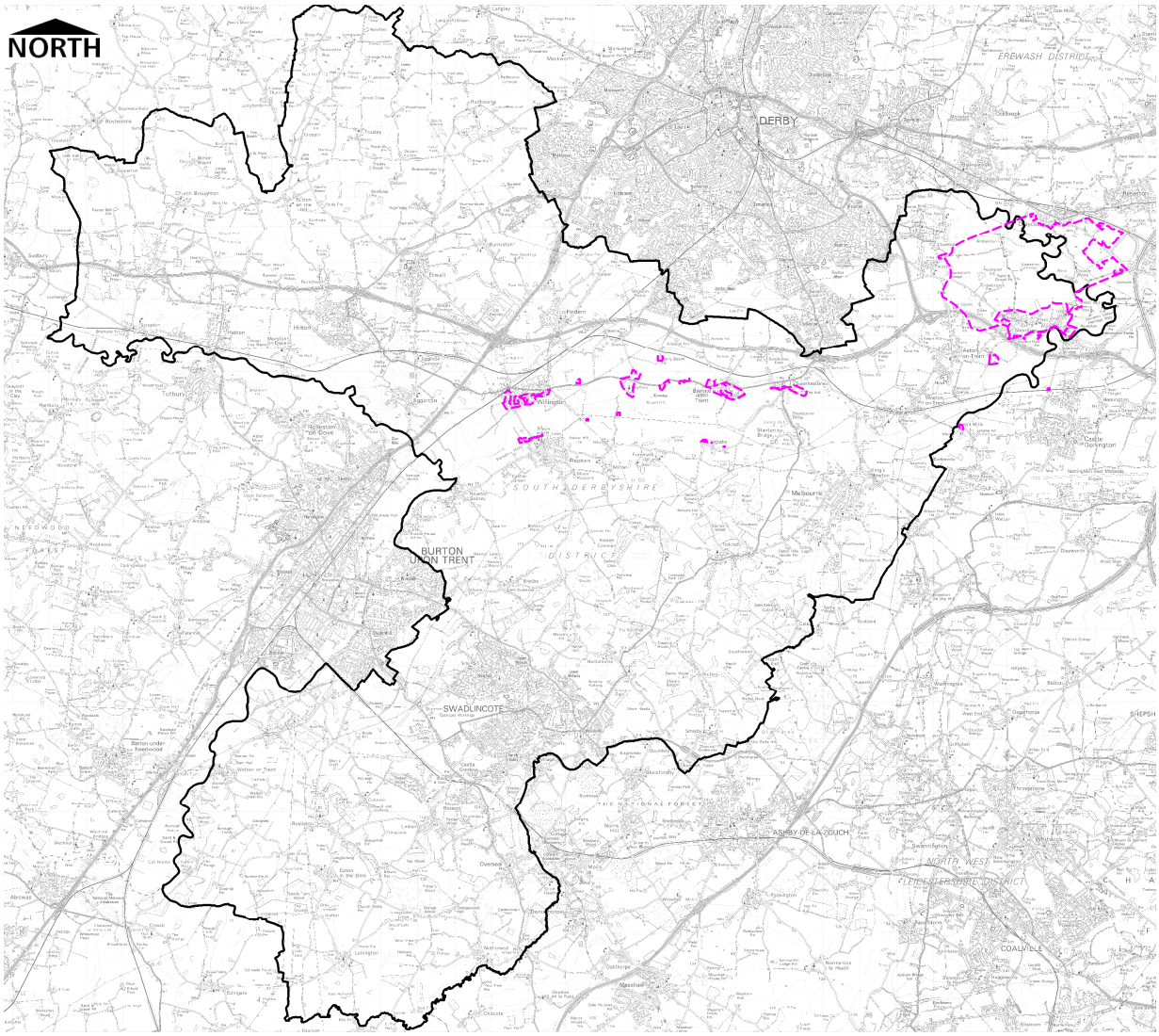

Figure 2-3: Flood Warning Areas

2.2.8 Flooding Mechanisms

Overtopping

Overtopping occurs when water passes over a flood defence. When flow exceeds the capacity of the conveying channel, the water level will rise in that channel until its banks are overtopped. Water will then spill over the channel banks and onto adjoining land. With an upland river the adjoining land is its natural floodplain, which will generally be of limited extent and fairly well defined. In a downstream river where the gradient flattens the floodplain can be much wider. Flood risk management and urban development can significantly alter natural flow paths within the floodplain area and affect the dispersion of floodwater.

Flood defences are usually designed with a degree of 'freeboard', the height by which the crest level of the defence exceeds the design flood level. Main river defences and tidal embankments are designed to have a constant freeboard above their design level so, in theory, when they are overtopped the overflow should be small in volume and of uniform depth along the full length of the defence embankment, occurring during the highest water levels at the peak of the flood. In reality the freeboard varies from point to point due to the natural subsidence of defences over time, and water heights can vary locally. Even so, the embankment acts like a weir limiting the rate of flow and volume over the embankment and limiting flooding velocities and volume to the immediate area.

Breaching

Breaching of flood embankments is one of the main causes of major flooding in lowland areas. Breaches can occur in any situation where there is a defence which has a crest raised above adjacent land levels. An earth embankment may be breached as a result of overtopping, which weakens the structure through erosion, eventually creating a breach in the defences. Breaches in embankments are more likely during high water level events. A fluvial breach in an embankment will result in the dispersal of floodwater from the channel resulting in a lowering of the water levels and flow through the breach.

The time taken for a breach to be sealed can have a major effect on the extent and depth of flooding. In addition to the flood risk associated with a breach event, there is an implied flood hazard. The highest hazard exists in the period immediately following a breach, and usually, but not necessarily, in the areas closest to the breach. Floodwater flowing through a breach will be of high velocity and volume, dissipating rapidly across large low-lying areas, and possibly affecting evacuation routes. Flooding as a result of a breach in defences can be life threatening with far reaching consequences.

Should potential development be proposed behind defences, detailed hazard mapping may be required during any Level 2 SFRA.

Mechanical or Structural Failure

Flooding may result from the failure of engineering installations such as 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.

2.3 Flood Risk Statistics

Table 2-3 summarises the main flood risk statistics within South Derbyshire.

Table 2-3: Summary of Flood Risk Statistics

Statistic	Area (km^2)	% of Area	
Total Area of SDDC Administrative Area	337.00	100%	
Area of SDDC in Zone 3 (High Flood Risk)	61.95	18.4%	of area
Area of SDDC in Zone 2 (Moderate Flood Risk)	5.74	1.7%	of area
Area of SDDC in Zone 1 (Low Flood Risk)	269.31	79.9%	of area
Total Existing Developed Area	20.14	5.98%	of area
Existing Development in Flood Zone 3	1.39	0.41%	of area
Existing Development in Flood Zone 2	0.68	0.20%	of area
Existing Development in Flood Zone 1	18.07	5.36%	of area
Drainage Problem Areas	Minimal Drainage Flooding – records show points rather than areas.		

2.4 Administrative Bodies

2.4.1 South Derbyshire District Council

The study area lies wholly within the administrative area of SDDC. Flood risk and GIS information was provided by their drainage and GIS teams.

2.4.2 Environment Agency

The study area is covered by the EA's Midlands Region, – Eastern and Central Areas. The EA Midlands Region has discretionary powers under the Water Resources Act (1991) for all Main Rivers and their associated flood defences within the study area.

2.4.3 Severn Trent Water

STW is responsible for storm and foul water management across the South Derbyshire study area. In addition, private individuals may be responsible for drainage systems that operate prior to discharge either into a watercourse or into a public (adopted) sewer network.

2.4.4 Derbyshire County Council

DC_OC were contacted as part of this SFRA and provided details of the county structure plan, and Emergency Planning documents. Their highways team were also contacted for any highways drainage information.

2.4.5 British Waterways

British Waterways were contacted for information relating to flooding associated with the Trent and Mersey Canal. They confirmed that they held no records.

2.5 Potential Development Pressures

The District of South Derbyshire covers an area of 337km^2 and is bounded to the north by the city of Derby and to the northwest by Ashbourne and the Peak District. Burton upon Trent in East Staffordshire lies immediately to the west where the River Trent and River Dove create the county boundary. On its eastern side South Derbyshire extends from the River Derwent to the east of Derby, south along the River Trent and then along the Leicestershire border. The southern boundary is shared with the counties of Warwickshire, Staffordshire and Leicestershire.

The main land use within the district is agriculture this occupies 71% of district land use and reflects the districts predominantly rural nature. However, there is significant pressure for new development, on the fringes of Derby City and Swadlincote reflecting South Derbyshire's status as the fastest growing district in Derbyshire.

In recent years significant new development has taken place in both Swadlincote and Hilton. Swadlincote is the main focus of the district and has a population of around 33,000 and is the largest settlement and commercial centre for the district which recorded a population of 89, 800 in 2006. The recent conjoined Inquiry has identified sites at Highfields Farm, Willington Power Station, Wragley Way, Boulton Moor and Stenson Fields. See Table 2-4.

The draft RSS for the East Midlands states that development within South Derbyshire is to be primarily focused on Swadlincote in the form of sustainable urban extensions where necessary. More exact development locations will only be possible after the Core Strategy, Issues and Options and Sequential Testing process has been undertaken. Development pressures vary somewhat across South Derbyshire, with most development being focussed in Swadlincote. The most significant pressure for SDDC, as it is for many LPAs across the country, comes from identifying land for new housing, particularly brownfield land.

2.5.1 Housing Land

The Derby and Derbyshire Joint Structure Plan (2001) requires the provision of 12,000 new dwellings in South Derbyshire between 1991 and 2011. For the purposes of strategic planning this is split into two distinct sub-areas – the Derby and Swadlincote sub-areas. The Joint Structure Plan requires 6,500 dwellings in the Derby sub-area and 5,500 in the Swadlincote sub-area between 1991 and 2011.

The draft RSS 8 does not maintain the sub-area approach of the Joint Structure Plan. Instead the draft RSS focuses housing development in two broad locations – sustainable urban extensions to the Derby Principal Urban Area (PUA), which should provide 255 dwellings per annum of the required 605 and Swadlincote which should provide the location for the remainder of dwellings.

Table 2-4: Regional Spatial Strategy Targets - 2001 – 2026

	Target
Mean Housing Increase	15,100
Mean Annual Increase	605
Indicative Previously Developed Land	60%

The housing trajectory (Figure 2-4) is from the South Derbyshire Annual Monitoring Report (AMR) 06-07 and sets out the housing take-up and supply in the District from 1991–2017, as at March 2007. According to the AMR, a total of 9,348 dwellings had been constructed within South Derbyshire between April 1991

and March 2007. This represents only 78% of the total requirement up until 2011 with 80% of the Plan period having elapsed. Therefore, the overall completion rate for the period 1991 – 2007 is below the annual build rate of 600 dwellings per annum required by the Joint Structure Plan. However, this trend does not apply equally across the district. The AMR indicates that both the Swadlincote sub-area and the 'non-PUA' areas currently benefit from a land supply far in excess of 5 years. Conversely, in the Derby sub-area/PUA, housing land supply falls considerably below the 5 year requirement.

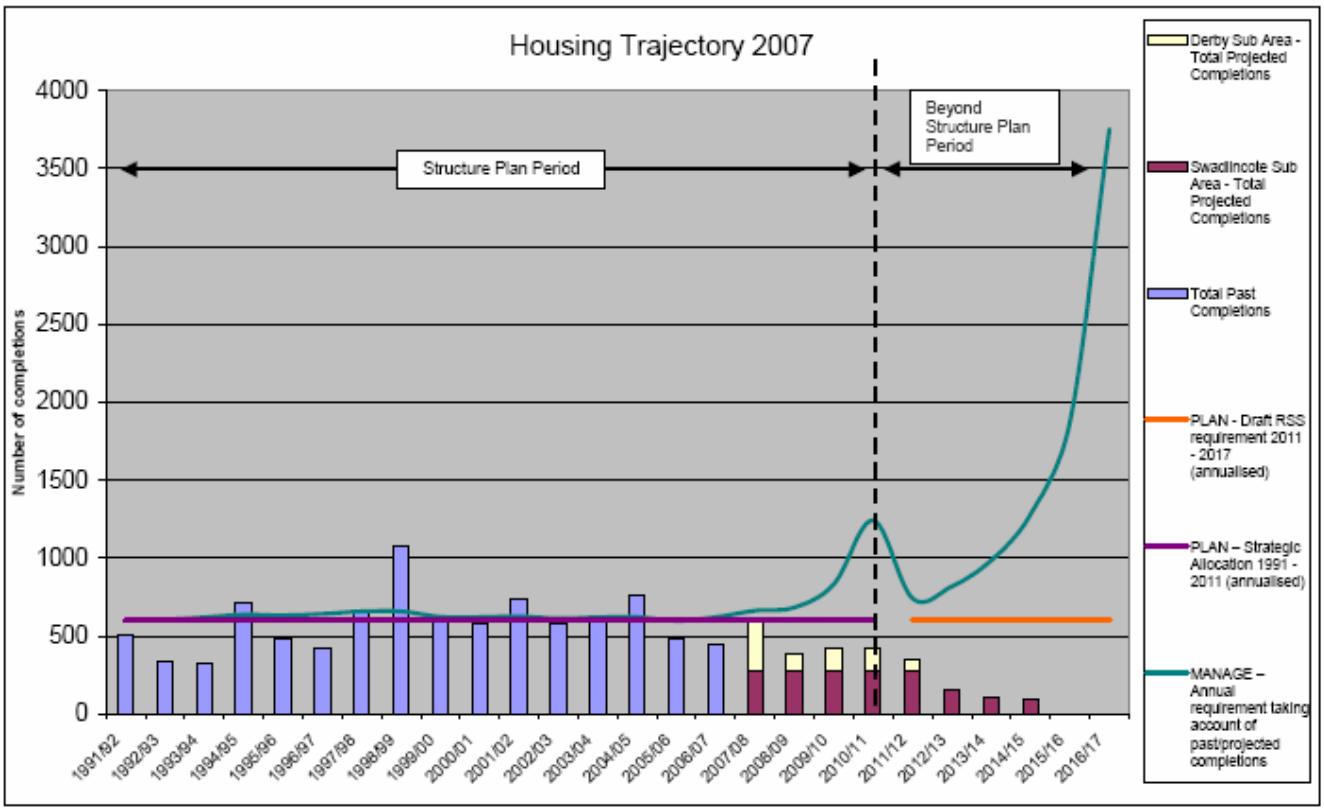

Figure 2-4 Housing Trajectory

Of the 472 dwellings that were completed within the District in 2006/07, 86% were on previously developed land (PDL). This compares to 82% in 2005/06 and 79% in 2004/05.

The shortfall in the Derby sub-area/PUA is mainly attributable to the lack of allocated sites within the northern part of the District. There remain a number of major outstanding planning applications to the north of the district, adjacent to Derby City, which were considered at a conjoined public inquiry which finished in February 2008. A decision is expected on the conjoined inquiry sites on or before 29th January 2009, and construction could commence in 2010, should permission be granted. The grant of planning permission to one or more of the sites is expected to significantly increase the supply of housing in the Derby sub-area.

Table 2-4 shows recent major planning applications within South Derbyshire.

Table 2-4: Major planning applications considered in the conjoined inquiry

Site Name	Proposed Development	Potential Flood Risk
Highfields Farm	Up to 1200 residential units, new primary school, new community facilities (including local retail units, restaurants, public house and hot food takeaway) associated infrastructure including strategic landscaping and provision of a new country park	1.07 ha of the site lies within the 1in 100 year fluvial flood plain of Hell Brook and Holly Brook. New construction of buildings will take place outside the floodplain envelope
Willington Power Station	1000 residential units, up to 10,000 square metres of Employment floor space (B1, B2 and B8) and new community facilities (including retail food store, health care facility and family restaurant, associated infrastructure including new community park, nature reserves and sports and children's play areas	Site lies outside the flood plain for the River Trent although a minor drainage channel located in the eastern part of the site could flood a small area of the site (less than 1 ha) during a 100-year event. This area is to be retained as soft landscaping
Wragley Way	Up to 850 dwellings and associated infrastructure including children's play areas, sports provision and open space	No part of the site is located within the 1in 100 year flood envelope. Although a small area (around 2 ha) of the site is located in the 1in 1000 year flood envelope although appropriate design measures will be incorporated to mitigate risk
Boulton Moor	Provision of up to 1058 dwellings, primary school, retail provision to include a general store and four further units (comprising A1 – A5 uses), public open space and sports pitches) supporting infrastructure and associated landscape works	Not subject to fluvial flood risk.
Stenson Fields	Application for 500 dwellings and the provision of a community facility and a series of linked open spaces	Not subject to fluvial flood risk
Source: South Derbyshire District Council		

The South Derbyshire Local Plan was adopted in May 1998 and includes three major housing allocations: the former Hilton MOD depot; Church Gresley and Stenson Fields. The first two of these allocations have planning permission and are under construction. Originally allocated for 1,100 dwellings, the site at Hilton has had 1,361 dwellings completed. As at 31 March 2007, the expected total number of dwellings to be built is 1,537. The continued emphasis in government guidance on making efficient use of land means that this site will provide a larger number of dwellings than initially expected.

A large allocation at Church Gresley was granted outline planning permission (for 10 years) in 2000 and the first detailed application (for 185 dwellings) was approved in March 2002. Other detailed applications have since been approved for 361 dwellings. Although construction has already commenced, it is considered unlikely that more than 477 dwellings (out of 1,000) will be completed before the end of the Plan period.

The bulk of the Stenson Fields site has been completed and an application for a further 100 dwellings on the final phase was received in January 2007. In addition, a residual area of land remains to the north of Hilton at Lucas Lane (for around 47 dwellings) as an adopted Local Plan allocation.

As noted in the introduction to the Council's AMR, an emerging Local Plan was withdrawn in May 2005. Thus, aside from the above sites, there are no development plan commitments to assist in making up the shortfall of residential land supply in the Derby Sub-Area.

Employment Land

Between 1991 and 2011, the Derby and Derbyshire Joint Structure Plan (2004) makes provision for 50 ha of employment land in the north of the district allied to Derby and 100 ha in the Swadlincote sub-area.

The draft Local Plan now withdrawn has no legal status, but is of interest as an indication of the supply position. The withdrawn Local Plan showed that between 1991 and 2004, SDDC had provided 63 ha of employment land in the Derby sub-area, exceeding the Structure Plan target. Development had started on 28 ha of this land. The remainder was due to take place on Dove Valley, where subsequently, development has taken place. For the Swadlincote sub-area, the Draft Local Plan Tetron Point is now almost complete and only land north of Occupation Lane and Woodville Woodlands remain undeveloped.

The data in Table 2-5 is taken from the South Derbyshire Employment Land Study 2007 and indicates the demand for land in the district for 2001-16. The requirement for industry and warehousing is estimated at some 29.5 ha, comprising a net growth of 9 ha and a large margin of 21 ha, reflecting the large size of the existing stock. For offices, demand and requirement are at 5 and 6 ha respectively.

Table 2-5: Employment Land Demand and Requirement, South Derbyshire, 2001-16

Net Change	Industry & Warehousing		Offices	Industry and Warehousing
	Sqm	Ha	Sqm	Ha
Forecast Demand	35, 054	8.8	21, 720	5.4
Margin	92, 900	20.7	2	0.7
Requirement	117, 954	29.5	24, 320	6.1

Source: South Derbyshire Employment Land Study 2007

The data in Table 2-6 is taken from the South Derbyshire Employment Land Study 2007 and shows the balance of supply against demand. For offices, as noted earlier the quantified supply is an insignificant -1 ha against a small forecast market requirement of 6 ha, resulting in a theoretical undersupply of 7 ha. For industrial/warehousing property, planned supply exceeds the estimated requirement by 52 ha.

Table 2-6: Market Balance, South Derbyshire, 2001-16

Net Change	Offices	Industry & Warehousing	Offices	Industry & Warehousing
	Sqm	Ha	Sqm	Ha
Supply	-3.328	325, 480	-1	81
Forecast Demand	21, 720	35, 054	5	9
Requirement	24, 320	117, 954	6	29
Over (under) supply	- 27, 648	207, 526	-7	52

Source: South Derbyshire Employment Land Study 2007

Minerals and Waste Development

When considering minerals and waste site allocations, the SFRA should be consulted to avoid locating vulnerable sites in high flood risk locations. 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. Mineral working should not increase flood risk elsewhere and needs to be designed, worked and restored accordingly. 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. Table D.2 of PPS25 classifies landfill sites as 'more vulnerable' developments, and are therefore restricted to Flood Zone 1 and Flood Zone 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 Zone 1, Flood Zone 2 and Flood Zone 3a. The sequential approach should be applied on a site level where possible to locate ancillary facilities such as processing plant and offices in areas at lowest risk of flooding. Sequential working and restoration can be designed to reduce flood risk by providing flood storage and attenuation.

The spatial strategy of 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 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.

Stockpiles and ancillary buildings could reduce the storage capacity of the floodplain. In addition, the stockpiles and ancillary buildings could alter the natural flow of the floodwater 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.

2.6 Climate Change and Future Flood Risk

PPS25 and the accompanying Practice Guide include for an increase in the peak rainfall intensity of up to 30%. This will significantly affect smaller urban catchments, leading to rapid runoff to watercourses and surface water flooding, surcharging of gullies and drains and sewer flooding.

The CFMP 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. Catchment models and the Modelling and Decision Support Framework (MDSF) software were used in the CFMP to test sensitivity to the flood risk drivers across the catchments in the study area.

Changing land use may have positive (mitigating) or negative impacts on flood risk. It is widely believed that large scale increases to the amount of 'green spaces' such as tree planting and habitat creation within the National Forest, or the incorporation of parks and open spaces within development, may have an attenuating effect on the timing and levels of peak river flows, through decreasing surface runoff. This is possible through increased interception of rainfall and evapotranspiration by vegetation, and also the increase of more permeable land. These effects may be maximised by strategically linking such green spaces into corridors or areas. It would be prudent for SDDC to consider undertaking a Green

Infrastructure Study to identify opportunities to develop such green spaces, consideration should also be given to the undertaking of a SWMP.

To account for climate change in South Derbyshire, modelled flood outlines for Flood Zone 3a including the effects of climate change were provided by the EA for several watercourses. Where there are no modelled climate change results, an estimate of the impacts of climate change on flood outlines is required. To this end, the Flood Zone 2 outlines were used as a proxy. This is not to say that the 100 year flood outline will necessarily increase to the 1 in 1000 year outline, but rather that one would expect the depth and extents of flooding to increase to somewhere between the 1 in 100 year and 1 in 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.

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.

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 SoP 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.

The PPS 1 Climate Change 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.

The Adaptation Strategies for Climate Change in the Urban Environment (ASCCUE) project is a study undertaken collaboratively by the University of Manchester, The University of Cardiff, University of Southampton and Oxford Brooks University.

The project aimed to further the understanding of the impacts and risks of climate change on towns and cities through three 'exposure units' of human comfort, urban green space and the built environment. One of the aspects examined was surface water runoff during extreme rainfall events. With an increase in development, there comes an increase in the amount of impermeable areas thus leading to increased runoff during storm events. In one of the worst-case modelled scenarios (large urban centre), an increase in rainfall of 56% by 2080, led to an increase in runoff of 82%. This highlights the increasing conflict and pressures that are emerging between climate change scenarios and future development aspirations.

2.6.1 Fluvial Flood Risk

Scott Wilson have been provided with several detailed hydraulic models for watercourses within the study area. There is a potential for increased peak river flow as a result of climate change, as identified in Table 2-7, and an increase in peak flow results in a greater floodplain envelope. The hydraulic models provided have an outline of Flood Zone 3a, Flood Zone 3b and Flood Zone 2 plus an allowance for climate change and therefore takes account of the 1 in 25-year, 1 in 100-year and 1 in 1000-year fluvial flood event plus a 20 % increase in peak river flows at the 1 in 100 year event.

For watercourses where no detailed hydraulic model was available, the approach was taken to use the Flood Zone 2 and Flood Zone 3 outlines where appropriate as a substitute until such a time that modelled data is available. The methodology is explained further in Section 4.5.

Table 2-7: Recommended precautionary sensitivity for rainfall intensities and river flows (PPS25 Table B.2)

Parameter	1900 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		

2.6.2 Surface Water and Sewer Flooding

The potential increase in peak rainfall intensity (Table 2-7) is likely to lead to an increase in surface water flooding, surcharging of gullies and drains and sewer flooding. Issues on surface water flooding are very localised and should be considered at the site-specific FRA stage.

2.7 Land Use Change

A recent DEFRA/EA Study[4] considered the impact of land use change upon flood risk mitigation, particularly afforestation. This study is particularly relevant given the presence of the National Forest with South Derbyshire (Figure 2-5). The report examined previous work in this field and found that in forested areas infiltration rates were up to sixty times that of neighbouring grassland. Changes in infiltration rates also occurred quickly, approximately in 2-6 years. Interactions between woodland and flood mitigation are complex and although relatively well understood at a small scale, impacts on a larger catchment-wide scale are much less understood. It is difficult to combine many local scale impacts to obtain a catchment wide impact, particularly as the impact of woodland upon flood risk can vary markedly within a catchment, according to local changes in geology, biology and slope.

The relatively permeable superficial and underlying solid geology in the south-west of the study area (typically the Church Gresley to Walton-on-Trent area), coupled with potential afforestation could provide a benefit in terms of surface water attenuation at a local level. Research has shown that attenuation works most effectively when it is local to the development it is providing mitigation for. Attenuation is also most effective in lower or middle catchments.

[4] Environment Agency, January 2008, The Role of Land Use and Land Management in Delivering Flood Risk Management

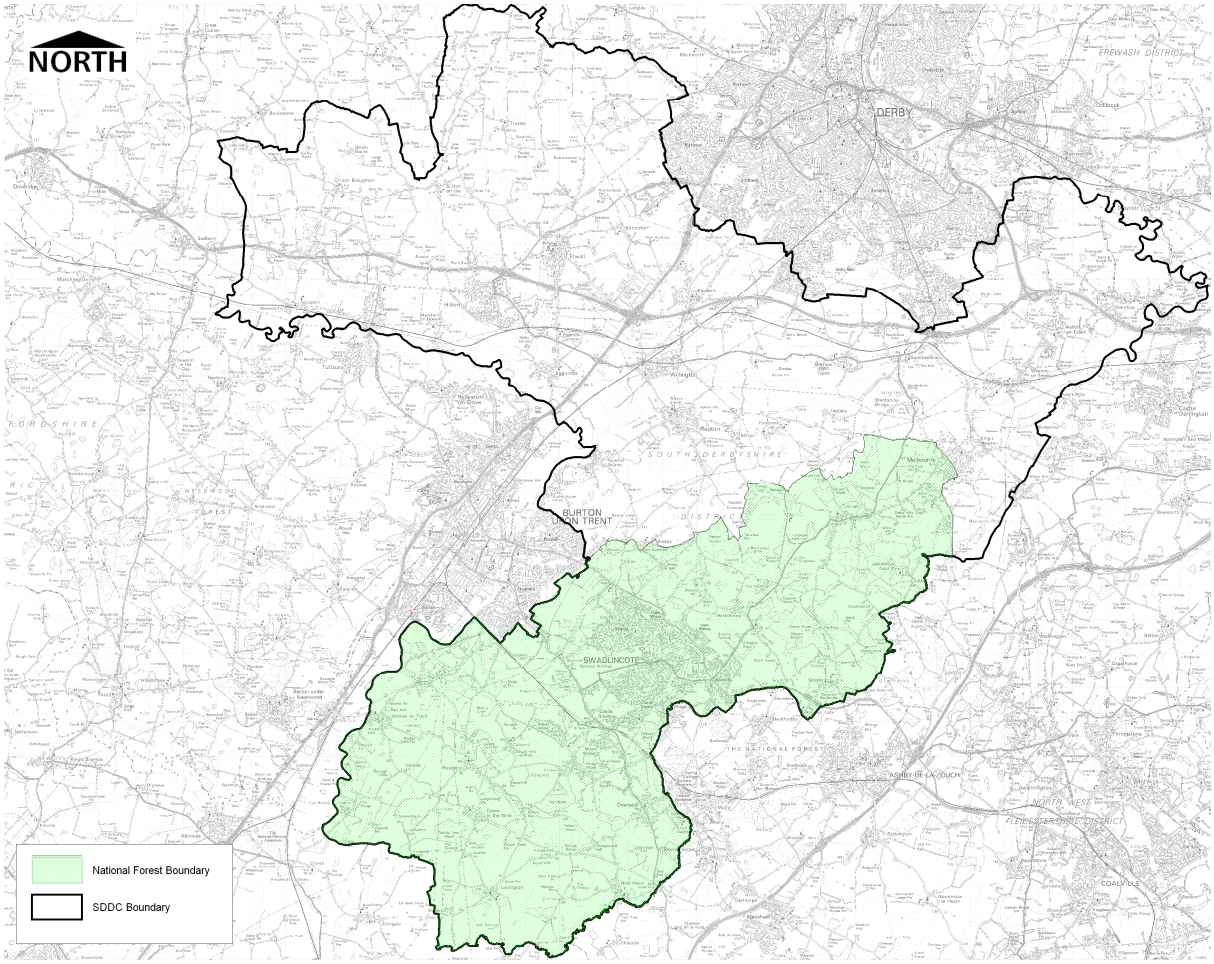

Figure 2-5: National Forest

3 Policy Review

This section provides an overview of the planning policy framework relevant to SDDC. This report conforms to National and Regional Planning Policy. Information contained in the SFRA will provide evidence to facilitate the preparation of robust policies for flood risk management. The SFRA should be used to inform the LDDs and will enable informed decisions to be made relating to land use and development allocation within the respective DPDs.

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

Figure 3-1 shows the hierarchical levels of the planning system.

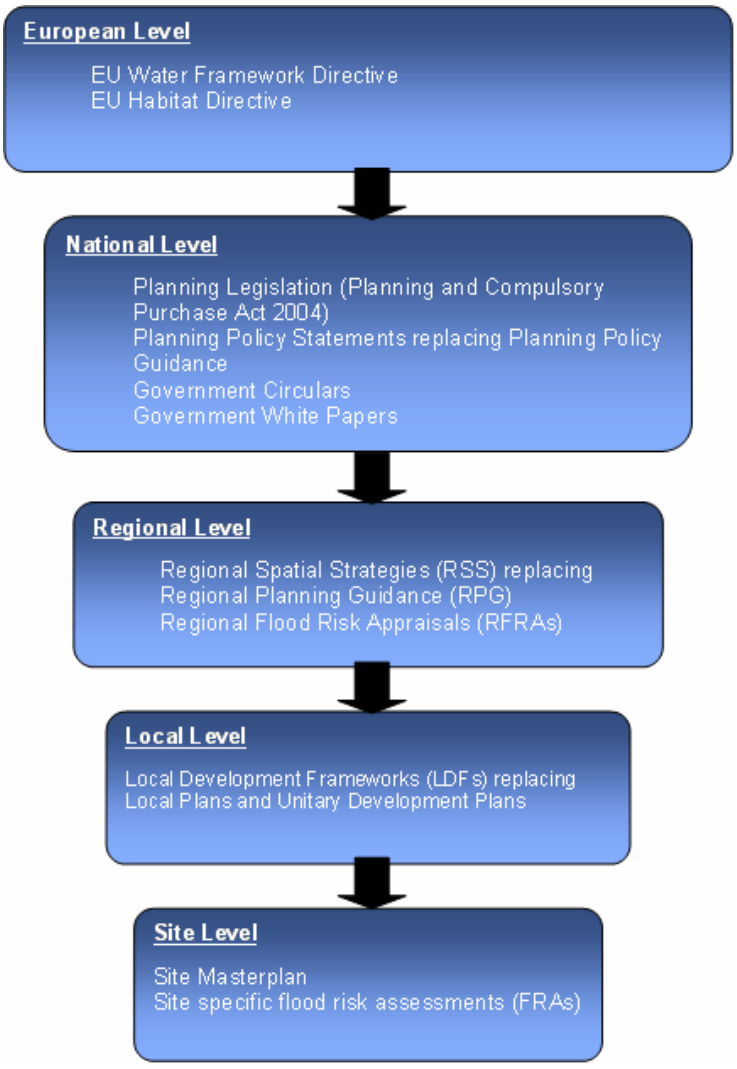

Figure 3-1: Flow chart showing structure of the planning system

3.1 Planning Policy

The planning policy review collates and summarises all planning policy and guidance, relevant to flood risk in the South Derbyshire administrative area. Firstly, PPS25 was reviewed as the key flood risk and development policy at a national level, followed by draft RSS 8 for the East Midlands.

The policy review covered policies pertaining to flood risk and development in flood risk areas and so also expanded to review key strategic development pressures, such as targets for housing provision, as set out by the draft RSS, as these need to be taken into consideration when assessing flood risk.

3.2 European Policy

Water Framework Directive (December 2000)

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.

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

1. 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 to protect, enhance and restore aquatic ecosystems are set out,
2. 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.

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 RBD that is relevant to South Derbyshire is the Humber RBD. The river basin planning process involves setting environmental objectives for all groundwater and surface water (including estuaries and coastal waters) within the RBD, and designing steps and timetables to meet the objectives. The EA is responsible for implementing the WFD in England and Wales and aim to have completed draft RBMPs by 2009.

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.

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.

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

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.

The EA's 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. The South Derbyshire SFRA should play an important role in informing the water management framework in the emerging Humber RBMP.

RBMPs Influencing Spatial Plans

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).

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.

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 LDFs by land use planners. As stated above, the South Derbyshire SFRA should inform the RBMPs and, as a result, the LDF being prepared by the SDDC should already

include policies and recommendations relating to flood risk management and development within catchments.

3.3 National Planning Policy

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

PPS25 is the obvious key national policy in relation to flood risk and is therefore necessarily the starting point for any policy review on flood risk. 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 SFRAs and the location of development in order to avoid and manage flood and residual risk. PPS 25 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 imperative planning considerations.

PPS25 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 RFRAs / SFRAs) as appropriate, either as part of the SA 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,
- Ensuring spatial planning supports flood risk management and emergency planning.

A Risk-based Approach

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 RFRA and at the local level a SFRA. Policies and proposals should be established on the basis of flood risk assessments.

PPS25 indicates that the Regional Planning Body should take flood risk into consideration when determining strategic planning considerations in the 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 LDDs at the local level.

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 exceptions 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,
- SFRAs should be prepared in consultation with the EA, emergency response and drainage authority functions of the LPA,
- Development should not add to flood risk and should, where possible, reduce it.

SFRAs should identify the four key Flood Zones:

Flood Zone	Category	Assigned Annual Flood Risk Probabilities
1	Low Probability of Flooding	Land having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)
2	Medium probability of Flooding	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) nor between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any report.
3a	High Probability of Flooding	Land having a 1 in 100 annual probability of river flooding (>1%) or a 1 in 200 annual probability of flooding from the sea (>0.5%) in any year.
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.

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

1. Be proportionate to risk and appropriate to the scale, nature and location of the development,
2. Consider risk of flooding to the development and risk arising from the development,
3. Consider the impacts of climate change,
4. Be undertaken early, by competent people,
5. Consider adverse and beneficial effects of flood management infrastructure and consequences of failure,
6. Consider vulnerability of those occupying the development, taking account of the Sequential and Exception Tests, the vulnerability classification and safe access arrangements,
7. 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,

8. The effects of flooding events (including extreme events) on people, property, the natural and historic environment and river and coastal processes should be considered,
9. The remaining residual risk reduction measures should be included. It should be demonstrated that this is acceptable for the particular development/land use,
10. 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,
11. Assessments should be supported by appropriate data and information including historical data on previous events.

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 RBMPs, which must be published by the EA by 2009. Para 2.27 of the Companion Guide to PPS25, states that where sub-regional SFRAs are undertaken, these will provide more detailed information on the broad spatial distribution of flood risk within extensive areas of Flood Zone 3, where development is to be considered, but here it will be necessary to apply the Exception Test. The Thames Gateway sub-regional SFRA is cited as an example.

3.3.2 PPS25 in Context

It is important to see 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 supplement to PPS1 “Climate Change and Sustainable Development”.

3.3.3 PPS1 Supplement “Climate Change and Sustainable Development”

PPS1 is the Government's overarching statement on the purpose of the planning system. Paragraph 3 of the PPS makes clear that ‘sustainable development is the core principle underpinning planning’. The PPS1 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.

PPS25 is clearly a key part of the Government’s programme of responses to the challenge of climate change. If climate change is not stabilised (mitigated) then this will have two impacts on flood risk. Projected sea level rises would suggest that the risk of flood defence levels being overtopped would increase. Second, climate change is likely to create higher rainfall in winter, and consequently to 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 will also mean increases in the extent of flooding from rising groundwater. Therefore, the implementation of this PPS1 supplement is crucial in mitigating for flood risk now and in the future.

3.3.4 PPS3 Housing

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.

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 (SuDS), and good quality design and site layout, it is possible to build safely and to manage flood risk.

3.3.5 PPS7 Sustainable Development in Rural Areas

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 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.

3.3.6 PPS9 Biodiversity and Geological Conservation

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 and there is also an imperative to consider the impact of removing woodland on carbon sinks and on flooding.

There is also a grave risk that if land is used for development because its value in respects other than productive capacity is limited, the pressure on less productive land for production may increase in the future. In the case of increased flood risk, any adverse affects arising from the development of land should be avoided rather than minimised.

3.3.7 PPS12 Local Spatial Planning

PPS12 sets out the Government's policy on the preparation of local development documents, which together comprise the LDF. Key issues include the consideration of climate change and 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.

3.4 Regional Planning Policy

At a regional level, the East Midlands RSS8 adopted in March 2005, provides the broad development strategy for the region through to 2021. The East Midlands Regional Assembly (EMRA) is also in the process of preparing a Regional Plan to replace this as RSS8 and will cover the period up to 2026. A draft of this plan is currently available and is being consulted upon.

3.4.1 The East Midlands Regional Spatial Strategy (RSS8), March 2005

The issue of flood risk is raised at a highly strategic level in the adopted RSS8. Regional Core Objective 9 (within Policy 1) of the adopted RSS8 is:

> *To take action to reduce the scale and impact of future climate change, in particular the risk of damage to life and property from flooding, especially through the location and design of new development*. (p.14)

Furthermore, Policy 3 includes flood risk as a physical constraint within its sustainability criteria. Policy 34 also refers to the important role that the management of strategic river corridors plays in managing flood risk.

Policy 36 addresses "A Regional Approach to Managing Flood Risk" and reinforces the general messages that have since emerged in PPS25 and stresses the need for Strategic Flood Risk Assessments "*where appropriate*", though SFRAs are now mandatory following PPS25.

Beyond direct references to flood risk, the adopted RSS8 refers to the Derby Principal Urban Area (PUA), which includes the northern part of South Derbyshire District, as a strategic focus for development and to the Three Cities Sub-Area, of which South Derbyshire is a part. In relation to housing, Derby and Derbyshire is allocated an annual housing provision of 2,550 dwellings.

3.4.2 The Draft East Midlands Regional Plan

Policy 1 in the draft Regional Plan reflects the same policy in the adopted RSS8 and so Objective i) refers to the risk of flooding in relation to the need to reduce the impacts on climate change. The Derby PUA is also still promoted as a strategic focus for development and the region is divided into the same sub-areas, with South Derbyshire located in the Three Cities sub-area.

Within the Housing sub-section of the draft Regional Plan, the Derby Housing Market Area (HMA) is discussed (p.24) and reference is made to *"urban intensification and planned and sustainable urban extensions"* within the Derby PUA. In addition, it states that *"unsustainable levels of development in smaller towns in Amber Valley and South Derbyshire"* should be avoided and specifically refers to Swadlincote as a location for *"supporting regeneration … in a way that is consistent with [its] role and function".*

The annual housing provision target set for South Derbyshire by the draft Regional Plan for the period between 2001 and 2026 is set at 605 units per annum. The interim minimum requirement for additional pitch provision for Gypsies and Travellers (cf. Appendix 3 of the draft plan) is set at *"up to 7"* for South Derbyshire.

3.4.3 A Flourishing Region: Regional Economic Strategy for the East Midlands 2006-2020 (2005)

The Strategy identifies climate change as a major global economic driver and states that the effects of climate change itself may have far-reaching implications including, heightened flood risks and the associated impacts on agricultural land, housing developments and related planning and insurance constraints.

A priority environmental action of the Strategy is adaptation to climate change, the region needs to "*identify where and how we mitigate against change, adapt to new circumstances and exploit new opportunities"* (p.99).

3.4.4 East Midlands Regional Flood Risk Appraisal (2006)

The RFRA for the East Midlands considers flood risk at the regional level. The assessment for the region is that:

> *"although flood risk is a significant factor in the East Midlands, adoption of a range of appropriate flood risk management policies and mitigation measures will enable Regional Plan policies to be implemented in a sustainable manner"* (p43).

Flood Risk Profiles were determined for each LPA. The Flood Risk Profile for South Derbyshire reveals that a significant amount of Flood Zone 3 land exists within the district. However, as yet, no SFRAs have been carried out in the district.

The flood risk profile states that frequent flooding occurs in parts of South Derbyshire District and uncertainty exists in the district regarding future development requirements. Uniquely there is uncertainty in the Derby sub-area as to whether flood risk will play a significant role in determining development land allocations, or whether any Flood Zone 3 land is likely to be developed prior to year 2026.

3.4.5 Three Cities Sub-Regional Strategy

Derby, Nottingham and Leicester form the Three Cities Sub Area (TCSA) as identified by the Regional Spatial Strategy for the East Midlands (RSS8) and the draft RSS (the Draft East Midlands Regional Plan) respectively.

The draft RSS contains a Three Cities Sub-Regional Strategy, which aims to create more sustainable patterns of development and movement within (and between) Derby, Leicester & Nottingham and their hinterlands, and to promote overall economic competitiveness.

Specific economic objectives include:

- Identifying employment land to meet the needs of indigenous manufacturing and distribution uses and to encourage new investment,
- Enhancing transport links and public transport accessibility both in and between the cities,
- Ensuring retail, office, residential, entertainment and service uses are in central areas, to support the vitality and viability of the city centres.

Draft RSS Three Cities Sub-Area Policy 13 seeks to:

- Avoid unsustainable levels of development in smaller towns in Amber Valley and South Derbyshire,
- Support the regeneration of Swadlincote, Alfreton, Belper, Heanor and Ripley in a way that is consistent with the role and function of these towns.

Draft RSS Three Cities SRS Policy 4 seeks to deliver 605 dwellings per annum in South Derbyshire, of which 255 dwellings per annum should be sustainable urban extensions to the Derby PUA, with the remainder of development in the District focused primarily on Swadlincote, including urban extensions as necessary.

Draft RSS Three Cities SRS Policy 4 also states that the siting of major development should also have regard to the environmental capacity of its location, and include measures to minimise and mitigate any negative impacts. Flooding is acknowledged as a potentially serious issue for the sub-area, given that the 3 PUAs all have rivers flowing through them and have a history of flooding in the past.

3.4.6 New Growth Point – Three Cities & Three Counties – Derby, Leicester & Nottingham

The three cities of Derby, Leicester and Nottingham are a New Growth Point, part of the Government's plans to increase the rate of house building in England from 160,000 to 200,000 per year by 2016. Their bid put forward proposals for sustainable growth to help achieve this ambition, proposals include:

- An additional 81,500 homes by 2016, of these, 9,800 will be in Derby,
- Regeneration and provision of community facilities to encourage more people into the city centre,
- A new public park linking Derby city centre with the Derwent Valley Mills World Heritage Site,
- Improving connectivity and public transport within and between the three cities, including links to East Midlands Airport.

The Three Cities & Three Counties is the largest and most complex of the 29 New Growth Points in England, currently offering some 19% of the expected national total of new homes over the lifetime of the programme. In support of the Three Cities' and Three Counties' growth ambitions the Government allocated around £5.48m in 2007-08 from the first year's funding pot.

3.5 Local Planning Policy

The Development Plan for South Derbyshire currently comprises:

- The Regional Spatial Strategy for the East Midlands (March 2005),
- The Derby and Derbyshire Joint Structure Plan (January 2001),
- The South Derbyshire Local Plan (May 1998).

Work has commenced on the LDF for South Derbyshire, which will replace the Structure Plan and Local Plan but still include the RSS. This framework will contain a range of LDDs setting out the policies for land-use planning in the District.

The most recent Local Development Scheme (LDS) for South Derbyshire came into effect in March 2007. Slippage has occurred in achieving milestones in the 'Woodville - Swadlincote Area Action Plan' and the 'Core Strategy' as set out in the LDS. This arose largely as a result of ongoing judicial review proceedings on the withdrawn draft Local Plan, staff resource implications of major planning applications and preparations for a conjoined public inquiry, the publication of the draft East Midlands Regional Plan and significant new national planning policies. The most recent LDS states that the core strategy of the LDF is due for adoption in June 2010.

3.5.1 Derby and Derbyshire Joint Structure Plan (2001)

Following a Government Direction in September 2007 a large number of policies within the Structure Plan expired, however, some still remain relevant. In accordance with the principles of sustainable development, the housing policy seeks to concentrate development within existing urban areas in order to minimise the use of greenfield sites and make best use of existing infrastructure.

Housing Policy 17: South Derbyshire District sets a target of 12,000 dwellings or 600 dwellings per annum in South Derbyshire between 1991 and 2011 to be located generally in the following areas:

- The north of the District, in the Derby Sub-Area, including provision on the periphery of Derby: 6,500 (325 per annum),
- Swadlincote area: 5,500 (275 per annum).

The overall annual target is very similar to the draft RSS allocations, although the breakdown by sub-area places less of an emphasis on Swadlincote than the current targets within the draft RSS.

River corridors are recognised in the Structure Plan as being important for their drainage function, water resources, water quality, nature conservation, fisheries, recreation and their contribution to the character of the landscape. Accordingly, the river corridors of the Trent, Derwent and their tributaries are identified in Structure Plan *Environment Policy 4* as environmental priority areas in which the environment should be conserved and enhanced.

3.5.2 Adopted South Derbyshire Local Plan (1998)

The South Derbyshire Local Plan is time expired. It was adopted in May 1998, prior to the 2001 Structure Plan, and covered the period up to 2001. In 2003, a Revised Deposit Draft Local Plan (RDDLP) was placed on deposit for further consultation. However, for various reasons the RDDLP was withdrawn.

The underlying aim of the Local Plan is to deal with socio-economic changes in South Derbyshire and selected policies within it have been saved until the Core Strategy has been prepared. The Local Plan states that new development will be located in such a way as to:

- Meet the needs identified in the Derbyshire Structure Plan, principally through the development of sites at Swadlincote, Hilton, Church Broughton and Melbourne,
- Make full and effective use of vacant, underused and previously developed land and existing or committed infrastructure,
- Continue the expansion of Swadlincote, further regenerate the town and reinforce its role as the administrative, employment and commercial focus of the district.

Environmental Policies of relevance to Flood Risk such as *EV2: Flood Defence* were not saved beyond September 2007 and as such there is no local policy regarding flood risk. Thus South Derbyshire is reliant on the guidance set out in the adopted and emerging RSS8 and PPS25. The Local Plan included three major housing allocations: the former Hilton MOD depot, Church Gresley and Stenson Fields, all of which are in the process of being delivered.

3.5.3 South Derbyshire Economic Development Strategy 2007- 2012 (2007)

Developed by SDDC in consultation with the South Derbyshire Local Strategic Partnership, the Economic Regeneration Strategy aims to address the economic challenges facing the District and sets a vision for its future regeneration. The Strategy's vision is:

> *"to promote greater economic wellbeing in South Derbyshire, in order that it becomes a healthier, more prosperous and safer place to live with better jobs and prospects for local people and businesses"* (p35).

The Strategy anticipates a period of continued growth for South Derbyshire, underpinned by the significant levels of development envisaged in the emerging Regional Development Plan. The Strategy maintains that a growing population, combined with existing high levels of economic activity and out-commuting, emphasises the need to create additional employment opportunities, many of which will need to come through inward investment. The Strategy specifies the need for a 'big vision' for the District in which the requirement to provide for a growing workforce is considered together with employment land needs and demands on transport and other infrastructure and facilities.

3.5.4 Woodville-Swadlincote Town Centre Area Action Plan

Preparation of the Woodville-Swadlincote Town Centre Area Action Plan (AAP) commenced in 2007. The AAP aims to bring forward economic regeneration and environmental improvements to a 71 ha area between Woodville and Swadlincote Town Centre, incorporating the Swadlincote Regeneration Route – a road increasing accessibility to the area and providing relief to Moira Road and the 'Clock' roundabout in particular. An Issues and Options Consultation was held in July 2007 for the AAP.

3.6 Waste & Minerals Planning Policies

3.6.1 The Derby and Derbyshire Waste Local Plan (2005)

The adopted Waste Local Plan refers to flood risk and recognises the need for waste developments to be sensitive to flood risk not only because of the impact of the development itself but also because of the risk of leaching from waste sites into water courses. The justification supporting policies W5 and W9 both make reference to the need to accommodate flood risk in waste developments.

3.6.2 Preferred Options Report for the Derby and Derbyshire Waste Sites Development Plan Document (2007)

Derbyshire County Council and Derby City Council are preparing a Waste Sites DPD that will replace the Waste Local Plan. The Preferred Options report is part of the preparation process for the Waste Sites DPD and is a material planning consideration. It has been consulted upon.

A key objective of the DPD will be:

> *"avoiding the parts of sites which are particularly susceptible to flooding, including in the former mill locations in the valleys of the Etherow and Rother"* (Objective 4, p.17).

The report also states that FRAs will be necessary for all potential waste management developments in a Zone 3 location.

Ten preferred waste management sites, including one for landfill/landraise, are located in South Derbyshire. Six of these, including the landfill/landraise site, are in the north of the district with the remaining four to the northwest of Swadlincote. There is potential for flood risk to be affected by the six sites in the north due to their proximity to major rivers.

3.6.3 The Derby and Derbyshire Minerals Local Plan (2000)

The Derby and Derbyshire Minerals Local Plan through *Policy MP4: Interests of Acknowledged Environmental Importance*, recognises the need to protect the quality and quantity of water resources, water supply and land drainage and flood protection interests from the impact of mineral extraction and reclamation.

An aim of the Plan is to ensure that mineral development does not adversely affect flood regimes on the River Trent, River Derwent and River Dove and to ensure that reclamation seeks opportunities to provide positive benefits by reducing flood risks where possible.

3.6.4 Supplementary Planning Guidance on the After-Use of Sand and Gravel Sites in the Trent, Lower Derwent and Lower Dove Valleys (2004)

The Supplementary Planning Guidance (SPG) compliments policies of the adopted Derby and Derbyshire Minerals Local Plan by setting out a framework of principles aimed at securing a preferred pattern of after uses for worked out sand and gravel sites.

The SPG indicates that the location of sand and gravel deposits within the river valleys and their working and reclamation raises a number of water related issues such as flood risk, groundwater protection, and the impact on the ecological and recreational value of the river corridor. The SPG recognises the opportunities to increase flood storage and manage flood risk better through mineral working, particularly sand and gravel.

The SPG draws attention to the adverse impact that heavy pressure on the catchment and the main river for flood defence has had on the Trent Valley:

> *"It has led to significant damage to the natural and historic environment through the loss of wetland habitats and floodplain landscapes, effectively disconnecting the river from its floodplain. The use of flood banks for agricultural land, and increased development has also reduced the area of the historic floodplain that is able to flood, retaining floodwater in the river and increasing the pressure on defences downstream"* (p.24).

The SPG sets out the following general principles for protection and enhancement of the water environment:

- The provision of wetlands to increase water storage and mitigate against flooding will be encouraged,
- Reclamation schemes must not result in without adequate compensation, a reduction in the floodplain, any obstruction of flood flow routes, or overall contribute to an increase in flood risk, including an increase in flood risk elsewhere,

- Reclamation schemes within the floodplain will need to take into account the potential impact on groundwater quality and groundwater resources (including the rights of existing licensed groundwater abstractions) and any consequent impacts on watercourses.

3.6.5 Preferred Options Report for the Derby and Derbyshire Mineral Development Framework – Minerals Site Allocations - Aggregates - Development Plan Document (2007)

DC_OC and DC_IC are jointly preparing a new Minerals DPD that will set out the policies and identify the sites relating to Aggregates up to 2019. It will replace the existing Minerals Local Plan. The DPD is currently at Preferred Options stage and has been consulted upon. As such, it is a material planning consideration.

Five of the six preferred sites for sand and gravel extraction are in or immediately adjacent to the northern parts of South Derbyshire, within or just outside the Derby PUA and near to major rivers. These have the potential to impact flood risk and potentially limit development for housing and other uses in the north of the district.

However, the DPD recognises the importance of not affecting flood risk, stating:

> *"All the rivers have important flood defence regimes including functional floodplain, which need protecting, especially with the additional stress put on them from the possible effects of climate change"* (p.11).

The DPD also states that:

> *"Mineral development must not adversely affect flood regimes on the river systems of the Trent, Derwent and Dove and reclamation should seek opportunities to provide positive benefits by reducing flood risks where possible"* (p.14).

3.7 Non-Statutory National Planning Documents

3.7.1 Making Space for Water

During 2004, the Department for Food and Rural Affairs (DEFRA) undertook a consultation exercise, the object of which was to engage a wide range of stakeholders in the debate regarding the future direction of flooding strategy. The consultation document 'Making Space for Water' is part of the Governments overall approach to managing future flood risks and sets out the following aim:

> *"To manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as to:*
>
> - *Reduce the threat to people and their property,*
> - *Deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles"* (p.1).

Thus, the aim of the strategy is to balance the main pillars of sustainable development, namely social, economic and environmental factors.

Making Space for Water examines the impact of climate change on flood levels. Experts consider that the primary impacts on flood risk will be from changes in precipitation, extreme sea levels and coastal storms. DEFRA and the EA will produce revised guidance for use by those implementing flood and coastal erosion risk management measures. The revised guidance, yet to be published, will ensure that adaptability to climate change through robust and resilient solutions becomes an integral part of all flood and coastal erosion management decisions.

Making Space for Water emphasises the Government's commitment to ensure that a pragmatic approach to reduce flood risk is adopted. However, the paper notes that 10 per cent of England is already within mapped areas of flood risk. Contained within these areas are brownfield sites, which policy has identified as a priority for future development. The document asserts that over the past five years 11 per cent of new houses were built in flood risk areas.

The plan advocates the use of European Union (EU) funding streams, such as INTERREG IIIB, to enable local authorities to undertake trans-national projects aimed at advancing knowledge and good practice in flood risk management. The document also encourages integration with water management initiatives, in particular CFMP. The document proposes that RSSs and LDFs should take full account of strategic flood risk assessment and incorporates the sequential approach as set out in PPS25.

At the development control level, the document encourages local planning authorities to follow the existing guidance to require site-specific FRAs. In addition, the use of FRAs as supporting documents to planning applications in areas of flood risk is encouraged. The document proposes that if mitigating measures are shown to be required, they should be fully funded as part of the development.

3.7.2 Sustainable Communities Plan

The Sustainable Communities Plan (SCP) was launched by the ODPM in February 2003. The plans main aims include improving the overall quality of housing in England, a step change in housing supply to meet demand, encouraging new growth areas while maintaining and protecting the Green Belt. These objectives are to be achieved with sustainability at the centre to ensure a legacy of improved, liveable communities.

The challenge is to reconcile the SCP's requirement to identify sufficient land for large volumes of new homes whilst ensuring that the sites allocated satisfy sustainability criteria specifically with regard to the avoidance of flood risk.

'Sustainable Communities in the East Midlands: Building for the Future' is the document that covers the districts commissioning this SFRA and will be discussed further in the Regional Planning Policy and Guidance Section.

3.7.3 Regional Flood Risk Appraisal

The RFRA for the East Midlands was produced in July 2006 and seeks to inform the Regional SA as part of the ongoing development of the RSS. It assessed flood risk data from a variety of sources and assigned a flood risk score to areas on a district wide basis based upon a number of criteria including percentage of land in Flood Zone 3, probability and consequence of flooding, secondary sources of flooding and residual risk. South Derbyshire was considered as part of the Derby HMA area and although the Derby HMA as a whole was given a medium importance score of 6, no score at that stage was provided for South Derbyshire.

3.8 Catchment Flood Management Plans

A CFMP is a high-level strategic plan, carried out by the EA, which is used to identify and agree long-term policies for sustainable flood risk management within individual river catchments. CFMPs undertake an assessment of flood risk to identify the causes, size and location of flood risk throughout the catchment and the various influences that can affect the probability and consequences of flooding. This enables the effect of potential changes in the catchment on flood risk to be identified. Each potential source of change can be influenced by land use planning policy, such as a changing policy approach towards greenbelt protection or the allocation of large greenfield sites for housing development. Potential changes may include, for example:

- Development and land use change, such as new development or significant changes in the developed environment,
- Changes in the rural landscape, including large scale changes in land management,
- Loss of, or potential threat to, wildlife habitats or biodiversity,
- Climate change.

Flood risk management looks at the probability of a flood occurring and the potential resultant impacts. A spatial planning element also exists in flood risk management since it involves decisions on when, where and how to store or convey flood waters to minimise the risks to people, property and the environment.

CFMPs identify broad, long term (50-100 years) policies for sustainable flood risk management in the context of a particular catchment. The planning period is therefore considerably longer than the period typically considered to be “long-term” in land-use planning policy terms, which is usually 10 to 15 years. This potential conflict in planning timeframes should be taken into consideration, as a change to land-use policy can occur in a much shorter period of time than the CFMP may account for. There is also a potential conflict in that catchment boundaries do not necessarily relate to LPA boundaries and land use policy approaches may vary between LPAs, increasing the complexity for flood risk management decisions across the catchment.

CFMPs aim, amongst other objectives, to inform and support planning policies, statutory land use plans and implementation of the WFD, 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.

Preparing CFMP’s involves carrying out a strategic assessment of current and future flood risk from all sources, understanding both the likelihood and impact of the risk and the effect of current measures to reduce that risk. The scale of risk is broadly measured in economic, social and environmental terms. CFMPs identify opportunities and constraints within the catchment to reduce flood risk through strategic changes or responses, such as changes in climate, urban development, land use, land management practices and/or the flood defence infrastructure and waterways.

CFMP policies which are identified for each individual “policy unit” (which relates to a specific geographical area), establish whether action should be taken to increase, decrease or maintain the current scale of flood risk. The CFMP does not identify specific ways of managing flood risk, which are the subject of subsequent, more detailed studies. A single policy is applied to each policy unit. Six policy options exist and may be applied:

Table 3-1: CFMP Policy Options

Policy Option	Policy
1	No active intervention (including flood warning and maintenance), continue to monitor and advise
2	Reduce existing flood risk management actions (accepting that flood risk will increase with time)
3	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
4	Take further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and climate change)
5	Take further action to reduce flood risk (now and/or in the future)
6	Take action to increase the frequency of flooding (where appropriate) to deliver benefits locally or elsewhere, (which may constitute an overall flood risk reduction, e.g. for habitat inundation)

In order to achieve the specified policy approach, a number of actions may be identified for each policy unit. It is expected that CFMPs will be used by regional and local government authorities to inform their spatial planning activities, SAs/SEAs and emergency planning.

There is one CFMP covering the study area, the River Trent CFMP which is at the stage of draft preparation. Consequently, it is unlikely that its implications have been fully taken into account in current DPDs.

South Derbyshire is covered by hydrological units A, C and D, and policy units 5 (Derby, Burton and Nottingham) and 6 (Mid Staffs and Lower Tame) in the draft River Trent CFMP. Broadly speaking these units correspond to, the River Trent, the River Dove and the River Derwent.

The CFMP explains that the two main flood mechanisms in policy unit 5 are surface water flooding and overwhelming of the urban drainage system following heavy rainfall. It also highlights the problem of surface water in urban areas being unable to discharge to the River Trent due to high water levels behind defences. The second main flooding mechanism is insufficient channel capacity leading to overtopping. This problem can be exacerbated by structures such as bridges and weirs further restricting flow and raising water levels. In policy unit 6, the main flood mechanism is overtopping.

The CFMP considered flood risk under climate change scenarios which involved scaling up the EA broadscale model inflows by 20%, and where necessary increasing rainfall by 30%. Urban growth scenarios were also considered by increasing the URBEXT value in the model's hydrology. Landuse change was also considered by altering the amount of rainfall runoff in the catchment and reducing the response time of the catchment.

The CFMP concludes that the urban areas in the upper Trent suffered the highest increases in properties at risk of flooding such as up to several hundred more properties at risk Burton upon Trent. Flood depth was shown to increase by approximately 0.15m around Burton upon Trent and future flood risk here was assessed as high.

In the middle Trent villages between Burton upon Trent to the M1 including places such as Willington, Newton Solney and Barrow on Trent, the impact of the future scenario is likely to be significant and the

future flood risk has been assessed as medium. In this area the number of properties flooded increased by 20%, and flood depths increased by 0.18m-0.23m.

On the River Dove, under the future scenario, the number of properties at risk of flooding doubles and a number of minor roads are flooded. The depth of flooding increases by 0.15-0.25m, however water velocity increases are minor. The CFMP assessment of future flood risk in Scropton is low.

In Hatton, the number of properties flooded under the future scenario increases from 100 to 550 and flood depth increases by up to 0.3m. The CFMP future scenario assessment for Hatton is of a significant impact and a medium risk.

Egginton is at risk of flooding from the River Trent and River Dove but the main risk of flooding to the village is from two small brooks running through the village which have not been modelled as part of the broadscale modelling study. Flooding from the River Dove and River Trent however is shown to further encroach into the village, increasing flood depths on the roads in particular by up to 0.2m. The overall assessment of the future scenario in Egginton is however small, and the future flood risk is low to medium.

The CFMP has recommended Policy Option 5, take further action to reduce flood risk (now and/or in the future) for Policy Unit 5 (Burton Derby and Nottingham). This unit encompasses a large swathe of the study area along the Trent corridor and the lower reaches of the River Dove and Derwent.

In Policy Unit 6 which takes in the majority of the study area south of the River Trent and a the area immediately adjacent to the River Trent from Burton Upon Trent to Sandiacre, including Repton, Willington, and Swadlincote, there are fewer populated areas and the floodplain is more natural. As such, Policy Option 6 has been recommended. Appendix J provides a description of how this policy might be applied.

3.9 Flood Risk

3.9.1 Regional / National

1. In accordance with PPS25, all sites should be allocated in accordance with the Sequential Test to reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the Flood Zone classification,
2. FRAs should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area,
3. FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1,000 m^2,
4. Flood Risk to development should be assessed for all forms of flooding (in accordance with PPS25 Annex E),
5. According to PPS25, it is recommended that where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.

3.9.2 Sub-Regional / Local

1. As stated in PPS25, surface water flooding should be investigated in detail as part of site specific FRAs for developments and early liaison with the EA and the relevant LPA for appropriate management techniques should be undertaken,
2. As stated in PPS25, Groundwater flooding should be investigated in more detail as part of site specific FRAs.

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

- Draft River Trent CFMP,
- Lowland Derbyshire Biodiversity Action Plan,
- National Forest Biodiversity Action Plan,
- Derbyshire Derwent, River Mease, Tame and Anker, River Dove and River Trent Corridor Catchment Abstraction Management Strategies (CAMS).

3.10 Sustainable Drainage Systems

A guide to SuDS is provided in Appendix A. Sustainable Drainage Policies should address the following issues:

3.10.1 Regional / National

1. SuDS should be included in new developments unless it is demonstrably not possible to manage surface water using these techniques,
2. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity,
3. SuDS are a requirement of the new Buildings Regulations,
4. FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2 ,
5. As stated in PPS25, runoff rates from new developments should not have volumes and peak flow rates of surface water leaving a developed site any greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect,
6. It is recommended that runoff and/or discharge rates should be restricted to Greenfield runoff rates in areas known to have a history of sewer and/or surface water flooding.

3.10.2 Sub-Regional / Local

At the site-specific FRA level, the suitability of SuDS should be investigated for each development. When a decision has been made regarding a SUDS method, the involved organisations should agree on responsibilities and produce a management and maintenance strategy. Problems arise when this strategy

has not been decided upon prior to adoption and the SUDS system can fail due to lack of upkeep and maintenance.

An assessment off the underlying geology and soil, together with site-specific recommendations for SuDS and FRAs is presented in the Broad Scale Assessment of SuDS at the end of Appendix A.

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

- Regional policy for the East Midlands Policy 35 is relevant to the management of flood risk,
- The River Trent CFMP,
- The Lowland Derbyshire Biodiversity Action Plan,
- The National Forest Biodiversity Action Plan,
- Derbyshire Derwent, River Mease, Tame and Anker, River Dove and River Trent Corridor Catchment Abstraction Management Strategies (CAMS).

3.11 Water Environment

3.11.1 Regional / National

1. Development should not have a detrimental impact on the water environment through changes to water chemistry or resource,
2. Developments should look to incorporate water reuse and minimisation technology,
3. Any development should not be located within the 8 metre Byelaw distance of the riverbank or flood defence structures and associated elements, to ensure access for maintenance but amongst other things should ensure a riparian corridor for improvement of the riverine environment.

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

- The Water Framework Directive (summarised in section 6.2),
- Regional policy for the East Midlands Policy 35 is relevant to the management of flood risk,
- The River Trent CFMP,
- The Lowland Derbyshire Biodiversity Action Plan,
- Derbyshire Derwent, River Dove and River Trent Corridor Catchment Abstraction Management Strategies (CAMS),
- Making Space for Water (DEFRA).

Flood Risk Management Policies contained within the CFMPs have been set out by the EA and assigned to different zones within the SFRA area. The strategies suggested above interlink with these aspirations and if integrated will help to strengthen the position of the LPA.

4 SFRA – Methodology

4.1 Objective

As outlined in Sections 1.3 and 1.4, the objective of the Level 1 SFRA is to collate and review the information available relating to flooding in the study area. Once reviewed and any data gaps have been resolved, the information is then presented in a format to enable SDDC to apply the Sequential Test to their growth areas and to identify potential development sites in Flood Zone 2 and Flood Zone 3, which would require the application of the Exception Test through a Level 2 SFRA. 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.

4.2 Tasks

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

- Inception meeting with SDDC and EA on 10th April 2008,
- Determination of local stakeholders,
- Contact with stakeholders to request data/information,
- Collation and review of data and population of data register,
- Presentation of available relevant information on flood sources and flood risk,
- Review of received data against SFRA objectives,
- Identification of gaps in data.

4.3 Stakeholders

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

- South Derbyshire District Council,
- Environment Agency,
- Derbyshire County Council,
- Severn Trent Water,
- Highways Agency,
- British Waterways.

Parish Councils

- Aston-on-Trent Parish Council
- Barrow-on-Trent Parish Council
- Barton Blount Parish Council
- Bearwardcote Parish Council
- Bretby Parish Council
- Burnaston Parish Council
- Calke Parish Council
- Castle Gresley Parish Council
- Catton Parish Council
- Cauldwell Parish Council
- Church Broughton Parish Council
- Cotton-in-the-elms Parish Council
- Dalbury Lees Parish Council
- Drakelow Parish Council
- Egginton Parish Council
- Elvaston Parish Council
- Etwall Parish Council
- Findern Parish Council
- Foremarke Parish Council
- Foston & Scropton Parish Council
- Hartshorne Parish Council
- Hatton Parish Council
- Hilton Parish Council
- Hoon Parish Council
- Ingleby Parish Council
- Linton Parish Council
- Lullington Parish Council
- Marston-on-Dove Parish Council
- Melbourne Parish Council
- Netherseal Parish Council
- Newton Solney Parish Council
- Osleston & Thurvaston Parish Council
- Overseal Parish Council
- Radbourne Parish Council
- Repton Parish Council
- Rosliston Parish Council
- Shardlow & Great Wilne Parish Council
- Smisby Parish Council
- Stanton by Bridge Parish Council
- Stenson Fields Parish Council
- Sutton on the Hill Parish Council
- Swarkestone Parish Council
- Ticknall Parish Council
- Trusley Parish Council
- Twyford & Stenson Parish Council
- Walton-on-Trent Parish Council
- Weston-on-Trent Parish Council
- Willington Parish Council
- Woodville Parish Council

4.3.1 Local Authorities

SDDC provided 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, SDDC was able to provide some detail of flooding within their boundary and site-specific FRAs were provided to add resolution and detail to existing flood risk data. Neighbouring LPAs were also contacted as part of the consultation phase. This was to determine the effects of any proposed redevelopment in each area may have on South Derbyshire.

4.3.2 Environment Agency

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. South Derbyshire falls within the Midlands Region of the EA and is administered by the Eastern and Central Area offices.

At the inception meeting discussions were held with the EA 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 B, but can be summarised as:

- Catchment Flood Management Plans (CFMP) for the River Trent (Draft),
- Rivers Derwent, Dove and Trent Catchment Abstraction Management Strategy (CAMS),
- Strategic Flood Risk Mapping (SFRM) outlines and supporting data,
- Details and locations of historical flood events,
- Groundwater Vulnerability Mapping,
- Locations of flood defence assets and flood warning areas.

The EA have also assisted with advice on internal strategic projects being carried out at a national and regional level. Similarly, the EA have assisted in the production of the SFRA by providing expert advice and comment.

4.3.3 Severn Trent Water

STW provide potable water distribution and wastewater collection for the South Derbyshire administrative area. STW have provided a register of flood events that have affected properties (internal) and outside areas such as roads (external) to a particular postcode. This information is provided to the regulatory body Office of Water Services (OFWAT) and is used to help define their works 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). As a result, a detailed analysis of the scale, consequences and risks of sewer flooding has not been possible at this stage of the SFRA.

The principal contacts and their associated details for the above stakeholders are presented in Appendix C.

4.4 Data / Information Collected

Data was requested from the above stakeholders. Received data was integrated with Scott Wilson's GIS system where possible, to facilitate a review. The data requested from the identified stakeholders was based on the following categories:

- Terrain Information,
- Mapping data (ordnance survey),
- Hydrology,

- Hydrogeology,
- Flood Defence,
- Environment Agency Modelled Flood Levels,
- Environment Agency Flood Zone Maps,
- Historical flooding,
- Sewer flooding problems,
- Planning related data and policies.

All data was registered on receipt and its accuracy and relevance reviewed to assess confidence levels for contribution to the SFRA. Details of all the data collected at the time of production are presented in Appendix B.

Table 4-1: Method for qualitative confidence ranking of data received

		RELEVANCE		
		1 - VERY RELEVANT	2 - PARTLY RELEVANT	3 - NOT RELEVANT
ACCURACY	1 - EXCELLENT	**VERY GOOD**	**GOOD**	**GOOD**
	2 - GOOD	**GOOD**	**GOOD**	**FAIR**
	3 - FAIR	**GOOD**	**FAIR**	**FAIR**
	4 - POOR	**FAIR**	**FAIR**	**POOR**
	5 - VERY POOR	**FAIR**	**POOR**	**VERY POOR**

4.5 GIS, Flood Mapping and Application

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

Broadly, the layers can be classified into planning policy, informative and flood risk categories. Appendix D includes a more detailed table highlighting the GIS layers that have been used and their limitations.

4.5.1 GIS Data Gaps & Assumptions

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 South Derbyshire study area, it has been necessary to make certain assumptions, so that gaps in data could be filled; these assumptions have been outlined in the proceeding sections and Appendix D.

4.5.2 Flood Risk GIS Layers

The following sub-section is intended for use in conjunction with the Flood Zone mapping presented in the Appendix E of this study. Planning guidance indicating what type of development is likely to be appropriate in certain Flood Zones is presented in Tables D.2 and D.3 of PPS25. These tables can then be viewed in conjunction with the SFRA Flood Zone mapping to inform planning decisions.

SFRA Flood Zone Mapping

These maps present Flood Zone 1, Flood Zone 2, Flood Zone 3a and Flood Zone 3b in relation to current levels of flood risk. In addition some of these areas have also been mapped to take into account the climate change as recommended by PPS25. These maps are included in Appendix E and should enable the LPA to undertake the Sequential Test as part of the SFRA.

In order to present the most up-to-date and relevant flooding information available, the Flood Zone maps have been created using a variety of existing sources of data. Where detailed hydraulic modelling has been undertaken and flood outlines mapped, these have been used in preference to broad-scale modelled flood outlines. This results in a single map for each Flood Zone generated using a combination of data. For each reach, information on the data has been provided detailing the source of the data used to create the Flood Zone and the relative confidence in the data.

For example, the flood outlines for Hell Brook and Cuttle Brook and the River Trent have been derived from hydraulic modelling studies. The River Trent modelled flood outline for Flood Zone 3b does, in places, appear to be larger than the EA Flood Zone 3. This is because the EA Flood Zone maps have been updated (to include more recent outputs from the River Trent modelling then those made available) but do not differentiate between Flood Zone 3a and Flood Zone 3b. Until such time that the updated River Trent Flood Zone 3b outline has been made available to us, it was decided to adopt a conservative approach and use the previous River Trent model Flood Zone 3b. 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, or the upstream catchment is too small to be picked up through the broadscale modelling.

Functional Floodplain

Functional floodplains (Flood Zone 3b) have the highest probability of flooding of all the Flood Zones defined within Table D.1 of PPS25. As outlined by Table 5-1 (Chapter 5 PPS25), there are only two appropriate land uses that should be permitted in this zone, water compatible land uses and essential infrastructure. Any planning applications for proposed appropriate development must be accompanied by a site-specific FRA that proves that the proposed development will not impede flood flows, will not increase flood risk elsewhere and will remain operational in times of flood. In light of the above, it is important that functional floodplain is illustrated by the SFRA in order for SDDC to consider its location when preparing LDF documents and other strategic documents.

Functional floodplain is defined by Table D.1 in PPS25 as an area of land where water has to flow or be stored at times of flood. The functional floodplain has an annual probability of flooding of 5% (i.e. from a 1 in 20 year return period event). PPS25 states that functional floodplain should be determined considering the effects of defences and other flood risk management infrastructure.

Functional floodplain has been created for relevant locations within the SFRA study area. For several watercourses within the study area, the 1 in 25 year flood outline has been modelled. Where this is the

case, this has been used to map the functional floodplain. Where the 1 in 25 year flood outline is not available Flood Zone 3 has been assumed to be functional until such a time that more detailed information is available, such as the Level 2 SFRA (where necessary), an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA, as recommended by PPS 25 guidance.

The Effects of Climate Change

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, Flood Zone 3b and Flood Zone 2 including the effects of climate change have been presented.

For several modelled fluvial reaches, climate change has been added to the 1 in 100 year flood event using a net increase of 20% over and above peak flows. In areas where climate change has not been modelled or mapped, an increase in the depth and extent of the existing Flood Zone is likely. In order to take this into account, it has been agreed with SDDC 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 the Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA.

Modelled outlines do not exist for the Flood Zone 2 plus climate change. It must be assumed that the extent of flood event would be greater than the existing outlines. As there are limitations, and extensive uncertainties, in deriving the floodplain for such an extreme event, it is not practical to use a proxy dataset or make assumptions to produce the Flood Zone 2 plus climate change outline. It is therefore suggested that any proposed development adjacent to the existing Flood Zone 2 is supported by a detailed FRA which examines the location and extent of the Flood Zone 2 plus climate change.

Historical Flood Mapping

Historic flood events have been plotted as a series of points in approximate areas that have flooded in the past. It should be noted that the majority of these flood events have not been linked to return periods. Much of the information used to create the points is based on historic flood events primarily from the BHS CBHE database[5] and local data provided by SDDC, and some inaccuracies may exist. In addition, historical flooding records do not always differentiate between flooding caused by fluvial sources and flooding as a result of other sources such as overwhelmed drainage or waterlogged rural land. However, the layer serves a useful purpose to highlight to SDDC that there are areas, some of which may be shown to be outside the Flood Zones, which have experienced flooding in the past.

In agreement with SDDC, this layer has not been included on the maps in Appendix E, but has been made available to SDDC as a GIS layer.

Sewer and Stormwater Flooding

Limited information regarding incidents of sewer flooding have been provided by STW in the form of DG5 data. The locations of incidences of sewer flooding have been presented as a series of points in a GIS layer. This layer will help to highlight to SDDC that there are certain areas where the drainage network can be overwhelmed during periods of high intensity rainfall and therefore new development in these areas should take account of this.

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

Flood Defences

SDDC supplied a cut from the EA national defences layer for their administrative area, there is however no information on the SoP offered by defences shown on this layer. Reports and discussions with SDDC and the EA suggest that recently completed defences in Hatton offer a SoP of 1 in 100 years, the SoP of defences in Egginton are notionally 1 in 25 years. In Scropton the River Dove defences are predominately 1 in 100 years, with a SoP of 1 in 50 years in parts.

Flood Warning Layers

Areas benefiting from an EA flood warning have been provided as a separate GIS layer. Emergency Planning Officers can use the flood warning layers in conjunction with the Flood Zone maps and flood defence information to assist in developing emergency plans for areas at risk of flooding within the South Derbyshire study area.

Groundwater Vulnerability Mapping

The EA's groundwater vulnerability maps have been presented in a thematic map to highlight areas that overlie aquifers with a high vulnerability. Major Aquifers with a high vulnerability tend to have a more permeable surface geology. 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.

British Geological Survey Geology Mapping

British Geological Survey (BGS) maps were assessed as part of the Level 1 SFRA. The data has been used to undertake the geology and SuDS review in Appendix A. Geology maps for the area are shown in Appendix F.

4.6 SFRA – Flood Risk Review Summary

4.6.1 Summary

In line with PPS25, the Sequential Test should be applied at all stages of the planning process. The aim of this is to direct new development towards areas that have a low probability of flooding. The mapping provided in Appendix E indicates the geographical extent of Flood Zone 2, Flood Zone 3a and Flood Zone 3b for the South Derbyshire study area.

The broad-scale and localised maps clearly show that, whilst flood risk exists in areas of the district, it does not pose a widespread and significant issue for the potential allocation of development sites. Where potential development sites are at risk from flooding, SDDC must determine their suitability based on the Sequential Test and vulnerability classifications presented in Tables D1 and D2 of PPS25. Wherever possible the SDDC should seek to direct development to lower probability Flood Zones. Where this is not possible, development should preferably be located in Flood Zone 2 and where this is not possible, sites in Flood Zone 3 may be considered.

Dependent on the vulnerability of the proposed development (as classified in PPS25 – table D2), some development sites that are either wholly or partly situated in Flood Zone 2 or Flood Zone 3 may require the application of the Exception Test. Those development areas requiring application of the Exception Test will require further assessment in a Level 2 SFRA. Information on the application of the Sequential Test, guidance on strategies for managing flood risk, guidance on the potential use of SuDS and guidance on site-specific FRAs are provided in Section 5.2, Chapter 6, and Appendix A.

5 The Sequential Test

5.1 The Sequential Approach

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 (except water-compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

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 (Table 5-1 and Table 5-2). Development should be directed towards Flood Zone 1 wherever possible, and then sequentially to Flood Zone 2 and Flood Zone 3. A flow diagram for application of the Sequential Test from the (Draft) Practice Guide Companion to PPS25 is provided (Figure 5-1).

The application of the sequential approach aims to manage the risk from flooding by avoidance. This will help prevent the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers and mitigation measures are provided.

The LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test and where necessary the Exception Test (see Appendix D of PPS25) in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development based on past trends.

PPS25 acknowledges that some areas will be at risk of flooding from flood sources other than fluvial. 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:

- Surface Water,
- Groundwater,
- Sewers,
- Artificial Sources.

As highlighted in Section 2.2 these flood sources are typically less understood than fluvial sources. Data primarily exists as point source data or through interpretation of local conditions. In addition, there is no guidance on suitable return periods to associate with floods arising from these sources. For example modern storm water drainage systems are constructed to a 1 in 30 year standard. Any storm event in excess of the 1 in 30-year return period storm would be expected to cause flooding. Contact with STW needs to be maintained as part of the SFRA updating process to ensure that any sewer models or data on sewer flooding incidents is incorporated into the SFRA. PPS 25 recommends that site specific FRAs should undertake detailed drainage and surface water investigation. It is recommended that such findings are collated on an ongoing basis to ensure the full extent of such issues is highlighted to the district.

If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

5.2 Using the SFRA to Apply the Sequential Test

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.

The recommended steps required in undertaking the Sequential Test are detailed in Section 5 The recommendations are based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 5-3. The use of the SFRA maps, data and GIS Layers in the application of the Sequential Test is detailed in Sections 5.2 and 5.4.

Table 5-1 Flood Zones definitions (see Table D1, Annex D of PPS25)

Flood Zone	Definition		Probability of Flooding
	Fluvial	Tidal	
1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
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
3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
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 of a flood event occurring in any year

Table 5-2 Flood Risk Vulnerability Classification (from PPS25, Appendix D, Table D2)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable' and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 5-3 Flood Risk Vulnerability and Flood Zone 'Compatibility'
(from PPS25, Appendix D, Table D.3)

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

(✓ - Development is appropriate, × - Development should not be permitted)

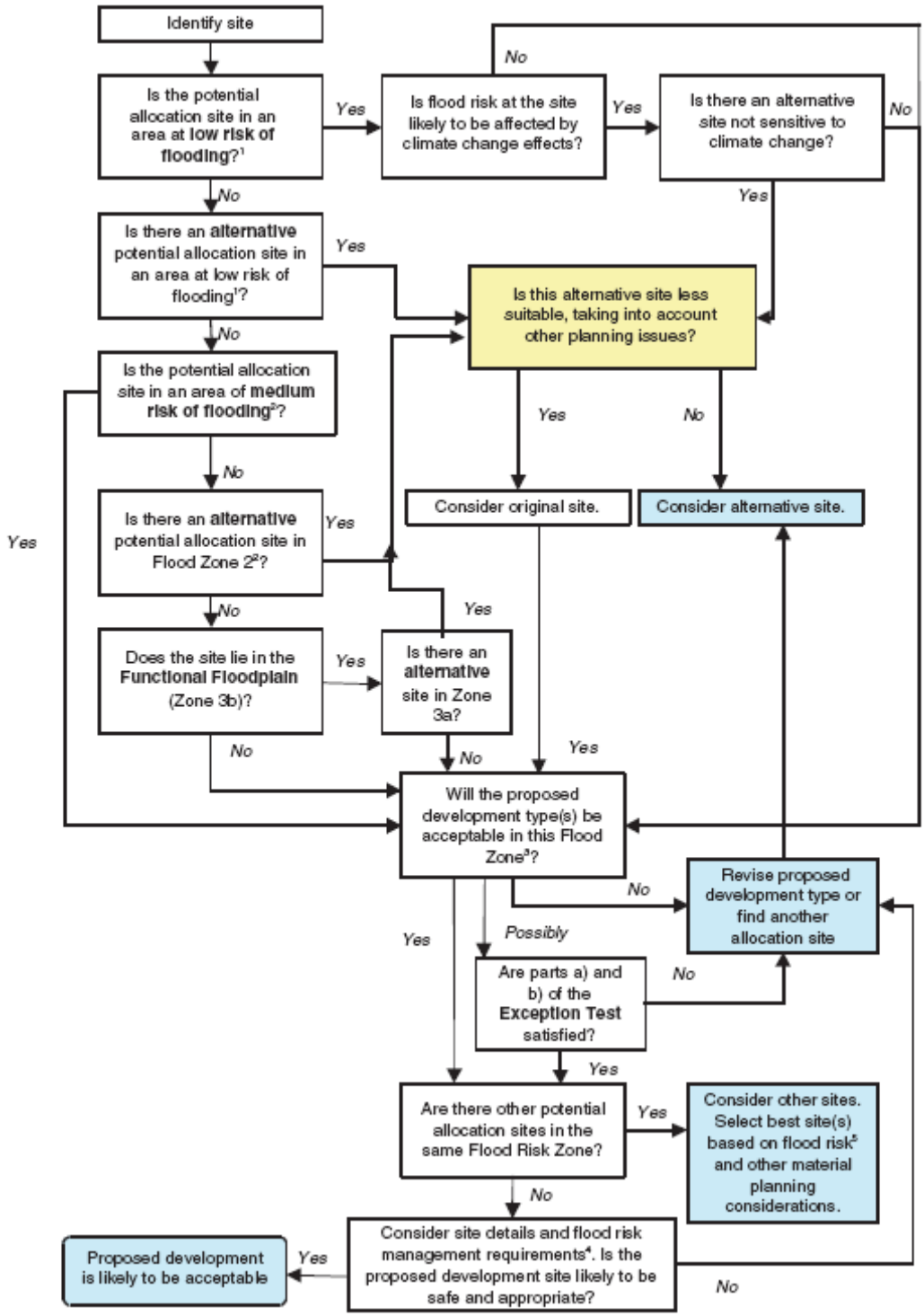

Figure 5-1: Flow diagram illustrating the application of the Sequential Test

Table 5-4 Sequential Test Key - A Guide to using the GIS Layers

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

Table 5-4 Sequential Test Key - A Guide to using the GIS Layers (continued)

Category	GIS Layer	Example Questions
Other Flood Sources	SFRA combined fluvial and tidal 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 Outlines, Parish Council data, GEZ, CEH stream network (BFI) and 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?

Table 5-5 Flood Risk Vulnerability and Flood Zone Compatibility

Use Category	Development	FLOOD ZONE			
		1	2	3a	3b
		FRA[1]	FRA	FRA	FRA
Essential Infrastructure	Essential Transport Infrastructure, Strategic Utility Infrastructure, Electricity Generating Power Stations	A	S ⇩ A	S ⇩ E ⇩ A	S ⇩ E ⇩ A
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	A	S ⇩ E ⇩ A	N	N
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)	A	S ⇩ A	S ⇩ E ⇩ A	N
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)	A	S ⇩ A	S ⇩ A	N
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)	A	A	A	A

To be read in conjunction with Table D.1 and Table D.2 in PPS25. Table 5-5 seeks to highlight what development is appropriate in flood zones and where FRAs are required.

TABLE 5-5 - KEY

A: *Appropriate use*
N: *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*

FRA[1]*: FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1,000 m*^{2}*.* This allows the *consideration of the vulnerability of flooding from sources other than river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off.*

FRA*: Flood risk assessment required for all developments.*

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.

5.3 Recommended Stages for application of the Sequential Test

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendix E. The recommended stages for the application of the Sequential Test by the Council are as follows:

1. Assign potential developments with a vulnerability classification (Table D-2 PPS 25). Where development is mixed, this should be moved to the higher classification,
2. The location and identification of potential development should be recorded,
3. The Flood Zone classification of potential development sites should be determined based on a review of the EA Flood Zones and the Flood Zones presented in this SFRA for fluvial and tidal sources. Where these span more than one Flood Zone, all zones should be noted,
4. The design life of the development should be considered with respect to climate change:
    - 60 years – 2072 for commercial / industrial developments,
    - 100 years – 2112 for residential developments,
5. It should be noted that for the purposes of the Sequential Test, Flood Zones with no consideration of defences should be used i.e. the SFRA flood zones,
6. Highly vulnerable developments should be located in those sites identified as being within Flood Zone 1. It should be noted at this stage that Flood Zone 1 represents any area that is not

determined as Zone 2 or Zone 3. If these cannot be located in Flood Zone 1 because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area,

7. Once all highly vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as more vulnerable. In the first instance more vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate more vulnerable development, sites in Flood Zone 3a can be considered. More vulnerable developments in Flood Zone 3a will require application of the Exception Test. More vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain,
8. Once all more vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as less vulnerable. In the first instance less vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain,
9. Essential infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zone 3a and Flood Zone 3b, provided the Exception Test is fulfilled,
10. Water compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. They do not require the application of the Exception Test,
11. On completion of the sequential test, the LPA may have to consider the risks posed to a site within a Flood Zone in more detail in a Level 2 Assessment. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone. Consideration of flood hazard within a Flood Zone would include:
    - Flood risk management measures,
    - The rate of flooding,
    - Flood water depth,
    - Flood water velocity.

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 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 FRA).

The maps presented in Appendix E are designed to assist SDDC 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 Zone 2 and Flood Zone 3 and, if the sites cannot be relocated, it will be necessary to undertake an Exception Test.

5.4 Using the SFRA Maps, Data and GIS Layers

Table 5-4 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.

Appendix G summarises the steps required to maintain and update the SFRA together with a revision schedule. This should be checked to prior to the SFRA being used at a strategic land allocation scale or on a Development Control level to ensure the most current and up-to-date version of the SFRA is being used. In addition, close consultation with some of the key stakeholders, in particular the EA, may highlight updated flood risk information that may reduce uncertainty and ensure the Sequential Test is as robust as it can be.

As identified in Section 2, 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.

To overcome this gap in the data and to enable SDDC to proceed with the 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 polices 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 current 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.

It should be noted that adopting this approach requires SDDC to accept an element of risk when reviewing and allocating their development sites. For example, should SDDC 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 Flood Zone 3a to be redefined as Flood Zone 3b with consideration of climate change.

As part of the SFRA update process, new modelled watercourse outlines should be incorporated into the SFRA mapping. New modelled outlines may become available as part of a site specific FRA or as part of ongoing EA updated modelling.

6 Site Specific Flood Risk Assessment Guidance

6.1 Introduction

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 the risk of injury, property damage or even death. 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 to 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.

Opportunities to manage flood risk posed to and by 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.

A Level 1 SFRA should present sufficient information to assist LPAs 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 and may show a specific site to be within Flood Zone 1 when it may be adjacent to a watercourse. Therefore individual applications will be required to submit individual FRAs.

Guidance on how to deal with windfall and brownfield sites, and also the scope for determining the requirements for a Level 2 assessment can be found in Appendix I.

Site-specific FRAs 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.

The guidance presented in the following sections has been based on:

- The recommendations presented in PPS25 and the Practice Guide Companion,
- The information contained within this SFRA report.

At the time of writing this document no site-specific allocations had been finalised, therefore pending the finalisation of the LPA allocations, the development areas were used to identify the flood risks to potential growth and development areas. If on completion of the preferred options there are any allocations that fall outside these growth areas, then the Sequential Test and potential exception test for these sites will need to be explored at that time. The following recommendations are made by way of an indication of how to proceed with the SFRA process once the preferred options allocations are finalised:

- The LPAs should apply the Sequential Test to the potential development sites and identify those sites they consider will be necessary to apply the Exception Test,

- If sites require the Exception Test the LPAs should provide responses to parts 'a' and 'b' of the Exception Test for each of the allocation sites,
- Following completion of the Sequential Test and parts 'a' and 'b' of the Exception Test the EA should be consulted to confirm their acceptance of the LPAs arguments and justification for progressing with sites that require the Exception Test. The LPA should then refer future developers to complete an FRA to meet the requirements of part c) of the Exception Test in line with recommendations set out in PPS25.

6.1.1 When is a Flood Risk Assessment required?

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.

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

- Development sites located in Flood Zone 2 or Flood Zone 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 m^2. 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 8m (water environment) of any watercourse regardless of Flood Zone classification.

6.1.2 What does a Flood Risk Assessment require?

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.

The Practice Guide Companion to PPS25 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.

The staged approach comprises of three stages outlined below.

6.1.3 Level 1 - Screening Study

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.

6.1.4 Level 2 - Scoping Study

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 masterplans of the site raising a developer's awareness of the additional elements the proposed development may need to consider.

6.1.5 Level 3 – Detailed Study

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 dwelling 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.

At all stages, the LPA, and where necessary the EA and/or STW should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for Planning Applications.

6.1.6 Site-Specific Guidance

SDDC should consider the consequences of including SuDS on development sites and the impact these can have on the developable area. In all cases the LPA should assess allocation sites in relation to geology and local issues to enable completion of the SuDS summary in Appendix A; National and local policies should be reviewed against local flood risk issues and objectives identified by the EA. Through completion of these recommendations the LPA will be able to transparently manage flood risk and ensure risk to their development sites and communities, now and in the future are mitigated.

National Flood Risk Guidance

PPS 25 Methodology must be followed as detailed above.

EA guidance on sequential testing must be followed as detailed above.

Local Flood Risk Policy

Where development is to be situated within a Flood Zone the following policies should be observed:

- The development should seek to reduce flood risk overall,
- Flood proofing/resilience measures should be incorporated into the design e.g. bungalows should have velux windows, sockets located high up on walls,
- Access and Egress routes must be at suitable level to be agreed in conjunction with the EA,
- Emergency Planning,
- EA Flood Warning Procedure should be adhered to,
- Flood action plans should be developed- these would consider Escape routes, a refuge room, adequate supplies of bottled water and food,
- Using Section 3.9 and Appendix A, site specific FRAs should ensure appropriate SuDS techniques are investigated according to local geology.

6.2 Residual Risk Management

Residual risk in a generic sense can be defined as being the remaining risk following the implementation of all reasonable risk avoidance, reduction and mitigation measures. In a flood risk context, this residual risk pertains to the flood risk that remains after flood avoidance and alleviation measures have been put in place. Examples of such residual risks include overtopping or breaching of flood walls or embankments.

Residual risk management therefore aims to prevent or mitigate the consequences of flooding that can occur despite the presence of flood alleviation measures.

Application of the Sequential Test as part of PPS25 aims to preferentially develop or relocate potential development sites into areas with low flood risk. Where this is not realistically possible, some development sites may be located in higher flood risk areas, such as PPS25 defined Flood Zones 2 and Flood Zone 3. As a result, such developments will require residual risk management to minimise the consequences of potential flooding, e.g. following a breach or overtopping of local defences.

Ensuring properties are defended to an appropriate design standard reduces flood risk. However, further options are also available should the residual risk to a development prove unacceptable. This chapter presents some of the information and options available to understand and manage residual risk.

6.2.1 Potential Evacuation and Rescue Routes

In the event of a flood incident, it is essential that the evacuation and rescue routes to and from any proposed development remain safe. The EA deem evacuation routes safe if they fall within the white cells of Table 13.1 of the Defra/EA document FD2320 for a 1 in 100/200 year design event as a minimum. This allows the LPA to consult with the emergency services over the suitability of the access route. If potential evacuation routes are likely to become inundated so that safe access/egress would not be possible, then the proposed development should be relocated. This may also be the case should the possible evacuation routes be particularly long or across difficult terrain.

A key consideration in relation to the presence and use of evacuation routes is the vulnerability and mobility of those in danger of being inundated. Development for vulnerable users e.g. disabled or the elderly, should, be located away from high-risk areas. The Sequential Test does not however differentiate between the vulnerability of the end users of the site, only the vulnerability of the intended use of the site. A proposed residential development for highly vulnerable end users, will still fall under the 'More Vulnerable' classification in Table D.2 of PPS25 and the Sequential and Exception Tests will apply accordingly. Where development for highly vulnerable end users cannot be avoided, safe and easy evacuation routes are essential.

6.2.2 Time to Peak of Flood Hazard

The time to the peak of the flood hazard relates to the amount of time it takes for a flood event to reach its maximum level, flow or height. The greater the time to peak, the greater the time available for evacuation. The time to peak can, for residual flooding, be very short. Should a defence structure breach then inundation can be rapid, resulting in a short time to peak for the areas local to the breach. Typically, areas immediately adjacent to a breach location will have a shorter time to peak than areas setback from the flood defence.

6.2.3 Methods of Managing Residual Flood Risk

The following sub-sections outline various methods available for the management of residual flood risk. The methods outlined will not be appropriate for all development types or all geographical areas. Therefore, they should be considered on a site-by-site basis. In addition, it is important that the use of such techniques do not exacerbate flooding elsewhere within the flood cell.

Recreation, Amenity and Ecology

There are many different ways in which recreation, amenity and ecological improvements can be used to mitigate the residual risk of flooding either by substituting less vulnerable land uses or by attenuating flows or both. They range from the development of parks and open spaces through to river restoration schemes. In addition, they have wider ecological biodiversity and sustainability benefits. However, this method of dealing with residual risk should not be accepted as a reason to allow inappropriate development in high risk areas.

The basic function of these techniques is increased flood storage and the storage or conveyance of rainwater. Typical measures include various guises of pools, ponds, and ditches. These all can have the added benefit of improving the ecological and amenity value of an area. These features can provide a haven for local wildlife. In addition, they can contribute to a sites amenity value both aesthetically and for recreation by providing attractive areas available for activities such as walking, cycling, water sports or wildlife watching.

Secondary Defences

Secondary defences are those that exist on the dry side of primary defences. Typically, their main function is to reduce the risk of residual flooding following a failure or overtopping of the primary defences.

Secondary defences can relocate floodwaters away from certain areas or reduce the rate of flood inundation following a residual event. Examples of secondary defences include embankments or raised areas behind flood defence walls, raised infrastructure e.g. railways or roads and on a strategic level,

canals, river and drainage networks. The latter are a form of secondary defence as they are able to convey or re-direct water away from flood prone areas even if this is not their primary function.

Land Raising

Land raising can have mixed results when used as a secondary flood alleviation measure. It can be an effective method of reducing flood inundation on certain areas or developments by raising the finished levels above the predicted flood level. However, it can result in the reduction in flood storage volume within the flood cell. As a result, floodwater levels within the remainder of the cell can be increased and flooding can be exacerbated elsewhere within the flood cell. Level for Level compensation storage would be required where any loss of floodplain storage had occurred as a result of land raising or development within the floodplain.

Partial land raising can be considered in larger, particularly low-lying areas such as marshlands. It may be possible to build up the land in areas adjacent to flood defences in order to provide secondary defences. However, again the developer should pay due regard to the cumulative effects of flooding such as increasing flood risk elsewhere.

Finished Floor Levels

Where developing in flood risk areas is unavoidable, the most common method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water level. The EA require a 600mm freeboard on computed levels in addition to modelled flood levels when setting finished floor levels. It is also necessary to ensure that roads levels are such that emergency access and evacuation routes are maintained. This can significantly reduce the risk of the proposed development becoming inundated by flooding. As with the land raising option, it is imperative that any assessment takes into consideration the volume of floodwater potentially displaced by such raising.

In areas where significant depths of floodwater are predicted to inundate the site, development design can incorporate the use of non-habitable uses on the ground floor. These can include garage areas, utility or storage spaces. This method can be somewhat contentious as it can be difficult to ensure that the ground floor remains uninhabited for the lifetime of the development and emergency access can be difficult.

Flood Resilience

The Association of British Insurers in cooperation with the National Flood Forum has produced published guidance on how homeowners can improve the flood resilience of their properties (ABI, 2004). These measures can not only improve properties against flood risk, by reducing the residual risk, but can also improve the insurability of homes in flood risk areas. The guidance identifies the key flood resistant measures as being:

- Replace timber floors with concrete and cover with tiles,
- Replace chipboard/MDF kitchen and bathroom units with plastic equivalents,
- Replace gypsum plaster with more water-resistant material, such as lime plaster or cement render,
- Move service meters, boiler, and electrical points well above likely flood level,
- Put one-way valves into drainage pipes to prevent sewage backing up into the house.

Advice on flood mitigation for homes and businesses is also given in the ODPM's 2003 report, 'Preparing for Floods' (ODPM, 2003b).

Flood Warning and Emergency Procedures

Flood warning and emergency procedures are typically higher-level management strategies. Such procedures typically include information such as warning, evacuation and repair procedures. Documents providing guidance on how to use flood resistance and resilience measures to limit damage caused by flooding, such as 'Improving the Flood Performance of New Buildings, (CLG, May 2007), can also offer important guidance and should be referred to.

When undertaking FRAs for developments within flood risk areas, the local flood warning and emergency response plans should be referred to as a flood damage mitigation method.

Where these procedures already exist they should be updated to include the information generated by this SFRA. Emergency planning maps are provided in each of the supporting appendices and should be consulted in order to identify places of refuge within the District. This will ensure that emergency plans are appropriate to the conditions expected during a flood event and that LPAs and emergency services are fully aware of the likely conditions and how this may affect their ability to safeguard the local population.

References

National Policy & Guidance Documents

CIRIA, 2007, 'The SuDS Manual' C697, London.

DEFRA, March 2005, 'Making Space for Water,' DEFRA Publications, London. http://www.defra.gov.uk/environ/fcd/policy/strategy.htm.

European Commission, 2000, 'The Water Framework Directive'

HMSO, June 2004, 'Planning and Compulsory Purchase Act', The Queens Printer of Acts of Parliament http://www.opsi.gov.uk/acts/acts2004/20040005.htm.

HMSO Department for Communities and Local Government, December 2006, 'Planning Policy Statement 25: Development and Flood Risk' 2006, The Stationary Office, Norwich. http://www.communities.gov.uk/index.asp?id=1504639.

HMSO Department for Communities and Local Government, February 2007, 'Development and Flood Risk: A Practise Guide Companion to PPS25 'Living Draft': A Consultation Paper', Communities and Local Government Publications, London.

HMSO Department for Communities and Local Government, 2007, 'Code for Sustainable Homes: Technical Guide', Communities and Local Government Publications, London.

WRc, March 2006, 'Sewers for Adoption', 6th Edition.

Regional & Local Policy & Guidance Documents

EMRA ,Faber Maunsell (2006), East Midlands Regional Flood Risk Appraisal

Environment Agency (January 2006) The Derbyshire Derwent Catchment Abstraction Management Strategy

Environment Agency (March 2008) The Lower Trent and Erewash Catchment Abstraction Management Strategy

Environment Agency (2006) The River Dove Catchment Abstraction Management Strategy

Environment Agency (2003) The River Trent Corridor Catchment Abstraction Management Strategy

SDDC Planning Services (March 2007), Local Development Scheme March 2007-2010

SDDC Planning Services (May 2006) Scoping Report, Sustainability Appraisal Woodville-Swadlincote Area Action Plan

SDDC (May 1998), Adopted South Derbyshire Local Plan

Environment Agency (October 2007) River Trent Catchment Flood Management Plan Consultation Draft Plan

Environment Agency (March 2004), River Dove Flood Risk Management Strategy Scoping Report

Environment Agency/JBA (2005) Hell Brook Flood Risk Mapping Study

Environment Agency/JBA (2006) Cuttle Brook Flood Risk Mapping Study

Environment Agency/Black and Veatch (July 2005), River Trent Willington Modelling Study Final Report

Environment Agency/Black and Veatch (April 2004), Strategic Appraisal Report: Appendix F, Volume 4 Model 3 Fluvial Trent Final Modelling Report

Environment Agency/Black and Veatch (April 2004), Strategic Appraisal Report: Appendix F, Volume 5 Model 4 Fluvial Trent Final Modelling Report

Derbyshire County Council (January 2001), Derby and Derbyshire Joint Structure Plan Adopted Written Statement

EMRA (2005) England's East Midlands Integrated Regional Strategy: Our Sustainable Development Framework

Government Offices for the East Midlands (March 2005) Draft East Midlands Regional Plan (RSS 8)

Appendix A: Geology and SuDS Review

Sustainable Drainage systems

Traditionally, built developments have utilised piped drainage systems to manage storm 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 storm water from developed areas, the alteration of natural drainage processes can potentially impact on downstream areas by increasing flood risk and reducing water quality. Receiving watercourses are therefore much more sensitive to rainfall intensity, volume and catchment land uses after a catchment or areas of a catchment have been developed.

Due to the difficulties associated with updating sewer systems it is uncommon for sewer and drainage systems to keep pace with the rate of development/re-development and the increasingly stringent controls placed on discharges to watercourses. As development progresses and/or urban areas expand these systems become inadequate for the volumes and rates of storm water they receive, resulting in increased flood risk and/or pollution of watercourses. Allied to this are the implications of climate change on rainfall intensities, leading to flashier catchment/site responses and surcharging of piped systems.

In addition, as flood risk has increased in importance within planning policy, a disparity has emerged between the design standard of conventional sewer systems (1 in 30 year) and the typical design standard flood (1 in 100 year). This results in drainage inadequacies for the flood return period developments need to consider, often resulting in potential flood risk from surface water/combined sewer systems.

A sustainable solution to these issues is to reduce the volume and rate of water entering the sewer system and watercourses.

What are Sustainable Drainage Systems?

SuDS are the preferred method for managing the surface water run-off generated by developed sites. Buildings Regulations (Approved Document Part H), PPS 25 Annex F and the EA advocate the use of SuDS for surface water runoff. PPS25 notes that regional planning bodies and LPAs should promote their use for the management of runoff. SuDS seek to manage surface water as close to its source as possible, mimicking surface water flows arising from the site, prior to the proposed development. Typically this approach involves a move away from piped systems to softer engineering solutions inspired by natural drainage processes.

Discharge rates from a developed area vary depending on the characteristics of the site pre development. If the site was originally Greenfield in nature, surface water discharge rates should mimic the Greenfield rate. In accordance with PPS25 peak flow rates of surface water leaving a developed site should be no greater than the rates prior to the proposed development, unless specific off-site arrangements can be made that result in the same net effect. Where possible, efforts should be made to improve the current situation with regard to discharge from the site, particularly in areas known to suffer from surface water inundation.

SuDS should be designed to take into account the surface water run-off quantity, rates and also water quality. This should ensure their effective operation up to and including the 1 in 100 year design standard flood (including an allowance for climate change). This should be considered as a 30% increase (in peak rainfall) for proposed (housing) development that fits into the 2085-2115 band of Table B-2 in PPS 25, or a 20% increase (in peak rainfall) for proposed (commercial development) that fits into the 2055-2085 band of

Table B-2. In addition, these systems must be proven to be effective for the lifetime of the development, 100 years for residential developments and 60 years for commercial (as outlined by PPS25).

Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective:

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

The goals of SuDS 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).

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

The application of SuDS techniques is not limited to one technique per site. Often a successful SuDS solution will utilise a number of techniques in combination, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS.

Planning

All relevant organisations should meet at an early stage to agree on the most appropriate drainage system for the particular development. These organisations may include SDDC and STW. There are, at present, no legally binding obligations relating to the provision and maintenance of SuDS. However, PPS25 states that:

> "where the surface water system is provided solely to serve any particular development, the construction and ongoing maintenance costs should be fully funded by the developer."

The most appropriate agreement is under Section 106 of the Town and Country Planning Act (1990). Under this agreement a SuDS maintenance procedure can be determined.

When a decision has been made regarding a SuDS method, the various organizations involved should agree on a management and responsibility strategy. Problems arise when this has not been decided upon prior to adoption and the SuDS system can fail.

SuDS Techniques

SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc). Various SuDS techniques are available; however the techniques operate on two main principles:

- Infiltration,
- Attenuation.

All systems generally fall into one of two categories, or a combination of the two.

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

During the design process, liaison should take place with SDDC, the EA (if the site is over 1ha in size or identified as situated within a critical drainage area), and STW in order to establish that the design methodology is satisfactory and to also agree on a permitted rate of discharge from the site.

Infiltration SuDS

This type of SuDS relies on discharges to ground, where suitable ground conditions allow. Therefore, infiltration SuDS are reliant on the local ground conditions (i.e. permeability of soils and geology, the groundwater table depth and the importance of underlying aquifers as water resources etc) for their successful operation. Before implementing this type of SuDS, detailed ground investigation should be carried out as there is the potential for mobilization of contamination if any is present.

Various infiltration SuDS techniques are available for directing the surface water run-off to ground. However, development pressures and a desire to maximise development potential often result in typically small areas available for infiltration systems. These small areas, allied to the rapid rates of run off generation, often require some form of attenuation as part of the infiltration system. The storage may be provided in the sub-base of a permeable surface, within the chamber of a soakaway or as a pond/water feature.

Infiltration measures include the use of permeable surfaces and other systems that are generally located below ground.

Attenuation SuDS

Should it be found that the ground conditions are not favourable for infiltration techniques, the surface water run-off discharged from a site will need to be attenuated using on-site storage. While this is a SuDS technique that will reduce the rate of discharge from the site, the overall volume will not be minimised using

on-site storage alone. An important factor that needs to be taken into consideration when assessing the suitability of on-site storage as part of a proposed development is the volume required and the associated impacts the storage will impose on development proposals and risks to neighbouring properties.

An allowable rate of discharge from the site will need to be agreed with the EA, STW, and SDDC. This can have significant implications to the proposed development with regards to the large volume of storage that may be required. On-site storage can be constructed both above ground and below ground with the above ground systems usually being the cheaper option on a cost per metre cubed of storage basis. It should be noted however that the below ground systems may pose less constraints on the developable area of the site.

On site storage measures include basins, ponds, and other more engineered forms of storage underground, (the reader is directed to The SuDS Manual for further information regarding SuDS techniques).

Alternative Forms of Attenuation

In many situations the development of a site may involve proposals that would inhibit the use of basins or ponds as a means of managing the surface water run-off discharged from the site. This may be due to space limitations, economic feasibility, or other issues such as health and safety etc. In these situations it may be appropriate to use a storage option that is viewed as being more 'engineered' than an open basin or pond. Most of these methods involve the provision of storage beneath the ground surface, which may be advantageous with regards to the developable area of the site; however consideration needs to be given to construction methods, maintenance access and to any development that takes place over an underground storage facility. The provision of large volumes of storage underground also has potential cost implications. It should also be noted that underground storage tanks are the EA's least preferred option for on site attenuation and alternative methods should be used wherever possible.

Methods for providing alternative attenuation include:

- Deep Shafts,
- Geocellular Systems,
- Oversized Pipes,
- Rainwater Harvesting,
- Tanks,
- Green Roofs.

Combined Infiltration / Attenuation Systems

In most situations, SuDS systems include both infiltration and storage. Most of the techniques identified above can be used in combination; however dedicated infiltration and attenuation systems include swales and filter strips.

Combined systems often meet all three goals of SuDs whilst also reducing the land take required to accommodate them.

SuDS Suitability in SDDC Study Area

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

Tables A-1 and A-2 indicate the types of soils, drift deposits and solid geology that are present in the SDDC area, and their likely suitability to infiltration measures. This is based on a review of:

- Soils maps-(1:250,000) Soil Survey of England and Wales,
- Geology Maps (1:625,000) – British Geological Survey.

Tables A1 and A2 present the ground conditions found within SDDC and the types of SuDS techniques that may be suitable for a site located on these materials based upon a broadscale assessment of how freely draining they are. These definitions are based on a review of available information and our experience and should not supersede site-specific data and ground investigations.

In the design of any drainage system and SuDS approach, consideration should be given to site-specific characteristics and where possible be based on primary data from site investigations. The information presented in Table A-1 and Table A-2 is provided as a guide and should not be used to accept or refuse SuDS techniques.

Table A-1: Hard Rock Geology Units within South Derbyshire

Class	Sub class	Overview	General Drainage Assessment	SuDS Recommendation	FRA Requirements	Potential Areas Effected
Limestones	*Silurian*	*Limestones, ironstones, sandstones*	*Moderately drained*	*Infiltration and / or combined infiltration and attenuation systems may be appropriate*	*FRA will be required to determine suitable drainage and SuDS arrangements*	*North east of Hartshorne*
	Carboniferous	*Tournaisian and Visean limestones*	*Moderately drained*			*Calke Park*
	Inferior Oolite	*Limestone, ironstones*	*Moderately drained*			*Ticknall, north west of study area*
Upper Carboniferous	*Lower Westphalian coal measures*	*Coals, clays, shales, ironstones*	*Poorly drained soils*	*Attenuation systems*	*Site-specific FRA may be required to carefully consider suitable adoption of SuDS, though site area is less than 0.5Ha.*	*Swadlincote, Band between Hartshorne to Calke Park.*
	Namurian Millstone Grit	*Coarse mudstones, sandstones and shales*	*Poorly drained soils*			*East of study area, Melbourne, Stanton by Bridge, Kings Newton*
Permian and Triassic Sandstones		*Undifferentiated including Bunter, Breccia and Keuper*	*Moderately drained soils*	*Infiltration and / or combined infiltration and attenuation systems may be appropriate*	*FRA will be required to determine suitable drainage and SuDS arrangements*	*South of Trent, Repton, Ingleby, Newton Solney, Overseal, Netherseal, Woodville, Smisby.*
Triassic Mudstones		*Mudstones including Keuper Marl and Dolomitic Conglomerates*	*Poorly drained soils*	*Attenuation systems*	*Site-specific FRA may be required to carefully consider suitable adoption of SuDS, though site area is less than 0.5Ha.*	*Land north of the River Trent Corridor: Hilton, Etwall, Findern, Hatton, Barrow upon Trent, Swarkestone, Willington, Egginton, Aston on Trent, Shardlow.*
Notes: Broadscale assessment based upon British Geological Survey 1:625,000 paper maps, more detailed assessments will be required for site specific FRAs.						

Table A-2: Drift Geology within South Derbyshire

Classification	Overview	General Drainage Assessment	SuDS Recommendation	FRA Requirements	Potential Development Sites / Areas Effected
Alluvium	*Clay, silt and sand*	*Potentially poorly drained soils*	*Attenuation systems*	*Site-specific FRA may be required to carefully consider suitable adoption of SuDS, though site area is less than 0.5Ha.*	*Willington, Egginton, Swarkestone, Stanton by Bridge, Shardlow, Scropton, Hatton*
River Terrace Deposits	*Sand and gravel*	*Moderately drained*	*Infiltration and / or combined infiltration and attenuation systems may be appropriate*	*FRA will be required to determine suitable drainage and SuDS arrangements*	*North of the Trent corridor, Etwall, Findern, Hilton, Weston on Trent*
Till	*Diamicton*	*Poorly drained soils*	*Attenuation systems*	*Site-specific FRA may be required to carefully consider suitable adoption of SuDS, though site area is less than 0.5Ha.*	*Northern Swadlincote, Smisby*
Notes: Broadscale assessment based upon British Geological Survey 1:625,000 paper maps, more detailed assessments will be required for site specific FRAs.					

Appendix B: Data

TITLE	DESCRIPTION	CONFIDENCE
EA Flood Data	Rivers Derwent, Dove, Trent Corridor Anker and Mease CAMS	VERY GOOD
EA Flood Data	River Trent CFMP	VERY GOOD
EA Flood Data	Groundwater Vulnerability Maps	VERY GOOD
EA Flood Data	Main River Maps	VERY GOOD
EA Flood Data	Flood Warning Areas	VERY GOOD
EA Flood Data	Flood Defences	VERY GOOD
EA Flood Data	Broadscale Flood Zones	GOOD
EA Flood Data	Hydraulic model outputs for Cuttle Brook, Hell Brook and Fluvial River Trent	VERY GOOD
EA Flood Data	Modelling reports for Cuttle Brook, Hell Brook and River Trent	VERY GOOD
Mapping (SDDC) Data	10k rasters, 50k rasters, 250k rasters	VERY GOOD
Sewer Flooding (STW) Data	DG5 Data Sets for internal and external registers	GOOD
BGS Data (SDDC)	Artificial, bedrock, linear features, mass movement, superficial	VERY GOOD
Historic Flooding (SDDC)	Information relating to historical flooding events within the district	VERY GOOD
Parish Council data	Questionnaires returned to SDDC following consultation process	GOOD

Appendix C: List of Contacts

Organisation	Contact	Telephone	E-mail
South Derbyshire District Council	Kevin Exley	01283 228717	kevin.exley@south-derbys.gov.uk
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	John Beckett	01543 404900	john.beckett@environment-agency.gov.uk
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	Peter Richards	0161 2376043	peter.richards@scottwilson.com

Appendix D: GIS Layers

Type	Layer	Source	Description of Layer	Included	Comment	Benefits	Limitations
Fluvial	Environment Agency Broad-scale Flood Zone Maps	Provided as GIS layer by SDDC	Polygon layer showing EA flood zone maps including Flood zone 2 and 3	Y		A quick and easy reference that can be used as an indication of flood risk.	Flood zones may not give an accurate representation of flood risk. The models do not take into account defences; are commonly based on 5m resolution DTM; JFLOW software is commonly used that is generally thought to have inaccuracies. Typically watercourses with a catchment area less than 3km2 are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, it is suggested there is no flood risk.
	Main Rivers	Provided as GIS layer by EA	Polyline layer showing all watercourses designated Main Rivers	Y		Identification of the watercourses for which the EA have discretionary and regulatory powers	There are other watercourses that may be a significant flood source.
	Hydraulic model outputs: Cuttle Brook, 20yr, 100yr, 1000yr, 20yr+CC, 100yr+CC,100yr+CC	Provided as GIS layers by EA	Polygon data showing the modelled outlines of Cuttle Brook	Y	Limited data	Detailed and calibrated hydraulic model outlines that have been mapped using LiDAR (1m and 2m resolution). These outlines provide a much greater degree of accuracy and therefore confidence than the broad-scale flood zones.	There are watercourses within the study area that have not been modelled and therefore the flood risk from these cannot be as accurately assessed. In addition, the outlines for the River Trent have been superseded by the EA Flood Zone Maps following a revision of the fluvial Trent model.
	Hydraulic model outputs: Hell Brook, 20yr, 100yr, 1000yr, 20yr+CC, 100yr+CC,100yr+CC	Provided as GIS layers by EA	Polygon data showing the modelled outlines for Hell Brook	Y			
	Hydraulic model outputs: River Trent FT3 and FT4, 20yr, 100yr, 100yr+CC	Provided as GIS layers by EA	Polygon data showing the modelled outlines of River Trent.	Y			
	Combined Flood Zone 3b - Functional Floodplain	EA Flood Zone Maps & Hydraulic Modelled Data	Polygon layer created using best available data for whole district. Where 1:20yr modelled outlines available, these have been used to represent FFP (with agreement from EA and Council).	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 20yr event is not available, the 100yr FZ3 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available. In addition, the outlines from the Fluvial Trent have been used but these may not represent the most recent data and should be updated with the new Flood Zone 3b outline when available.
	Combined Flood Zone 3a	EA Flood Zone Maps & Hydraulic Modelled Data	Polygon layer created using best available data for whole district. Where 1:100yr modelled outlines available, these have been used to represent FZ3a (with agreement from EA and the Council). Where modelled data is not available for fluvial reaches, EA broad-scale FZ3 has been used.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 100yr event is not available, the 100yr FZ3 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.
	Combined Flood Zone 3 a+ CC	EA Flood Zone Maps, Hydraulic Modelled Data	Polygon layer created using best available data for whole district. Where 1:100yr + CC modelled outlines available, these have been used to represent FZ3 + CC (with agreement from EA and the Council). Where modelled data is not available EA broad-scale FZ2 has been used.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Assumption made that where modelled data for 100yr+CC event is not available, the 1000yr FZ2 broad-scale outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.
	Combined Flood Zone 2	EA Flood Broad Scale Flood Zone Maps and hydraulic modelled data	Polygon layer of 1:1000yr FZ2 outline created for whole district.	Y	Combined data	A single GIS layer created using best available information at time of publication.	Based on FZ2 broad-scale mapping and detailed model outputs.

Type	Layer	Source	Description of Layer	Included	Comment	Benefits	Limitations
Groundwater	Groundwater Vulnerability Maps	Provided as GIS layer by EA	Polygon layers showing major aquifers and their vulnerability	Y		Broadly shows extents of aquifers in the district. Where aquifers are highly vulnerable, they often have a more permeable covering and, together with dry valley and watercourse networks, potential groundwater flooding areas can be identified.	Coarse assessment of potential areas where GW flooding could occur. This is not foolproof and is based on assumptions. Where necessary, detailed groundwater flooding studies should be undertaken at SSFRA.
Other	Sewer Flooding History	DG5 data registers provided by Severn Trent Water	Data layer showing points of flooding with records of date of incident, location, extent, source, cause.	Y		Indicates areas that are most prone to flooding as have experienced flooding within a postcode area due to hydraulic incapacity.	The postcode areas cover relatively large areas and it is not possible to determine the exact location of the incidents from this dataset. Data only covers 6 month period and it is therefore difficult to determine long-term trends.
	Historic Flood Events	GIS layer of digitised historic flood events provided by SDDC	Polygon layer showing locations of recorded historic flood events	Y		Indicates areas which have been recorded as having been flooded	Source of flooding is not always recorded and quantity and accuracy of recorded information does not reflect true scale of past flooding
Mitigation	Flood Warning areas	Provided as GIS layer by EA	Polygon layer showing areas benefiting from flood warning and emergency plans with query details presenting what is involved in each.	Y		Indicates which areas the flood warning system covers.	
Mapping	OS Mapping	SDDC provided OS Mapping under contractor license	1:10k (limited coverage), 1:50k and 1:250k OS raster maps for use in GIS	Y		Provides background mapping to other GIS layers.	Designed for use at 1:10k, 1:50k, 1:250k scales

Appendix E: Flood Zone Mapping

Appendix F: Groundwater Vulnerability and Geology

Appendix G: SFRA Maintenance and Updates

How to maintain and update the SFRA

For an SFRA to serve as a practical planning tool now and in the future, it will be necessary to undertake a periodic update and maintenance exercise. This section clarifies what specific actions are recommended to ensure correct maintenance and updating of the SFRA.

GIS Layers

As described in Appendix E, the GIS layers used in the SFRA have been created from a number of different sources, using the best and most suitable information available at the time of publishing. Should new Flood Zone information become available, the data should be digitised and geo-referenced within a GIS system. A copy of the current dataset should be created and backed up and the new data should then be merged or combined with the current data set.

For other GIS layers such as the Historical Flood Outlines or the Sewer Flooding Information, it is likely that data will be added rather than be replaced. For example, where a new sewer flooding incident is reported in the catchment, a point should be added to the sewer flooding GIS layer rather than creating a new layer.

All GIS layers used in the SFRA have meta-data attached to them. When updating the GIS information, it is important that the meta-data is updated in the process. Meta-data is additional information that lies behind the GIS polygons, lines and points. For example, the information behind the SFRA Flood Zone Maps describes where the information came from, what the intended use was together with a level of confidence.

For any new data or updated data, the data tables presented in Appendix should be checked to ensure they are up-to-date.

OS Background Mapping

The SFRA has made use of the OS 1:10,000 and 1:50,000 digital raster maps. Periodically these maps are updated. Updated maps are unlikely to alter the findings of the SFRA.

Data Licensing Issues

Prior to any data being updated within the SDDC SFRA, it is important that the licensing information is also updated to ensure that the data used is not in breach of copyright. The principal licensing bodies relevant to the SFRA at the time of publishing were SDDC, Ordnance Survey, STW and BGS. Updated or new data may be based on datasets from other licensing authorities and may require additional licenses.

Flooding Policy and PPS25 Practice Guidance Updates

This SFRA was created using guidance that was current in December 2007, principally PPS25 and the accompanying Practise Guidance.

Should new flooding policy be adopted nationally, regionally or locally, the SFRA should be checked to ensure it is still relevant and updates made if necessary.

Stakeholder Consultation and Notification

The key stakeholders consulted in the SFRA were SDDC, the EA, and STW. It is recommended that a periodic consultation exercise is carried out with the key stakeholders to check for updates to their datasets and any relevant additional or updated information they may hold. If the SFRA is updated, it is recommended that the EA and the County Council Emergency Planning Department are notified of the changes and instructed to refer to the new version of the SFRA for future reference.

Frequency of Updates and Maintenance

It is recommended that the SFRA is maintained on an annual basis. Should any changes be necessary, the SFRA should be updated and re-issued.

Appendix H: Parish Council Flood Risk Consultation

Parish	Please provide details of the location and dates of recent flood events within your parish	For the events listed, please provide, where possible, the depth of floodwater, area affected by flooding, sources of flooding	Photo's held	Please provide details	In your view what are the main reasons which led to the flood events you have identified previously?	Are there any hydraulic structures within your parish that are prone to blockage	If yes please locate the broad location of these on the map and provide details on the structure location, frequency and who clears the blockage	Is there any other information regarding flood risk issues which you think could help inform the Strategic Flood risk assessment for the District.
Aston-on-Trent	--	--	--	--	--	--	--	--
Barrow on Trent	--	--	--	--	--	--	--	--
Barton Blount	The only area that floods after heavy rain is marked blue on your drawing	Areas affected are the fields Adjacent to Sutton Brook	No	--	Heavy rainfall	No	--	--
Bearwardcote	--	--	--	--	--	--	--	--
Bretby	a) 7 Bretby Lane b) Watery Lane c) Junction of Geary Lane & A5111, houses at this area	a) Dispute between DCC & S.Trent when houses were built off Moat Bank, the drain was not increased, and cant cope with rain water b) The culvert is blocked by vegetation. The pipes installed were undersized, rather than leaving them as ditches. Floods 2/3 times a year or any time when there is excessive amounts of rain. c) Floods when rains. The pipe has been increased from 6 inch to 10inch but still floods, as cant cope with the run off from the fields. Floods regularly when excessive rainfall	No	--	Rain comes periodically but very heavy and ground and drains cant cope with the excessive amounts of rain in relatively short time period	Yes	Ditches on watery Lane	--
Burnaston	a) Etwall Lane during summer 07 and over the winter. Water lay on the lane for 3 days 2 feet deep (marked x)	Approx 2 deep. Highway only. Run off from fields and blocked gully. The water doesn't affect properties but it did make the route impossible to get into and out of the village for 3 days.	No	--	Run off from fields with steep sides that in effect keeps the water from draining. Gullies were blocked, and heavy rain causes the flooding water to be unable to drain away The building of one large property, and the significant increase if the property opposite may also contribute. The area previous to these builds used to pool but passable - not the case now.	--		As the area is now liable to flood, some sort of road sign could be introduced in order to warn motorists that the lane is flooded and impassable. The lane is narrow, with lots of bends, so its difficult to turn around if it is blocked
Calke	See attached plan	a) 6 inch over the road, up to 3 feet on roadsides, flooded water due to storm water , June 07 b) Abbey flooded from roof and ground water run off from park c) Highway affected on a regular basis if grips not maintained up to 12 inch deep	Yes	(Telephone number provided)	A + B severe storm C maintenance of roadside grip cutting	No	--	Grips need maintaining on the private side of highway boundary
Castle Gresley	None	--	No	--	--	No	--	--
Catton	--	--	--	--	--	--	--	--
Cauldwell	--	--	--	--	--	--	--	--
Church Broughton	--	--	--	--	--	--	--	--
Cotton-in-the-elms	The following are prone to flooding on a regular basis a) Coalpit lane in the vicinity of - Bridge over Brook - Near S bend b) Also in the vicinity Manor Farm, Mill Street and Lullington Road	This is very considerable flooding due to the inadequacy of the infrastructure to cope with sudden and prolonged inclement weather	No	--	Please see answer to question 2	Yes	Lullington Road	--

Parish	Please provide details of the location and dates of recent flood events within your parish	For the events listed, please provide, where possible, the depth of floodwater, area affected by flooding, sources of flooding	Photo's held	Please provide details	In your view what are the main reasons which led to the flood events you have identified previously?	Are there any hydraulic structures within your parish that are prone to blockage	If yes please locate the broad location of these on the map and provide details on the structure location, frequency and who clears the blockage	Is there any other information regarding flood risk issues which you think could help inform the Strategic Flood risk assessment for the District.
Dalbury Lees	a) At site of the double bend south of Ravensdale Farm between Lees and Dalbury b) Across road by entrance to sewage works on Radbourne Road out of Lees c) Just outside Parish boundary The above occur whenever a concentrated downpour occurs	a) Depth up to 6 inches – overflow from roadside ditch b) Depth up to 3 inches – overflow from watercourse c) Depth up to 6 inches – overflow from water course	No		Inadequate capacity of ditches and underground piping	Yes	Sites illustrated on map. Not sure who clear blockages	--
Drakelow	--	--	--	--	--	--	--	--
Egginton	Egginton floods very frequently due to the flat landscape, many interrelating water courses and rivers, upstream development and location of the A38, Monks Bridge and aqueduct which obstructs drainage. Flood waters back up into the village from the River Dove, Egginton Brook and Hilton Brook. A flood bank gives reasonable protection, but properties which are reasonably vulnerable are situated on Church Road and off Main Street. Roads become impassable due to inadequate storm drains and the village is isolated and marooned (Emergency vehicles can not gain access at times of flood events. Floods occur annually	The properties primarily affected are the lower end of Church Road (Greenways) by the A38 where floods in November 2000 reached 1 metre in depth. The flood events have been fully documented by the Environment Agency and their consultants (Halcrow) and the river Dove, Hilton Brook and Egginton Brook fully modelled. This model gives depths velocity and isolation of flood flows and can be obtained from the EA). It shows how the flood defences are bypassed at times of major flood events and how roads quickly become impassable	No	Consultants who have modelled the Dove and brooks will have photos. Local Parishioners will also have photo but would need collecting	As mentioned interrelationship of watercourses upstream and downstream development. Development of the floodplain, more run-off, poor maintenance by the EA of vital drainage points (e.g. Monks Bridge) Heavier "tropical type" rainfall events and prolonged rainfall (especially in 2000), Topography.	Yes	Monks Bridge, The Drain, Egginton Brook. The responsibility for blockages on adopted rivers (River Dove, Egginton Brook and Hilton Brook) lies with EA. The Drain is the responsibility of SDDC.	Please consult the River Dove Strategy (phase 2) Pre feasibility Study dated August 2007
Elvaston	--	--	--	--	--	--	--	--
Etwall	a) Flooding of Derby Road at Dee Lane junction due to failure of gully clearing operation. Highway only, depth 100+mm b) Persistent flooding in heavy rain of the passage under the cycle track bridge on Heage Lane. Depth 1m+ c) Previous flood of road at Old Station Close/Hilton Road junction. This has not recently been reported. We have worries about flooding on proposed development at the end of Old Station Close.	No properties affected except C in question 1	No	--	a) Gully clearing b) low level of road relative to surrounding land c) Lack of opening in embankment between new leisure centre and the cycle track towards Etwall Brook	Yes	Gully Clearing	--
Findern	--	--	--	--	--	--	--	--
Foremarke	--	--	--	--	--	--	--	--

Parish	Please provide details of the location and dates of recent flood events within your parish	For the events listed, please provide, where possible, the depth of floodwater, area affected by flooding, sources of flooding	Photo's held	Please provide details	In your view what are the main reasons which led to the flood events you have identified previously?	Are there any hydraulic structures within your parish that are prone to blockage	If yes please locate the broad location of these on the map and provide details on the structure location, frequency and who clears the blockage	Is there any other information regarding flood risk issues which you think could help inform the Strategic Flood risk assessment for the District.
Foston and Scropton	-Several times each year both watery lane (1) and Leathersley Lane (2) are flooded to a depth of up to 300mm. Scropton Road (3) is also affected to a lesser extent. Some gardens in the centre of Scropton are regularly flooded. In November 2000 49 properties were flooded to a lesser or greater degree. 10 homes were unoccupied for a maximum of 15 months, also two business premises were badly affected. The main areas affected were Sunnyside (almost every home affected) and Leathersley Lane/ Chapel Lane-	flooding from roadside ditch/stream flooding from Foston Brook Field run-off and poor highway drainage The main events of November 2000 were mainly by Foston Brook over topping and R. Dove being extremely high. Two home and many Gardens were flooded to a depth of 1.4ms. All flood plain south of railway susceptible to flooding several times per annum.	No	But may be able to obtain photos from elsewhere	Insufficient flood defences, especially at Foston Brook. Poor maintenance of ditches, watercourses and flood banks, although there have been significant improvements in some areas since 2000.	Yes	Several culverts along and to the North of the section of Watery Lane shown on the Plan. Gullies on Foston Lane likely to be blocked by soil/silt washed off fields. SDDC/DCC have split responsibility for these items. EA have installed new flap valves at, at least, 3 locations and these need to be monitored	The problems on Watery Lane are exacerbated by HGV traffic to/from the Turkey Farm in Scropton. (DCC can provide recent figures). This road needs re-engineering. Residents are sanguine enough to realise you cant fight nature; however much remains to reduce the risks faced each year.
Hartshorne	--	--	--	--	--	--	--	--
Hatton	--	--	--	--	--	--	--	--
Hilton	--	--	--	--	--	--	--	--
Hoon	--	--	--	--	--	--	--	--
Ingleby	--	--	--	--	--	--	--	--
Linton	--	--	--	--	--	--	--	--
Lullington	--	--	--	--	--	--	--	--
Marston on Dove	2000 Adjacent to A516 in Hilton Village	Flash flooding after heavy and prolonged rain from higher ground North of A416. Lasted 3 days then dispersed by land drain into Hilton Brook	No	--	--	No	--	Risk is overstated – should be downgraded to medium risk
Melbourne	--	--	--	--	--	--	--	--
Netherseal	Flooding as per existing plan. No additional problems to report	--	No	--	--	No	--	--
Newton Solney	--	--	--	--	--	--	--	There is no risk from the river but flooding occurs on the roads as a result of overland flow off the fields and when road gullies are blocked
Osleston and Thurvaston	--	--	--	--	--	--	--	--
Overseal	--	--	--	--	--	--	--	--
Radbourne	--	--	--	--	--	--	--	--
Repton	--	--	--	--	--	--	--	--
Rosliston	--	--	--	--	--	--	--	--
Shardlow and Great Wilne	--	--	--	--	--	--	--	--
Smisby	--	--	--	--	--	--	--	--
Stanton by Bridge	None other that the Trent flood plains on which there is no housing	Fields to 3 to 4 foot from the Trent	No	--	Heavy Rain	No	--	No
Stenson Fields	--	--	--	--	--	--	--	--
Sutton on the Hill	--	--	--	--	--	--	--	--
Swarkestone	--	--	--	--	--	--	--	--

Parish	Please provide details of the location and dates of recent flood events within your parish	For the events listed, please provide, where possible, the depth of floodwater, area affected by flooding, sources of flooding	Photo's held	Please provide details	In your view what are the main reasons which led to the flood events you have identified previously?	Are there any hydraulic structures within your parish that are prone to blockage	If yes please locate the broad location of these on the map and provide details on the structure location, frequency and who clears the blockage	Is there any other information regarding flood risk issues which you think could help inform the Strategic Flood risk assessment for the District.
Ticknall	a) Summer 2007 – Water runs off the fields and hills and floods the House and Gardens by the Severn Trent Water Installation, runs down Ashby road and then along Main Street b) In the past whenever there is prolonged or very heavy rain the drains could not cope on Main Street, the gutter water becomes 3-4 foot wide and the houses on Main Street have to sandbag their doors. In the past there has also been flooding due to blocked culverts illustrated on attached plan (3)	As above	No	--	Removal of hedges, land drains ditches so the Houses mentioned have no protection. One householder has been installing their own flood defences Blocked/inadequate capacity of main surface water drains	Yes. Only a ditch highlighted on attached map (3)	Shown as 3	--
Trusley	1&2 on plan- 2 culverts under road incapable of taking water from inlet, when swollen through heavy rain 3 on plan, regularly blocked drainage system through centre of village - possibly also too small? 4 on plan, Part collapsed? Part blocked? Inadequate diameter?	a) 1&2 on map 1-2 feet, road flooded water from inlet (see question1) b) 3 & 4 on map, 1 foot approx at most but a regular occurrence	No	--	4 under designed/ collapsed/blocked stormwater culverts under public road	Yes	See plan	Blockages seldom if ever cleared. Do not know who (if anyone) does the clearing
Twyford and Stenson	--	--	--	--	--	--	--	--
Walton On Trent	June and July 2007, Riverside. The river is the county boundary and mainly floods into Staffordshire. However riverside homes are vulnerable	Flood water comes to within 1m of 2m of bungalows in riverside Walton on Trent: Source Watercourse	Yes		Prolonged rain in surrounding area	No	N/A	The consultation on the Walton on Trent Bypass. The new bridge will act as a damn. Villages are worried that if this structure is built serious flooding will occur more extensively in Walton on Trent The EA have stated that *"the proposed works have been designed such that there will be no raising of flood levels upstream of the existing Bailey Bridge, the new road and river bridge will not act as a dam and flood levels will not be raised".*
Weston on Trent	--	--	--	--	--	--	--	--
Willington	a) 7/11/2000 a.m (1) Village Centre Castleway, The Green and Repton Road. P.m (2)Repton Road, Beech Avenue and Bargate Lane b) September 2004 Repton Road and Village Centre c) January 2008 B5008 Etwall Road - Toyota Island to Railway Crossing	a) 750 mm (1) Property/Highway, Watercourse, Sand brook. (2) Watercourse (River back up) b) 300mm very heavy rain (30min) c) 100mm Ditch Fields (SDDC investigated), Rain	Yes	7/11/2000 01/2008	a) 2000 a.m (1) Heavy rain and backed culverts. P.m (2) River back up b) September 2004 Heavy rain (30min) water unable to get to river so roads flooded c) January 2008 Rain, run off from fields and new service area to block ditches on B5008	Yes	Railway culvert: B5008 Village Centre Ditch: B5008 - Service area A38/A50 to Sand Brook	--

Parish	Please provide details of the location and dates of recent flood events within your parish	For the events listed, please provide, where possible, the depth of floodwater, area affected by flooding, sources of flooding	Photo's held	Please provide details	In your view what are the main reasons which led to the flood events you have identified previously?	Are there any hydraulic structures within your parish that are prone to blockage	If yes please locate the broad location of these on the map and provide details on the structure location, frequency and who clears the blockage	Is there any other information regarding flood risk issues which you think could help inform the Strategic Flood risk assessment for the District.
Woodville	Not susceptible to flooding. Some problems on occasions in Occupation Road because of flooding under old bridge when there's lots of rain, Leicestershire border	--	No	--	--	Yes	Excess rain	--

Source: South Derbyshire District Council consultation with Parish Councils (2008)

Appendix I: Guidance on Windfall/Brownfield Sites and Scope for Level 2 Assessments

Following the SFRA and the detailed 1:10,000 scale mapping carried out over the whole District, there are areas where information is sparse or where there are uncertainties associated with the data used to define flood risk. For some of these areas, a potential conflict between development and flood risk has been highlighted in the SFRA. Therefore, it may be necessary to increase the quality and quantity of the flood risk data (for example, by additional river or sewer modelling) so that informed decisions on flood risk and planning policy can be made with more confidence.

The aim of this document is to provide a technical framework and guidance with which SDDC can use to determine the suitable criteria for selecting areas and specifying more detailed Level 2 assessments throughout the district as and when they are required.

The framework will set out the requirements of a Level 2 assessment according to PPS25 and the accompanying practise guidance (June 2008). It will detail how flood hazard is to be defined for an area including whether 2D river modelling and/or surface water runoff and sewer modelling may be required. Other items such as the residual risk to areas and emergency planning aspects will also be specified.

There may be some areas where a Level 2 SFRA is required immediately, additional areas across the district may be highlighted in the future and, for these, this framework should be used to guide the specification of services to undertake Level 2 SFRAs.

What is a Level 2 SFRA?

The mechanism for undertaking a more detailed study of flood risk for an area is defined in PPS25 as a Level 2 SFRA. A Level 2 SFRA uses information gathered during a Level 1 SFRA and concentrates on a potential development area to determine detailed information on the level of flood risk in order that sufficient evidence can be provided for the Exception Test to be applied.

This continues the hierarchical approach to flood risk defined in PPS25 and provides councils with more information to ensure that development follows the sequential approach and, if applicable, to apply the exception test and determine possible site layouts/policies that ensure flood risk is minimised to new development.

It is important to be clear that a Level 2 SFRA is not a replacement for site specific FRAs. Its purpose is strategic in nature to inform planning and policy decisions to the area in question and the district. There is no clear definition of the scale at which a Level 2 assessment should be undertaken in PPS25 or the accompanying practise guidance (June 2008) however, in other SFRAs across the country, a Level 2 SFRA has concentrated on individual towns and settlements or large development or regeneration areas within districts.

A Level 2 SFRA may not be necessary for all councils as it may have been possible to allocate all proposed development and infrastructure, in accordance with the sequential test, to areas of lower flood risk. For other councils, there is a much higher probability that a Level 2 SFRA will be required due to the extent of flood risk issues and the location and scale of proposed development.

Level 2 SFRA outputs

The main outputs from a Level 2 SFRA are usually:

- Location, condition, operating standard and level or protection offered by flood defences and flood risk management structures,

- An appraisal of the probability and consequences of overtopping or failure of defences including estimating the rate and onset of flooding, velocity and depth. This facilitates the production of rapid inundation zones and flood hazard maps,
- Production of FRA guidelines for sites or areas to enable developers to adhere to flood risk policies identified above,
- Assessment of residual risks, including emergency response, access and egress,
- Assessment of risks to other areas upstream and downstream of the area of interest as a result of development,
- For areas where there is a known sewer capacity/flooding issue, a Level 2 SFRA can assess this in more detail with regard to a particular site.

Using the above information, the flood risk within and across flood zones at a site or in an area can be determined. This allows policies and guidelines to be developed that place less vulnerable development and water compatible land use in areas of higher risk, whilst development of higher vulnerability is placed in areas of lower flood risk.

Identifying where a Level 2 SFRA is required

Chart 1 shows two routes to determining where a Level 2 SFRA is required.

The Sequential Approach

According to PPS25, a local authority should use a Level 1 SFRA to identify and allocate sites suitable for development in areas of least flood risk. PPS25 also states that the sequential approach to development and flood risk should be demonstrated initially through the Sequential Test.

The sequential test is designed, in the first instance, to allocate development within Flood Zone 1 (low probability of flooding). If this is not possible, development can be allocated within Flood Zone 2 (medium probability of flooding) and Flood Zone 3 (high probability of flooding) providing the development 'vulnerability' is suitable and subject to passing all three parts of the Exception Test in certain cases. Table D2 from PPS25 highlights the vulnerability classifications, whilst Table D3 in PPS25 summarises which vulnerability classification is suitable for which flood zone. These have been combined into Table I-1 highlight how development vulnerability affects its suitability in each of the flood zones.

Therefore, the approach highlighted in PPS25 for identifying where a Level 2 SFRA is required is for the district to undertake sequential testing as part of their development allocations process. Following the sequential test, should an allocation still be located within a medium to high flood risk area, then a Level 2 assessment will be required for the area to provide sufficient information for the Exception Test to be applied. Table I-1 shows that there are only four situations of vulnerability and flood zone placement where the Exception Test is required and therefore where a Level 2 SFRA is needed.

It is worth noting that, within PPS25, guidance and examples for the Sequential Test are referred to in the context of Fluvial and Coastal flooding. However, it is recommended that the sequential approach is applied to other sources of flooding too including artificial, surface water and overland flow, sewer flooding and groundwater flooding.

The 'Hybrid' Approach

In many instances, local authorities are aware of areas within their districts that are likely to come forward for development within their LDF prior to undertaking the PPS25 sequential test. Flood risk to these areas may have already been fully or partially defined within an SFRA. There may also be instances where the an SFRA has identified 'gaps' in the flood risk data for potential development areas or, there may be circumstances in which potential development areas are identified after the SFRA in locations where flood risk is either missing or requires further definition. In these circumstances, local authorities can be better informed of the flood risk to an area if a more detailed study – effectively a Level 2 SFRA – is carried out prior to sequential testing.

This is not to say that the PPS25 sequential approach should be ignored during the allocation of sites or that the SFRA is being used to justify development within an area. The method can actually better inform the sequential approach recommended in PPS25 and allow local authorities to consider vulnerability of development and flood risk to ensure that sustainable development with minimal flood risk is delivered. Following a more detailed study, the sequential approach is still followed with regards to development within the area(s) of interest and, if necessary, the Exception Test is carried out.

Table I-1: Flood Risk Vulnerability and Flood Zone Compatibility

To be read in conjunction with Table D.1 and Table D.2 in PPS25. 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 ⇩ E ⇩ ✓	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 ⇩ E ⇩ ✓	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)	✓	✓	✓	✓

✓: 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

Defining the requirements of a Level 2 SFRA

Each Level 2 SFRA study will differ slightly from others and will address the particular flood risk issues that are specific to the area in question. However, it is useful to understand what the general requirements are for a Level 2 SFRA in different circumstances so that, should the need arise, a Level 2 SFRA can be specified at any time. Flow charts have been produced (Chart 2 and Chart 3) that highlight issues the Level 2 SFRA should address and the level of detail and items of work required for the study.

These charts are not designed to be an exhaustive and detailed brief of services. As stated above, every Level 2 SFRA and more detailed study will have differ requirements depending on the flood risk issues (or combination of issues), location and the potential development options of the site or area of interest. As a result, some flexibility in the specification and provision of services for Level 2 SFRAs and more detailed studies is required.

The charts are based on the four main flood sources within the district. These include Fluvial, Sewer and Drainage, Pluvial and Surface Water and artificial sources (including reservoirs and canals).

Chart 1: Specifying where a Level 2 SFRA or more detailed studies is required

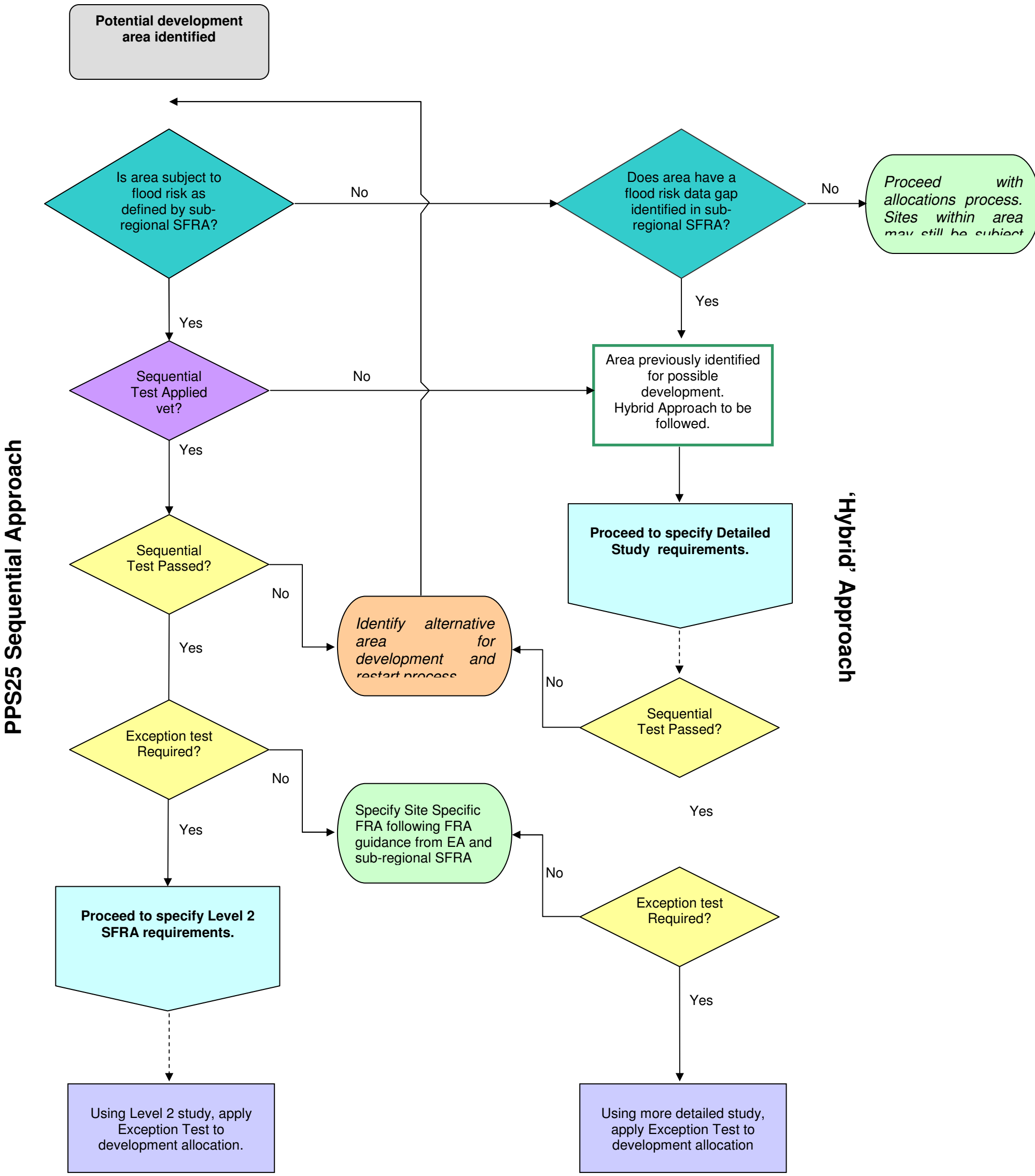


Chart 2: Specifying the requirements of a Level 2 SFRA or more detailed study for fluvial and pluvial sources of flooding

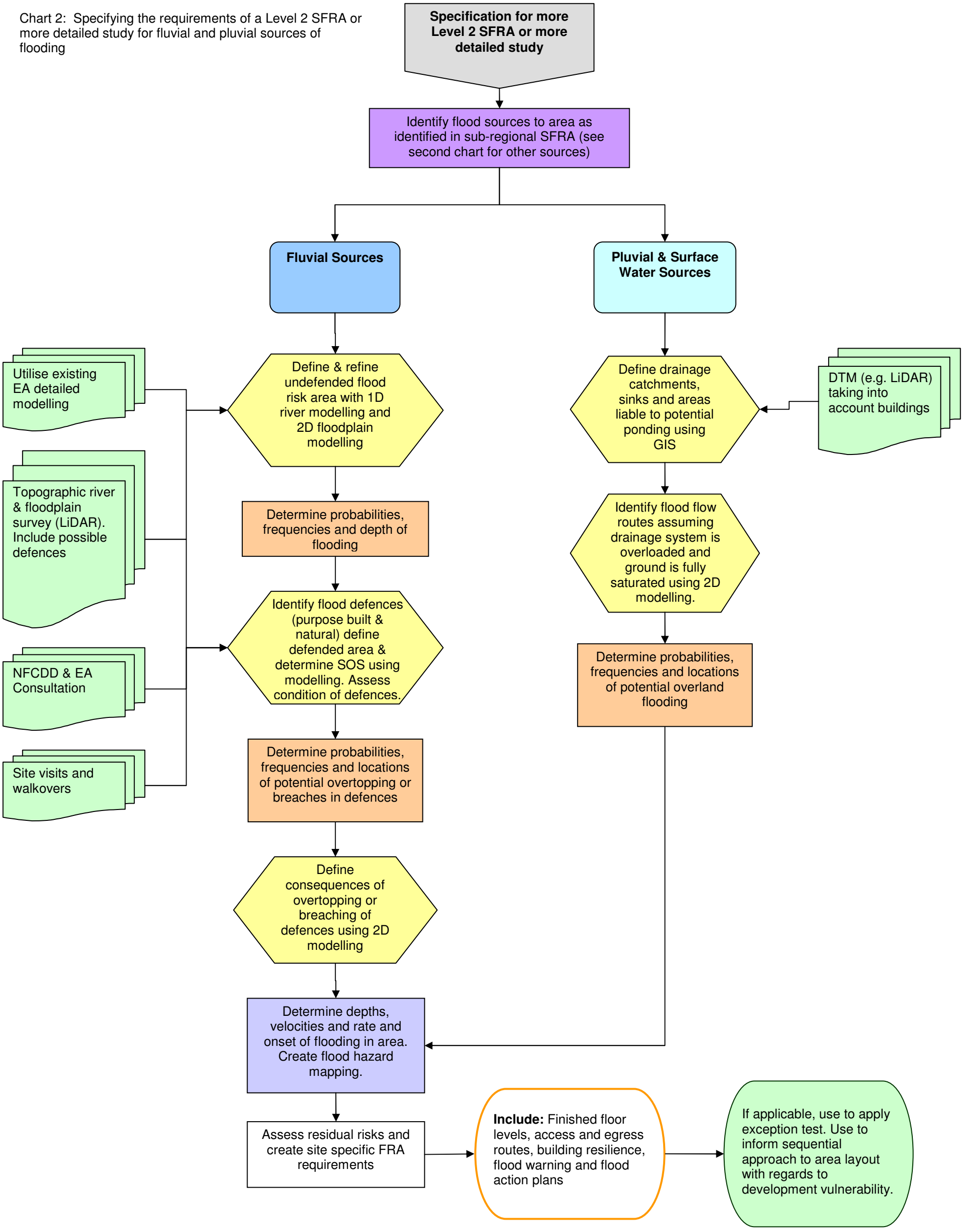
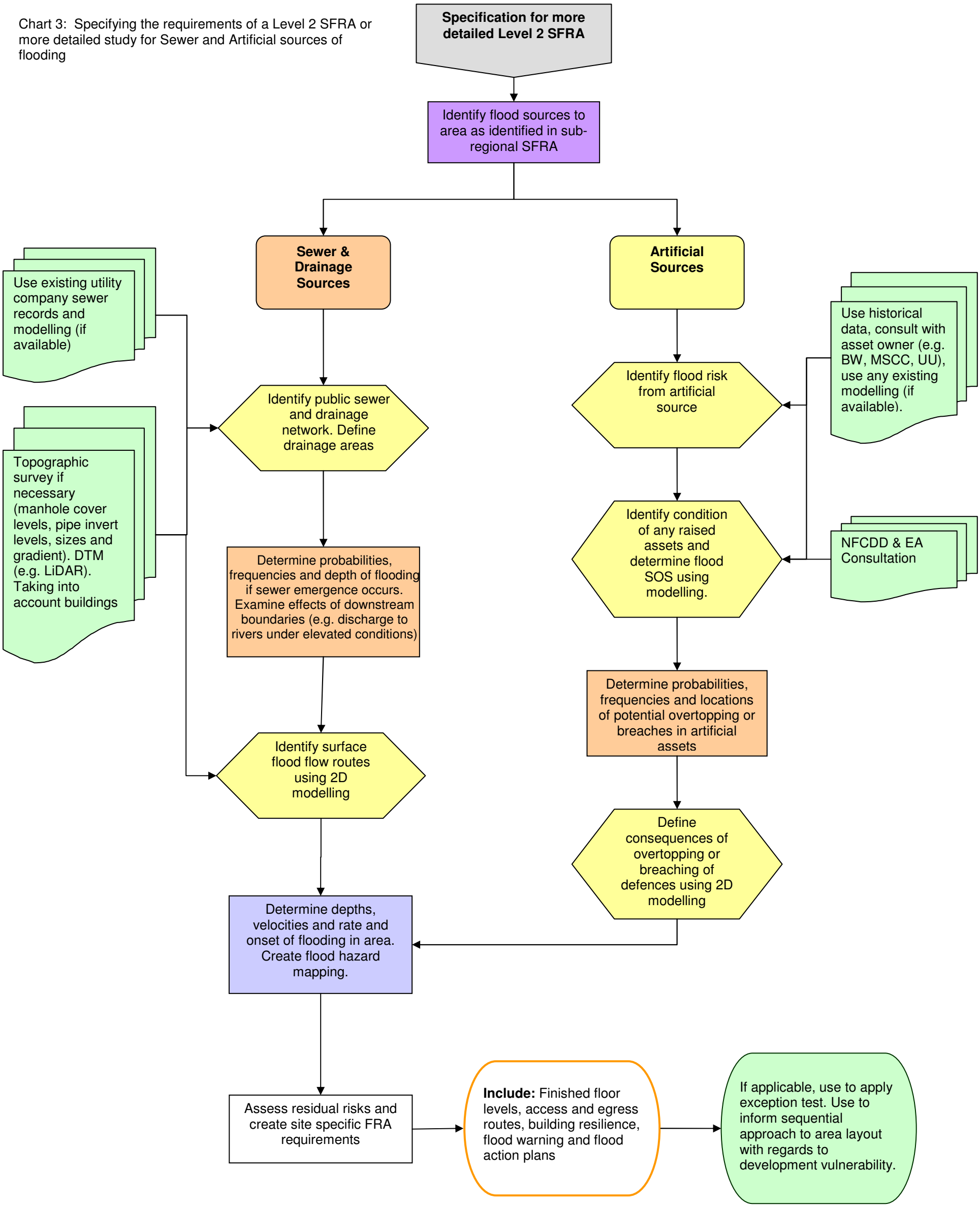


Chart 3: Specifying the requirements of a Level 2 SFRA or more detailed study for Sewer and Artificial sources of flooding



Appendix J: Opportunities for Floodplain Restoration

Parts of the study area fall within the Policy Unit 6 (Mid Staffordshire and River Tame) in the River Trent CFMP. These parts include the majority of the study area south of the River Trent and the area immediately adjacent to the River Trent from Burton upon Trent to Sandiacre. Policy Unit 6 has a recommendation of *Policy 6: Take action to increase the frequency of flooding (where appropriate) to deliver benefits locally or elsewhere, (which may constitute an overall flood risk reduction, e.g. for habitat inundation)*. Opportunities to restore the natural floodplain through removing redundant structures (i.e. dilapidated flood defence structures, culverts and bridges) and rolling back development from the river through providing a network of green corridors and other green infrastructure could be implemented in these areas. There may also be locations along sparsely populated areas along the River Dove where such opportunities may also exist.

Scott Wilson have carried out several multifunctional river restoration and rehabilitation schemes with the aim of reducing flood risk and enhancements to the natural environmental, amenity and biodiversity value. One such scheme was the Hermitage Stream restoration project, carried out in partnership with Havant Borough Council and the EA. 1km of concreted channel flowing though Leigh Park was replaced with a two stage natural stream. This project delivered flood risk and environmental benefits as part of an urban renewal project and the amenity benefits were maximised by involving the local community.

Scott Wilson also delivered the Robertsbridge River diversion. The river diversion provided an opportunity to replace over 1km of existing culvert with open channel. Where space permitted the diversion was designed as a sinuous channel, mimicking the form of the natural channel nearby in the catchment and incorporating artificial gabion riffles. Where a linear channel was dictated by site constraints a variety of bed materials and gradients were used to provide a diversity of habitats. Planting following construction was designed to assist with the natural re-colonisation of the river banks and bed.

Another example of a successful river restoration project is on Stamford Brook, a tributary of Sinderland Brook in Greater Manchester. It was an output of a collaborative project between the National Trust, Redrow (North West), Taylor Wimpey, the EA and consultants Haycock Associates Limited. This restoration was undertaken in conjunction with a new housing development and contributes to flood risk reduction, biodiversity enhancement and provides a local recreation amenity site. The brook was restored to a natural watercourse following its canalisation by the local authority in the 1970s. The new meandering watercourse has a wide floodplain, making space for water in times of flood. The development also had at its core a network of SUDS techniques including swales which stored runoff and then routed it to the restored floodplain. This network of SUDS and green corridors further maximised flood risk and habitat creation benefits.




http://www.haycock-associates.co.uk/Sinderland_Brook.html

It is feasible that such options for floodplain restoration and biodiversity enhancement could be tied into development in South Derbyshire.

Appendix K: SFRA Version Register

Version	Date Issued	Amendments Made	Stakeholders Notified	Document written by:	Document Checked by:	Document Approved by:
1	June 2008	Interim Draft SFRA	No	GC	AW	DO
2	July 2008	Draft SFRA Report	Yes	GC	AW	DO
3	October 2008	Final SFRA Report	Yes	GC	AW	DO
4	November 2008	Final SFRA Report	Yes	GC	AW	DO