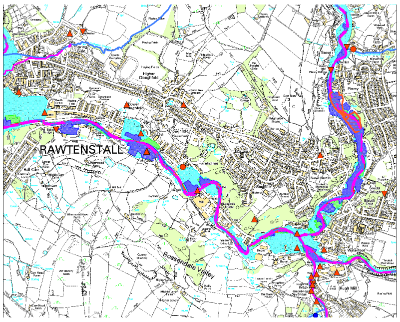
Rossendale Borough Council

Level 1 Strategic Flood Risk Assessment

Final Report
May 2009



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Rossendale Borough Council
Level 1 Strategic Flood Risk Assessment

Final Report

May 2009

Rev	Date	Details	Prepared by	Reviewed by	Approved by
D01	24/10/2008	Interim Draft	**Helen Burton** Assistant Flood Risk Specialist **Fay Tivey** Assistant Flood Risk Specialist **Lyndsey Regan** Planner	**Andrew Woodliffe** Senior Flood Risk Specialist	**David Dales** Director
D02	20/11/2008	Final Draft	**Fay Tivey** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**David Dales** Director
F01	27/02/2009	Final	**Fay Tivey** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Jon Robinson** Associate Director
F02	29/05/2009	Final v2	**Fay Tivey** Assistant Flood Risk Specialist	**Andrew Woodliffe** Senior Flood Risk Specialist	**Jon Robinson** Associate Director

Scott Wilson
Mansfield i-Centre
Hamilton Way
Mansfield
Nottinghamshire
NG18 5BR

Tel +44 (0)1623 600660
Fax +44 (0)1623 600661

www.scottwilson.com

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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
BHS	British Hydrological Society
BW	British Waterways
CAMS	Catchment Abstraction Management Strategy
CBHE	Chronology of British Hydrological Events
CFMP	Catchment Flood Management Plan
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
EA	Environment Agency
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
LCC	Lancashire County Council
LDD	Local Development Document
LDF	Local Development Framework
LDS	Local Development Scheme
LP	Local Plan
LPA	Local Planning Authority
LSPP24	Local Structure Plan Policy 24: Flood Risk
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
RBC	Rossendale Borough Council
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
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SFRM	Strategic Flood Risk Mapping
SoP	Standard of Protection
SP	Structure Plan
SPG	Supplementary Planning Guidance
SRS	Sub Regional Strategy
SuDS	Sustainable Drainage Systems
SW	Scott Wilson
UDP	Unitary Development Plan
UKCIP	United Kingdom Climate Impacts Programme
UU	United Utilities
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) and its Practice Guide (June 2008) recommend that SFRAs are completed in two stages. The Level 1 SFRA enables application of the Sequential Test by the LPA, and the Level 2 SFRA increases the scope of an SFRA for development sites where the Exception Test is required (i.e. those which have not passed the Sequential Test). 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 Rossendale SFRA, which has been commissioned by Rossendale Borough Council (RBC).

Flood related planning policy at national, regional and district levels has been collated. 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 RBCs LDF process. RBC 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 RBC SFRA. In addition, other key stakeholders have been consulted and those that have provided data include United Utilities (UU) and Lancashire County Council (LCC). 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 catchment of the River Irwell is the main hydrological influence of the study area, encompassing the River Irwell, River Spodden, River Ogden, Greave Clough, Whitewell Brook, Cowpe Brook and Limey Water. However, a small part of the study area also falls within the catchment of the River Ribble. 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 hydraulic 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 Flood Zone 2 and Flood Zone 3a and Flood Zone 3b. Whilst fluvial (or 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 0.1% annual probability (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% annual probability (1 in 100 year) flood event and is the part of Flood Zone 3 that is outside Flood Zone 3b (the functional floodplain) and 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 5% annual probability (1 in 20 year) floodplain (or 4% / 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 4% annual probability flood outline has been used to define the FFP where available. For reaches where this is not available, the 1% annual probability 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.

The SFRA Flood Zones have determined that approximately 2.61% of the administrative area of RBC falls within Flood Zones 2 and 3. The SFRA Flood Zones also show that the areas that are potentially at risk of flooding are along narrow strips of land immediately adjacent to watercourses, which is due to the well-defined channels of the watercourses, their general steepness and relatively small sizes. Urban locations within the study area that are potentially affected by flooding include parts of Bacup, Haslingden, Rawtenstall and Whitworth. In addition, there are numerous smaller settlements in the study area that have areas at risk of fluvial flooding.

Sewer flooding was identified using historical records from the UU (sewer flooding) DG5 database, which details the total number of flood events that have affected properties both internally and externally. 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 (5 digit postcode areas), it is difficult to pin-point specific areas in which sewer flooding is a particular issue.

No records of groundwater flooding were found during the course of the study. EA groundwater vulnerability maps show the study area to be underlain by minor aquifer of varying vulnerability. BGS mapping shows the area to be underlain by mudstones and sandstone which have limited permeability. There is therefore the possibility of groundwater vulnerability.

Consultation with the EA and RBC has confirmed 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 Geographical Information System (GIS) layer) is continuously being updated. The EA maintain and keep records of many of the flood risk management structures in the study area, 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 flood risk management structures within the study area varies markedly, specific schemes having a Standard of Protection (SoP) of between 20% (1 in 5 years) and 1% annual probability (1 in 100 years) events.

CFMPs have identified an increased level of flood risk to the study area over the next 25 to 100 years as a result of climate change. Firstly, as a result of wetter and warmer winters, an increase in large fluvial flood events is likely to affect the larger rivers and watercourses in the study area. Secondly, extreme rainfall events are likely to become more frequent leading to a greater storm intensity and duration. This is likely to lead to a great deal more runoff causing surface water flooding and overwhelming of the urban sewer networks in particular.

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 and watercourses). As part of the Level 1 SFRA, a SuDS map was produced to identify which particular SuDS techniques could be adopted for future developments. The SuDS map was created using geological data, groundwater vulnerability and source protection zones (SPZs).

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 North West Regional Spatial Strategy (RSS) outlines the housing provision targets for Rossendale and suggests an increase of 4,000 new homes between 2003 and 2021. The RSS stipulates that at least 65 % of housing should be located on brownfield (previously developed) land.

Detailed maps at a scale of 1:10,000 were produced covering the entire RBC administrative area. These assessments present available flood risk information and are accompanied by a narrative. The purpose of the detailed maps 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 FRAs may have to adapt to these changes in line with current guidance in response to continuing research into climate change.

The RBC SFRA has been completed in accordance with PPS25 and the current guidance outlined in the PPS25 Practice Guide (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 updated or revised as required by the LPA. 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 (PCPA) (HMSO, 2004) requires Local Planning Authorities (LPAs) to produce Local Development Frameworks (LDFs) to replace the system of Local Plans (LPs), Structure Plans (SPs) and Unitary Development Plans (UDPs). 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: Development and Flood Risk (PPG25) 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 that 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 PPS25 Practice Guide was released, which supersedes the PPS25 Practice Guide 'Living Draft'. The PPS25 Practice Guide sets out the requirements of an SFRA and a recommended approach, which 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 Practice Guide, 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 be accessible and provide guidance to aid the general planning process of the LPA.

1.2 The Rossendale SFRA

Rossendale is a predominantly rural area located within East Lancashire in the North West of England to the north of Bury, Rochdale and Wigan, and to the south east of Blackburn. The main urban areas are located within the Rossendale Valley and include the key settlements of Haslingden, Rawtenstall and

Bacup. The towns of Waterfoot, Whitworth, Stacksteads, Crawshawbooth, Edenfield and Weir comprise the smaller urban centres of Rossendale.

Rossendale is covered by the North West Regional Spatial Strategy (RSS). A Core Strategy is being developed for Rossendale Borough Council (RBC) as part of the Local Development Framework (LDF). The Core Strategy is expected to be submitted in 2010 and will replace the Rossendale District Local Plan (Adopted 1995).

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 important that flood risk is considered at a strategic scale to inform land allocations and future developments proposed by the emerging LDF.

1.3 The SFRA Structure

The PPS25 Practice Guide recommends that SFRAs are completed in two 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 RBC to review the potential development sites and to inform the scope of the SA.

1.3.1 Level 1 SFRA

A Level 1 SFRA 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), RBC, United Utilities (UU), Lancashire County Council (LCC), the Highways Agency (HA) and Lancashire Fire and Rescue Service (LFRS). In addition to the collection 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 relationships developed with key stakeholders 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

In accordance with PPS25, the PPS25 Practice Guide and the Scott Wilson (SW) proposal for undertaking the RBC Level 1 SFRA (dated June 2008), the main aims and purpose of the Rossendale SFRA are listed below:

- Collection of data pertaining to all flood sources including:
  - Flooding from rivers,
  - Flooding from the sea,
  - Flooding from land,
  - Flooding from groundwater,
  - Flooding from sewers,
  - Flooding from reservoirs, canals and other artificial sources.
- Contextualise the Level 1 SFRA with regard to national, regional and local planning policy,
- Creation of SFRA Flood Zones that use the best available information. The Flood Zones will be a hybrid of outlines derived from detailed EA modelling studies where available and where these are not available, broadscale EA modelling studies. In addition, the functional floodplain (FFP) will be redefined in agreement with the EA and in accordance with the definition given in the PPS25 Practice Guide,
- Creation of detailed plans of the Rossendale administrative area at 1:10,000 scale, which present information including Flood Zones, flood risk management structures, and other key flood information,
- Determination of existing flood risk management infrastructure, including the location and standard of infrastructure (as defined in the EA's National Flood and Coastal Defence Database (NFCDD)) and the coverage of EA flood warning systems,
- Guidance on the preparation of site-specific Flood Risk Assessments (FRAs),
- Guidance on the likely applicability of sustainable drainage systems (SuDS) techniques for managing surface water run-off, including the production of a SuDS map to provide a starting point for determining the suitability of various SuDS techniques across Rossendale,
- Identification of potential requirements for Level 2 SFRAs.

2 Rossendale Borough Council

2.1 Study Area

The study area comprises the administrative area of RBC, covering a total area of 138 km^2 (Figure 2-1). The study area is characterised by enclosed uplands, upland moorland, hills, reservoir valleys and wooded lower valleys with densely populated urban centres in the lower valley extents. Approximately 88% of the study area occupies green open space, which reflects the study area's predominantly rural nature. Approximately 22.5% of the study area is subsequently classed as Green Belt (approximately 31km^2).

The catchment of the River Irwell drains the majority of the study area. The River Irwell begins its course to the north of Bacup, and meanders through Rawtenstall towards the south east of Haslingden before flowing south into Ramsbottom. Tributaries of the River Irwell within the study area include Greave Clough, Whitewell Brook, Cowpe Brook, Limey Water and the River Ogden.

Woodnook Water rises near Rising Bridge in the north west of the study area and flows in a north west direction towards Accrington, forming part of the River Ribble catchment. The River Spodden rises north of Whitworth and flows south through the south east of the study area before flowing towards Rochdale.

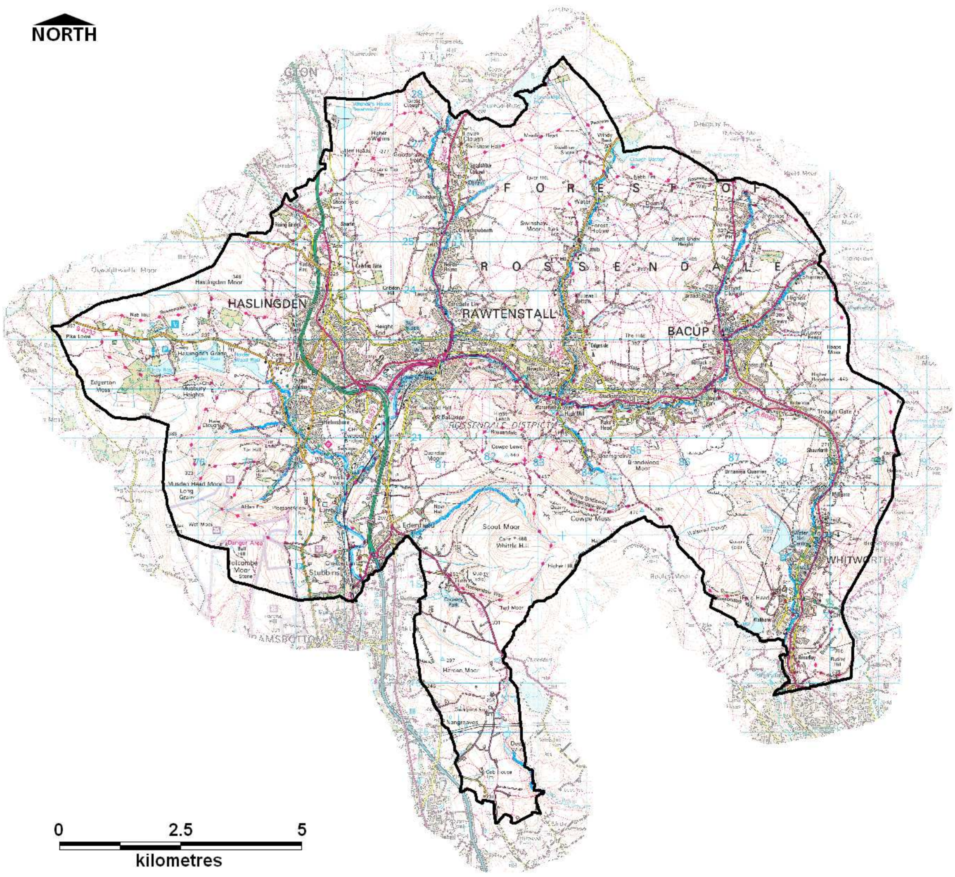

Figure 2-1: Study Area

2.2 Administrative Bodies

2.2.1 Rossendale Borough Council

The study area lies wholly within the administrative area of RBC. RBC is required to deliver planning strategies that manage and reduce the risk of flooding, and to consult the EA when preparing planning documents and determining applications.

Since there are no Internal Drainage Boards (IDBs) in Lancashire, RBC has discretionary powers for land drainage within the study area. These powers include regulating activities along smaller watercourses and undertaking works to alleviate flooding or recurrent flooding in areas not within the responsibility of the EA. In some cases, RBC will also have responsibilities as a 'riparian' owner, through its management of parks and open spaces and as a significant landowner.

Data relating to flood risk, historical flooding and planning was provided by the Environment Agency and the Council's Drainage, Planning and GIS teams.

2.2.2 Environment Agency

The study area is covered by the EA's North West Region. The EA has discretionary powers under the Water Resources Act (1991) for all Main Rivers and their associated flood risk management structures within the study area.

The EA has provided a large amount of data for the purposes of the SFRA, including data relating to flood risk management, flood risk policy and historical flooding.

2.2.3 United Utilities

UU is responsible for storm and foul water management across the RBC administrative 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.

2.2.4 Lancashire County Council

The County Council is responsible for producing appropriate plans for responding to flooding. The primary role of the authority in the event of an emergency is to provide care for people affected by the emergency.

The LCC Highways Department has a duty to maintain the structure of public roads, bridleways and footpaths so that the public's right to pass along public highways is protected. The authority has powers to install and maintain drainage systems to prevent flooding to a highway and where this is necessary, the authority may be obliged to provide such measures. The authority may also take action to address problems related to the drainage of adjoining land, where this would otherwise threaten a public highway.

2.2.5 Lancashire Fire & Rescue Service

LFRS are involved in the emergency response to flood events within the study area. The Data Management Team within LFRS has provided data relating to the locations of historical flooding incidents where the fire service has been involved in resolving the risk.

2.2.6 Highways Agency

The study area falls within Area 10 of the HA network. The Managing Agent Contractor (MAC) that is responsible for Area 10, A-one Plus, provided details relating to locations of recorded incidents of historical flooding since they begun the contract in November 2007.

2.3 Historical Flooding

There have been numerous recorded historical flood events in the Rossendale administrative area and it is widely recognised that there is a long history of river flooding within the upper reaches of the River Irwell catchment. These events are summarised by watercourse in Appendix A, with the dates, causes and effects presented where available. The EA were contacted regarding historic flood events and supplied their historic flood map. In addition, RBC supplied further detailed maps showing key locations where flooding has been identified and recorded. In addition, Catchment Flood Management Plans (CFMPs), the British Hydrological Society Chronology of British Hydrological Events (BHS CBHE) database[1] and internet searches were also used to find historical flood events within the study area.

There are many historical records of fluvial flooding within the study area. However, it is also evident that the study area has suffered from surface water flooding in the past. In addition, DG5 data received from UU indicates that parts of the study area have been affected by flooding from sewers. Sewer flooding data is presented in Appendix B.

2.4 Flood Sources

2.4.1 Flooding from Rivers

The majority of the study area falls within the upper catchment of the River Irwell. A small part of the north west of the study area, north of Haslingden, falls within the catchment of the River Ribble. The numerous watercourses that are located within the study area are listed in Table 2-1, though this is not an exhaustive list.

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

Table 2-1: Local Watercourses

• River Irwell (upper)	• Limy Water
• River Spodden	• Musbury Brook
• River Ogden	• Greave Clough Brook
• Alden Brook	• Sow Clough
• Cowpe Brook	• Swinnel Brook
• Dearden Brook	• Whitewell Brook
• Greens Clough	• Knowsley Clough Brook
• Tong End Brook	• Hud Clough
• Langwood Brook	• Trough Syke
• Folly Clough Brook	• Oaken Clough Brook
• Shaw Clough Brook	• Balladen Clough

As noted in the River Irwell CFMP (2008:63), fluvial flooding mechanisms in upper catchments, including the settlements of Bacup, Haslingden, Stubbins, Whitworth and Rawtenstall, are characterised by water levels of small rivers, brooks and streams rising quickly in response to rainfall events. This is as a result of the steep slopes, modified field drainage and impermeable geology and soils that characterise upper catchments. The time to peak flows are typically less than two hours, often giving the local population insufficient time to react and reduce the consequence of flooding.

Upper River Irwell and Tributaries

The Upper River Irwell rises on Deerplay Moor at Irwell Spring and flows south through Bacup before flowing west towards Rawtenstall and regaining a southerly direction towards Bury. The upper catchment is characterised by steep hills and narrow valleys with wooded ravines. High up in the catchment, mixed moorland and blanket bog are characteristic of the landscape, whilst pasture land dominates the flatter hill slopes and valleys lower down in the upper catchment.

Urban development is confined to the narrow valley floors of the upper River Irwell. In the main urban areas of Rawtenstall, Haslingden, Bacup, Waterfoot and Stacksteads, rivers are constrained by culverts, retaining walls and weirs.

Along its course, a number of tributaries flow into the River Irwell. Significant tributaries of the River Irwell include (in sequence downstream) Oaken Clough at Bacup, Greens Clough and Sow Clough upstream of Nun Hills, Cowpe Brook and Whitewell Brook at Waterfoot, Limy Water at Rawtenstall, the River Ogden at Irwell Vale (of which Musbury Brook, Alden Brook and Swinnel Brook are tributaries) and Dearden Brook at Stubbins. In addition, a number of smaller tributaries flow into the River Irwell within the study area.

The study area is located in the north of the Irwell catchment, where the underlying solid geology of the catchment generally comprises Lower Coal Measures overlying Millstone Grit. These are classified as minor aquifers meaning that they will hold water but only in relatively small amounts. The Millstone Grit is underlain by limestone.

River Spodden

The River Spodden is a major tributary of the River Roch and forms part of the catchment of the River Irwell. The River Spodden rises in the east of the study area, near the village of Shawforth, and flows in an easterly direction through Whitworth. Outside of the study area, the River Spodden continues to flow in a southerly direction until its confluence with the River Roch south of Rochdale.

The River Spodden flows through the urban areas of Shawforth, Whitworth and Wallbank, whilst the wider area drained by the River Spodden is predominantly rural in nature.

2.4.2 Flooding from Land

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). Within the study area, there are numerous historical flood events listed in Appendix A 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 becomes more frequent and although not necessarily on the same scale as fluvial flooding, it could still cause significant disruption.

2.4.3 Flooding from Groundwater

EA groundwater vulnerability maps (Appendix H) show the study area to be underlain by minor aquifer of varying vulnerability. BGS mapping shows the area to be underlain by mudstones and sandstone which have limited permeability. This bedrock is overlain by till diamicton, with pockets of sand and gravel in the centre of the study area and peat deposits to the edges of the study area. There is therefore the possibility of groundwater vulnerability.

The Department for Food and Rural Affairs (DEFRA) Strategy for Flood and Coastal Erosion Risk Management study (2004)[2] did not show any recorded instances of groundwater flooding in the study area. This does not mean that groundwater flooding has not occurred, or that it will not occur in the future, but that no incidents have been recorded in the EA records.

2.4.4 Flooding from Sewers

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 3.3% annual probability event (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). However many sewers are much older and date back to the Victorian era and are of an unknown capacity and condition.

UU has provided DG5 data for the previous 6 months within the study area. The data has been provided as the number of properties affected by internal and external flooding within broad (5-digit) post code areas. The data identifies that internal and external sewer and drainage flooding has occurred throughout the study area, with a particular clustering of events in the broad areas to the south of Haslingden and north of Rawtenstall. DG5 register internal flooding is defined as flooding which enters a building or

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

passes below a suspended floor; whilst external flooding is defined as flooding which is not classed as internal. Properties at risk are defined as properties that have suffered or are likely to suffer internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant period. All flooding incidents should be registered by the water company irrespective of the severity of the storm. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes[3.]

In addition, the River Irwell CFMP (2008:62) notes that flooding as a result of storm water overloading sewerage systems and highway drains can affect areas around Haslingden.

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 FRAs, or informed by any emerging Surface Water Management Plan (SWMP). Any relevant additional data should be incorporated into the SFRA during future updates.

In addition, one of the recommendations of the PPS25 Practice Guide 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 the study area. Draft guidance currently being produced by the Environment Agency suggests that a Water Cycle Study should be undertaken if:

- The scale of growth proposed by regional or local planning is **significant** when compared to the existing urban development. At present, significant refers to a 5% increase in new housing stock during the LDF period;
- The Environment Agency raise concerns about the environmental capacity of the water cycle to cope with proposed development;
- The Water Company identifies there are problems with funding, or putting new systems in place to meet the development framework;
- The development area is a proposed eco-town;
- It is a Growth Point status condition; or
- It is a condition of the RSS or LDF.

2.4.5 Flooding from Reservoirs, Canals and other Artificial Sources

There are several reservoirs within the study area and within the river catchments upstream of the study area that fall under the Reservoirs Act (i.e., greater than 25,000 m^3 capacity), the locations of which are shown on the detailed mapping in Appendix B. In addition, there are numerous smaller reservoirs which are associated with the industrial heritage of the study area.

Reservoirs carry with them an inherent flood risk as they have a potential risk of breaching or overtopping. Where development sites or site allocations are located downstream of a reservoir, the residual risk of reservoir breach or overtopping should be considered as part of a site specific FRA or Level 2 SFRA respectively (under review of a panel engineer).

British Waterways (BW) has confirmed that there are no canals within the study area.

[3] Environment Agency, Upper Mersey CFMP, May 2008

2.5 Flood Risk Management

2.5.1 Flood Risk Management Infrastructure

There are several flood risk management schemes in operation throughout the study area. These offer varying standards of protection (SoP). The Irwell CFMP notes that EA maintained flood risk management structures on the River Irwell through Bacup provide a SoP against the 5% annual probability event (1 in 20 years). The CFMP also notes that management of river channels in the Irwell Catchment is extensive and activities include weed and vegetation removal from river channel banks and beds, sediment and debris removal and bank and wall maintenance. This reduces the risk of flooding in many areas across the catchment.

The Irwell catchment is split into a number of Asset Systems Areas and the amount of money that is spent on flood risk management infrastructure depends on the number of properties at risk. However, In the Spodden Asset Systems Area, less than 1% of properties are at risk of flooding, but a significant proportion (13%) of maintenance spending is allocated to this Asset System Area. This is as a result of the need to prevent increased flood risk to urban areas downstream on the River Roch, due to large amounts of sediment sourcing from the River Spodden. It is important to note that many flood risk management assets in the area are privately owned, which makes it difficult to identify responsibilities for maintenance.

It should be noted that flood risk management schemes are built to a certain design standard and have a certain design life. One predicted effect of climate change is an increase in peak flow and as a result 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.

The EA has undertaken a Flood Risk Viability Study of the Upper Irwell Catchment[4]. Within the study area, the Viability Study recommends that further flood risk management schemes are investigated in Irwell Vale and Stubbins. In terms of options, the Viability Study notes that the options for flood storage are limited due to the steep gradients and limited availability in the confined river valleys. However, it should be considered as a priority nonetheless due to the environmental benefits. If schemes using raised flood risk management structures are progressed, the defence line should be located away from the river banks as far as practicable in order to retain the natural floodplain, provide some flood attenuation and create favourable conditions for habitat creation.

2.5.2 Flood Warnings

The Civil Contingencies Bill (2004) 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.

[4] Environment Agency, Upper Irwell Flood Risk Viability Study: Final report, April 2008

The EA has general supervisory and other statutory duties for flood defence and flood warnings in Rossendale. 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 (though flooding from the sea is not a risk in Rossendale). Some parts of the country benefit from 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. As noted in Section 2.4.1, owing to the nature of the upper Irwell catchment the time to the peak river flow is typically less than two hours, therefore giving limited time to issue flood warnings. In addition, the difficulties of issuing effective warnings of possible flood risk management infrastructure 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.

When conditions require, the EA provide local forecasts on the possibility of flooding and determine which flood risk management structures to operate and when, closing moveable systems 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 flood risk management structures. 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 flood risk management structures can protect life and reduce damage in the event of the defence level being exceeded by the severity of the flood.

Designated EA flood warning areas in Rossendale are limited to areas of Irwell Vale, Stubbins, Strongstry and Chatterton (immediately upstream of Ramsbottom). Approximately 70% of the properties in the Irwell Vale Flood Warning Area are signed up to receive flood warnings. The local topography consists of steep sided river valleys with generally narrow floodplains. The steep nature of the catchments means it responds quickly to rainfall and the time available to provide warning of floods is short.

2.6 Flooding Mechanisms

2.6.1 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 and affect the dispersion of floodwater.

Flood risk management structures are usually designed with a degree of 'freeboard', the height by which the crest level of the structure exceeds the design flood level. Main river flood risk management structures 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 crest, 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 flood risk management structures over time, and water heights can vary locally. Even so, the crest of the structure acts like a weir limiting the rate of flow and volume over the crest and limiting flooding velocities and volume to the immediate area.

2.6.2 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 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. 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 can be life threatening with far reaching consequences.

Should potential development be proposed behind flood risk management structures, detailed hazard mapping may be required during any Level 2 SFRA.

2.6.3 Mechanical or Structural Failure

Flooding may result from the failure of engineering installations such as land drainage pumps, sluice gates and floodgates. Hard flood risk management structures 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.

2.7 Flood Risk Statistics

Table 2-2 summarises the main flood risk statistics within Rossendale.

Table 2-2: Summary of Flood Risk Statistics

Statistic	Area (km^2)	% of Area	
Total Area of RBC Administrative Area	136.00	100%	
Area of RBC in Zone 3 (High Flood Risk)	2.09	1.54%	of administrative area
Area of RBC in Zone 2 (Moderate Flood Risk)	1.45	1.07%	of administrative area
Area of RBC in Zone 1 (Low Flood Risk)	132.46	97.39%	of administrative area
Total Existing Developed Area	15.00	11.03%	of administrative area
Existing Development in Flood Zone 3	0.68	4.53%	of urban area
Existing Development in Flood Zone 2	1.02	6.8%	of urban area
Existing Development in Flood Zone 1	13.30	88.66%	of urban area
Drainage Problem Areas	Records of drainage flooding are given as number of incidents, rather than areas affected		

***Note**: Flood Zone 2 refers to the area outside of Flood Zone 3. Flood Zone 1 refers to the area outside Flood Zone 2 and 3.*

2.8 Potential Development Pressures

Rossendale is surrounded by six other Authorities – Rochdale, Bury, Blackburn with Darwen, Hyndburn, Burnley and Calderdale. The Borough of Rossendale is one of the smaller Boroughs in Lancashire and is characterised by its urbanised valley floors, wooded lower valleys and grassy moorland in upland areas. Rossendale's topography has a major influence on the type and amount of development, both historically and currently, and therefore the Borough's character is heavily influenced by this.

The population of the Borough is approximately 67,000[5] which is expected to rise over the next two decades by 3%. Rossendale appears to have more families than the national average, with a higher proportion of under 16s and 30-59 year olds than the national average. Socio-economically, there are higher than average levels of deprivation in much of the main urban areas but some areas are amongst the least deprived nationally.

There are three main urban areas in Rossendale, centred on Rawtenstall, Bacup and Haslingden (of which Rawtenstall is the largest shopping and commercial centre within the Borough), with the vast majority of population and development concentrated in these areas. Therefore, it is clear that much of the Borough is of a rural nature.

In terms of road network, the key road transport link is the A56(T) which passes through the western part of the area (near Haslingden) and links the M66 (to Bury and the rest of Greater Manchester) with the M65 (to Blackburn, East Lancashire and Preston). Other than this, the road network is relatively limited and is focused on the A681 which is the east-west road linking the three main urban areas. The only rail link to the Borough is the East Lancashire Railway, which terminates at Rawtenstall, but this currently serves as more of a tourist attraction than a genuine public transport service.

The Borough has a strong heritage, particularly of the period of the industrial revolution, and is located within the South Pennines Landscape Character Area. There are nine Conservation Areas in the Borough and a total of 123 Grade II or II* Listed Buildings.

[5] Rossendale Borough Council, Rossendale Core Strategy Preferred Options Report, March 2006

Development pressures are centred on the three main urban areas, with the western corridor along the A56(T) being of particular attraction. Bacup, Stacksteads and Britannia, in the east of the Borough, are part of the Elevate East Lancashire Housing Market Renewal Pathfinder and are therefore also a focus for development.

2.8.1 Housing Land

The recently published RSS (September 2008) sets out an increased target for Rossendale of 4,000 new homes between 2003 and 2021 (222 new dwellings per annum), 65% of which should be on brownfield land.

At a local planning policy level, Rossendale District Local Plan (1995) Saved Policy H3 states that there are 56 housing sites (totalling 92 ha) that can accommodate approximately 2,060 dwellings. However, the majority of these allocations have now been built out. The Core Strategy Preferred Options Report (March 2006) concurs with the RSS in its housing target figures.

As noted above, the RSS targets (2003-2021) set an annual requirement of 222 net additional dwellings. During the first three years of this period Rossendale exceeded the target, but fell significantly short in 2006/07. Therefore, there is a slight under-provision in relation to the overall RSS target of 4,000 net additional dwellings in Rossendale to make-up between 2007 and 2021.

Of the 472 dwellings that were completed within the Borough in 2006/07, 37% were on previously developed land. This compares to 89% in 2005/06 and is significantly below the RSS target for development on brownfield land of 65%. In addition, 70% of the dwellings completed in 2006/07 were completed at less than 30 dwellings per hectare (dph). This is due to the large number of completions that have been individual developments on small areas of land. However, this is lower than the indicative minimum of 30 dph set out in Planning Policy Statement 3: Housing.

As mentioned above, the vast majority of housing allocations in the Local Plan have been developed-out. However, the Interim Housing Policy Statement (July 2008) highlights that:

> *"The Council can demonstrate that it has a rolling five-year supply of housing land when assessed against both the adopted targets in the Joint Lancashire Structure Plan and the proposed changes to the North West Regional Spatial Strategy." (Interim Housing Policy Statement, 2008:5)*

Rossendale Borough Council adopted a Strategic Housing Land Availability Assessment (SHLAA) in March 2009 which demonstrates that the Borough has sufficient land to meet the targets set out in the adopted RSS (September 2008) for the next 15 years.

The SHLAA identifies that there is enough previously-developed land in the Borough to meet the 10 year requirement, under the adopted RSS, although it is likely that some Greenfield sites will be required in the 10 -15 year period.

Table 2-3 is a summary of likely requirement for additional allocations, after allowance for outstanding planning permissions taken from the SHLAA.

Table 2-3: Housing Land Supply for Period 2003-2021

Period	Components	Adequacy of Supply
First 5 Years	*RSS Targets*	*1,303*
	PP Sites	890
	Shortfall re RSS Targets	413
First 10 Years	*RSS Targets*	*2,270*
	PP Sites	890
	Shortfall re RSS Targets	1380
First 15 Years	*RSS Targets*	*3,380*
	PP Sites	890
	Shortfall re RSS Targets	2490

Note: Supply from planning permissions is after a 20% non-implementation rate has been applied.

2.8.2 Employment Land

The 2006/07 AMR identifies that there is 18.34 ha of available employment land covering all employment use classes. In 2006/07, 2,770m^2 of business development was completed, of which 663m^2 was Business Use (B1) and 2,107m^2 was General Industrial Use (B2). In 2005/06, 8,419m^2 of business development was completed, of which 300m^2 was B1 and 8,119m^2 was B2. In 2005/06, much of the development was located within employment or regeneration areas but in 2006/07 none of the development was. In 2006/07, all of the development was on brownfield land while in 2005/06 1,922m^2 was on greenfield land, with the remainder on brownfield land.

2.9 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.

To account for climate change in Rossendale, 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 available, an estimate of the impacts of climate change on flood outlines is required. To this end, Flood Zone 2 outlines were used as a proxy. This is not to say that Flood Zone 3a will necessarily increase to Flood Zone 2, but rather that one would expect the depth and extents of flooding to increase to somewhere between the Flood Zone 3a and Flood Zone 2. 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 risk management structures 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 risk management structures and the carrying capacity of culverts, drains, sewers and open 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 Planning Policy Statement 1: Delivering Sustainable Development (PPS1) and the Supplement to PPS1 sets out important objectives in order to tackle climate change, sea level rise and avoidance of 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 aims 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.

2.9.1 Fluvial Flood Risk

There is a potential for increased peak river flow as a result of climate change, as identified in PPS25 and Table 2-4, and an increase in peak flow results in a greater floodplain envelope. Some of the watercourses have detailed hydraulic models which have produced the flood outlines for the 100 year event plus an allowance for climate change.

For watercourses where no detailed hydraulic model outlines were available for the 100 year event plus climate change, the approach was taken to use the Flood Zone 2 outlines as a substitute until such a time that modelled data is available. The methodology is explained further in Section 4.5.2.

Table 2-4: Peak Rainfall Intensity Increases and Peak River Flow Increases

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%		

2.9.2 Surface Water and Sewer Flooding

The potential increase in peak rainfall intensity (Table 2-4) 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 localised and should be considered at the site-specific FRA stage.

3 Policy Review

This section provides an overview of the planning policy framework relevant to flood risk for Rossendale Borough Council. This Level 1 SFRA 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.

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

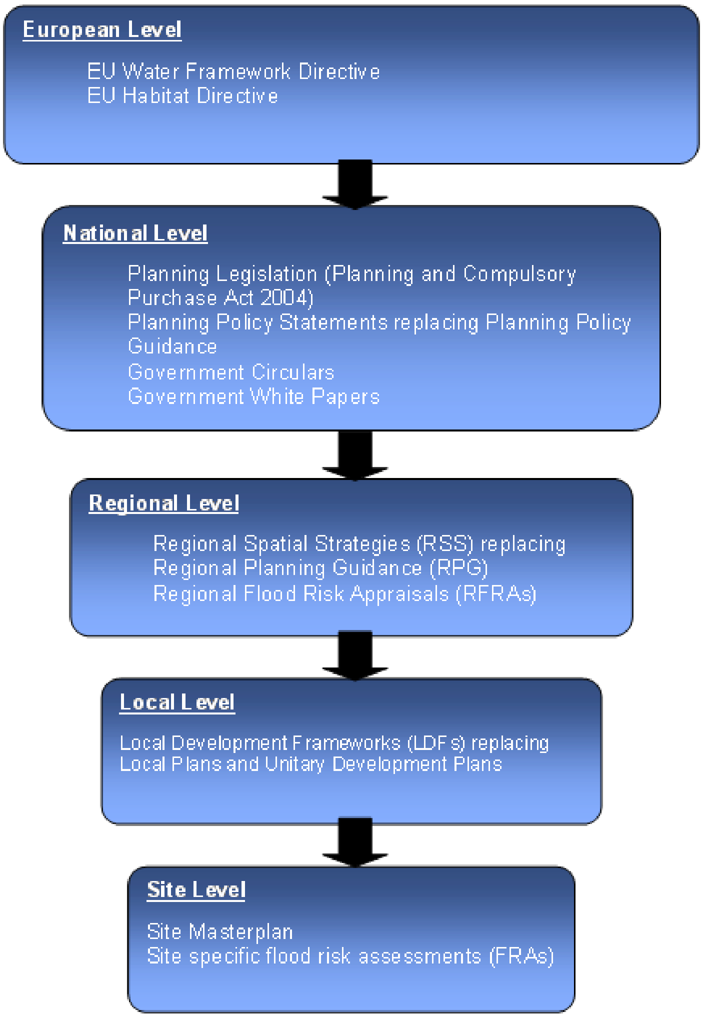

Figure 3-1: Flow chart showing structure of the planning system

3.1 Planning Policy

The planning policy review collates and summarises all planning policy and guidance, relevant to flood risk in the Rossendale administrative area. Firstly, PPS25 was reviewed as the key flood risk and development policy at a national level, followed by the recently published RSS for the North West. The review also looks at local planning policy.

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

3.2 European Policy

3.2.1 Water Framework Directive (December 2000)

The Water Framework Directive (WFD) is a substantial piece of European Community (EC) legislation and the largest directive related to water to date. The directive came into force in 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 waterbodies 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 EC:

1. Environmental and 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 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 Defra and Welsh Assembly Government River Basin Planning Guidance (WAG) (August 2006), an RBMP should be a strategic plan that gives all stakeholders within an 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).

3.2.2 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 waterbodies, 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 EAs 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 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.

3.2.3 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 LDFs. 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 Rossendale SFRA should inform the RBMPs and, as a result, the LDF being prepared by RBC 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 main key national policy in relation to flood risk and is the starting point for any policy review on flood risk. PPS25 is supported by a Practice Guide (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. PPS25 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 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 district level in the form of an SFRA. Policies and proposals should be established on the basis of FRAs.

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 SFRAs and consequently LDDs at the local level.

PPS25 identifies 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. 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 Flood Zones:

Table 3-1: Flood Zone Classification

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 of PPS25) for site-specific FRAs 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 (of PPS25) also identifies that there may be considerable benefits to 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. Paragraph 2.27 of the PPS25 Practice Guide, 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 that PPS25 is considered 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 PPS25, but which are necessary to achieve its objectives. The most obvious link is with the supplement to PPS1.

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 PPS1 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 risk management structures 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

Planning Policy Statement 3 Housing (PPS3) 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. Through 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. Through the incorporation of local flood mitigation measures such as 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

Planning Policy Statement 7 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. PPS7 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 Planning Policy Statement 9 Biodiversity and Geological Conservation (PPS9). Crucially, many protected sites fall within Flood Zones and it 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

Planning Policy Statement 12 Local Spatial Planning (PPS12) sets out the Government's policy on the preparation of LDDs, 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 an SA. Gathering information on flood risk is an important element of assembling the baseline information for these assessments and for formulating local policy within the LDF.

3.4 Regional Planning Policy

3.4.1 North West of England Plan – Regional Spatial Strategy to 2021

Flood risk is a key consideration within the RSS and its importance is recognised with a reference within Spatial Principle Policy DP9 to the need to adapt to climate change in order to minimise the threats from natural factors such as flood risk. This is supported elsewhere throughout the document, with climate change being considered an important issue.

Paragraph 7.17, in discussing Policy L4 on regional housing provision, refers to the RFRA and the need for the early completion of SFRAs by LPAs. In housing provision terms, Rossendale is grouped within the East Lancashire Authorities and the RSS states that there is:

> *"support for potential economic growth and regeneration, particularly in Housing Market Renewal Pathfinder areas; including replacement and renewal of housing stock and, where appropriate, the development of a wider range of housing types" (para. 7.18)*

This desire to see significant development of housing stock is supported by the RSS target for Rossendale of 4,000 new homes between 2003 and 2021 (222 new dwellings per annum), 65% of which should be on brownfield land, as set out in Table 7.1 in the RSS.

Policy EM5 seeks to guide LPAs in ensuring issues of water management, such as flood risk, are integrated into the development process and local policy in order to protect water resources and limit flood risk. It also refers to the need for SFRAs and to the Sequential Test in PPS25, stating that:

> *"Departures from this should only be proposed in exceptional cases where suitable land at lower risk of flooding is not available and the benefits of development outweigh the risks from flooding."*

Policy EM5 also recognises the need for SuDS to minimise flooding and environmental damage as a result of surface water run-off.

Rossendale lies within the Central Lancashire City Region but on the border with the Manchester City Region. As such, it will face development pressures associated with the Manchester City Region as well as from within the Central Lancashire City Region. However, it is not an area of focus for development within either City Region and, as such, development pressure will mainly come from local sources (e.g., for employment or services) and from housing.

3.5 Local Planning Policy

The Development Plan for Rossendale currently comprises:

- The North West Regional Spatial Strategy (September 2008),
- Rossendale District Local Plan (1995) Saved Policies.

The local planning context is provided by Rossendale District Local Plan (1995) Saved Policies, which was adopted in 1995.

Work is in progress on the preparation of Rossendale's LDF, a suite of planning documents that will set out the Council's future planning policies and eventually replace the Rossendale District Local Plan (1995) Saved Policies. The Saved Policies of the Local Plan will remain the statutory development plan until the LDF is formerly adopted.

The Local Development Scheme (LDS) is a document that sets out the program of work for the preparation of the LDF. The most recent LDS for Rossendale came into effect in November 2008 and indicates that the Core Strategy is due for adoption in early Summer 2009.

3.5.1 Adopted Rossendale District Local Plan (1995) Saved Policies

The Rossendale District Local Plan (1995) Saved Policies is now time expired and a number of policies have been held to be in non-conformity with the RSS.

The emerging LDF will supersede the Rossendale District Local Plan (1995) Saved Policies, but until a Core Strategy and other DPDs have been prepared, a number of selected policies of the Rossendale District Local Plan (1995) have been saved. Of most significance is Policy DS.1 which aims to locate most new development within the urban boundary.

The Saved Policies of the Local Plan contains no planning policies of direct relevance to flood risk, thus Rossendale is reliant on the guidance set out in the adopted and emerging RSS and PPS25.

3.5.2 Interim Housing Position Statement (July 2008)

The Interim Housing Policy Statement (IHPS) identifies a series of considerations that are material to applications, and provides clarity about how the Council intends to approach these considerations. There is a requirement for affordable housing.

3.5.3 Rossendale Core Strategy Preferred Options Report (2006)

The emerging Core Strategy identifies Rawtenstall (with Haslingden and Bacup) as Key Service Centres and a Regeneration Priority Area. It also identifies Whitworth as a Local Service Centre where priority will be given to new residential developments.

Proposed Policy E3 is of most relevance to flood risk and states that all developments should have regard to the North West Regional Assembly (NWRA) guidance: Meeting the Sequential Flood Test.

The proposed policy seeks to ensure that all applications for developments in high flood risk zones must demonstrate the need for the particular development in that location and provide flood risk assessment and appropriate mitigation proposals.

The proposed policy also states that developments should seek to have SuDS.

3.5.4 Rawtenstall Town Centre Area Action Plan Revised Preferred Options Report (2006)

Rawtenstall town centre has been identified by RBC as a key area for regeneration. The Rawtenstall Town Centre Area Action Plan (AAP) will identify the strategic vision and objectives for delivering regeneration in this location.

The AAP will focus on implementation - providing an important mechanism for ensuring development of an appropriate scale, mix and quality for key areas of opportunity, change or conservation.

The AAP is scheduled for adoption in late 2011. The Rawtenstall AAP Revised Preferred Options Report (2006) indicates that the APP will include specific policies regarding flood risk and alleviation.

3.5.5 Bacup, Stacksteads and Britannia Area Action Plan Issues and Options Report (2005)

The Bacup/Stacksteads AAP is being prepared for Bacup, Stacksteads and Britannia and is scheduled for adoption in Summer 2013. The AAP will identify the strategic vision and objectives for delivering regeneration in this location. This area is also identified as a Housing Market Renewal area as part of the Elevate Pathfinder initiative.

The Issues and Options Report 2005 (revision B) indicates that the EA has been consulted during the preparation of the Masterplan / AAP and has provided specific advice with regard to flood risk within the study area. The AAP indicates that, in accordance with PPS25, proposals for development within Flood Zones 2 and 3 or where sites are greater than one hectare in Flood Zone 1, must be accompanied by an appropriate FRA. The EA has advised that where sites situated within Flood Zones 2 and 3 are being considered for allocation through the AAP, RBC must demonstrate that the site is appropriate for the proposed use prior to allocation.

The AAP identifies water as a key asset within the local landscape and seeks to restore its importance in the built environment. The AAP seeks to ensure that measures to expose and improve access to the River Irwell are designed to accommodate potential flooding and to alleviate flood risk.

3.5.6 Rossendale Borough Council Economic Strategy (2008)

The Strategy aims to support and contribute to the development of a balanced economy in Rossendale by ensuring the provision of appropriate infrastructure, building suitable businesses and improving economic prosperity for all. Town Centre regeneration is a key theme of the Strategy with Rawtenstall, Bacup and Haslingden all assigned for redevelopment and increased infrastructure provision.

3.6 Non-Statutory National Planning Documents

3.6.1 Making Space for Water

During 2004, (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'*

(Making Space for Water 2004:1)

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% 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% of new houses were built in flood risk areas.

The plan advocates the use of European Union (EU) funding streams, such as INTERREG IIIB[6], to enable LPAs 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 SFRA and incorporate the sequential approach as set out in PPS25.

At the development control level, the document encourages LPAs 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.

3.6.2 Sustainable Communities Plan

The Sustainable Communities Plan (SCP) was launched by the Office of the Deputy Prime Minister[7] (ODPM) in February 2003. The main aims of the SCP 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 SCPs 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 North West of England: 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.

3.6.3 Regional Flood Risk Appraisal

The North West Regional Spatial Strategy Regional Flood Risk Appraisal (RFRA) was released in October 2008. The RFRA covers five main aspects:

- A survey of all LPAs within the North West to gauge their broad assessment of flood risk issues including surface water flooding,
- Work undertaken by the EA to evaluate the potential impact of fluvial and coastal flooding in relation to the proposed housing figures set out in the draft RSS,
- An assessment of any potential flood risk implications related to regionally significant economic development,
- An overview of the issues to consider with other aspects of flooding, namely groundwater and sewer flood risk,
- The potential impacts of climate change.

The RFRA adopts a Flood Risk Ranking system to categorise LPAs with regard to the level of flood risk in relation to development pressures and potential problems with accommodating development on low risk

[6] INTERREG III is an EU Initiative to promote transnational co-operation on spatial planning by encouraging harmonious and balanced development of the European territory. The overall aim is to ensure that national borders are not a barrier to balanced development and the integration of Europe and to strengthen co-operation of areas to their mutual advantage. The Initiative ran from 2000 to the end of 2006.
[7] Now superseded by Communities and Local Government (CLG)

sites. LPAs that are ranked as high are considered to have a greater challenge in finding brownfield sites outside of the floodplain to accommodate necessary growth. Rossendale is ranked as a level 6 (out of 15) and therefore has moderate challenges regarding flood risk in relation to development pressures.

The RFRA highlights that SFRAs and spatial plans should take account of other forms of flooding and climate change. Where areas have been highlighted as having potential for groundwater rebound, groundwater flood risk should be addressed as an issue for consideration. In addition, UU should be contacted at an early stage in the SFRA process. There must also be early dialogue between LPAs and UU around the site allocation process to ensure that it can be informed by any issues of sewer network capacity.

The RFRA highlights that opportunities should be taken to use the spatial planning system to reduce flood risk. This includes increasing flood storage and attenuation, careful consideration for site layout, increasing the use of SuDS reduce flood risk to critical infrastructure.

3.7 Catchment Flood Management Plans

A CFMP is a high-level strategic plan 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 as being ‘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 CFMPs 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 risk management infrastructure and waterways.

CFMP policies, which are identified for each individual 'policy unit' (which relate 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 3-2: Generic 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 are two CFMPs that cover the study area, the River Irwell CFMP completed in May 2008[8] and the River Ribble CFMP completed in March 2008[9]. However, only a small area in the north west of the study area is covered by the River Ribble CFMP.

Both the River Irwell CFMP and the River Ribble CFMP considered flood risk under climate change scenarios which involved scaling up the EA model inflows by 20%, and where necessary increasing rainfall by 30%. Urban growth scenarios were also considered by increasing the urbanisation factor in the model's hydrology to alter the amount of rainfall runoff and reduce the response time of the catchment. Afforestation and agricultural land use change with regards to drainage and intensification were also considered.

Each CFMP presents Policy Units and Policy Options. Appendix C presents the Policy Units and Options and highlights the settlements affected in each case, the causes and effects of flooding and the future flood risk.

[8] River Irwell Catchment Flood Management Plan, Environment Agency, May 2008
[9] River Ribble Catchment Flood Management Plan, Environment Agency, March 2008

3.8 Flood Risk

3.8.1 Regional / National

The following aspects relate to flood risk policy at the national and regional scales:

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 (all sites over 1 ha) in Flood Zone 1 (according to PPS25 Annex E).
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.

3.8.2 Sub-Regional / Local

The following aspects relate to flood risk policy at the sub-regional and local scales:

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:

- River Irwell CFMP,
- River Ribble CFMP,
- Lancashire Biodiversity Action Plan (BAP),
- The Northern Manchester Catchment Abstraction Management Strategy (CAMS).

3.9 Sustainable Drainage Systems

A SuDS map, methodology and guidance on the use of the SuDS map are provided in Appendix D. Sustainable Drainage Policies should address the following issues:

3.9.1 Regional / National

The following aspects relate to SuDS at the national and regional scales:

1. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity,
2. SuDS are a requirement of the Building Regulations,
3. FRAs are required for all major developments (all sites over 1 ha) in Flood Zone 1 (according to PPS25 Annex E).
4. As stated in PPS25, runoff rates from new developments should not be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect,
5. 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.

3.9.2 Sub-Regional / Local

At the site-specific FRA level, the suitability of SuDS should be investigated for each development.

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 in Appendices D and H.

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

- River Irwell CFMP,
- River Ribble CFMP,
- Lancashire Biodiversity Action Plan (BAP),
- The Northern Manchester Catchment Abstraction Management Strategy (CAMS).

3.10 Water Environment

3.10.1 Regional / National

The following aspects relate to water environment at the national and regional scales:

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 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,
- River Irwell CFMP,

- River Ribble CFMP,
- Lancashire Biodiversity Action Plan (BAP),
- The Northern Manchester Catchment Abstraction Management Strategy (CAMS).

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 Level 1 SFRA

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 presented in a format to enable RBC 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 RBC and EA on 30 July 2008,
- Determination of key stakeholders,
- Contact with key 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:

- Rossendale Borough Council,
- Environment Agency,
- Lancashire County Council,
- United Utilities,
- Highways Agency.

4.3.1 Local Authorities

RBC 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, RBC was able to provide some details of flooding within their boundary. However, in order to determine the effects that any proposed development in surrounding Districts may have on flood risk in Rossendale, the Planning section of the six neighbouring LPAs websites were consulted.

The vast majority of the study area is located in the upper catchment of the River Irwell. As such, development proposals in the neighbouring authorities are unlikely to exacerbate flood risk to the study area. However, any proposed development within the study area should be designed so that is does not exacerbate flood risk to downstream parts of the catchment, including Bury Metropolitan Borough Council (BMBC) and Rochdale Metropolitan Borough Council (RMBC).

4.3.2 Environment Agency

The EA is the principal holder of flood risk data in England and Wales. 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. Rossendale falls within the North West Region of the EA and is administered by the North and South 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 E, but can be summarised as:

- Catchment Flood Management Plans (CFMPs) for the River Irwell and River Ribble,
- Northern Manchester 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 in the production of the SFRA by providing expert advice and comment.

4.3.3 United Utilities

UU provide potable water distribution and wastewater collection for the Rossendale administrative area. UU have provided a register of flood events that have affected properties (internal) and outside areas such as roads (external) in a particular postcode area. This information is provided to the regulatory body Office of Water Services (OFWAT) and is used to help define their works programme. The data is presented in Appendix B. It is advised that UU are contacted as part of Level 2 SFRAs and site-specific FRAs in order to obtain more detailed and up-to-date information on the locations of sewer flooding incidents.

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

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 data collected at the time of production are presented in Appendix E.

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 RBC in their site allocation decisions and Development Control activities.

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

4.5.1 GIS Data Gaps and 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 RBC SFRA 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 G.

4.5.2 Flood Risk GIS Layers

The following sub-section is intended for use in conjunction with the Flood Zones presented in the detailed maps in Appendix B 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

Detailed maps present Flood Zone 1, Flood Zone 2, Flood Zone 3a and Flood Zone 3b (functional floodplain) 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 B 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. All data used in the creation of the SFRA Flood Zones were obtained from the EA.

The Flood Zone 3a and Flood Zone 2 outlines provided were updated by the EA in July 2008 and presented the best available information. The detailed model outlines provided by the EA were used to identify those areas of the Flood Zones derived from detailed models and those derived from broadscale modelling.

The Flood Zone 3b and Flood Zone 3a plus a 20% allowance for climate change were derived using a hybrid approach. Where detailed hydraulic modelling has been undertaken and flood outlines mapped, these have been used to represent the Flood Zone. However, broadscale modelling is not available for these Flood Zones. Therefore where detailed modelled flood outlines do not exist, the Flood Zone from a higher return period has been used as a proxy until such a time that this information is available (e.g., Level 2 SFRA, Strategic Flood Risk Mapping study, site-specific FRA). The result is a single map for each Flood Zone generated using a combination of data. Additional changes were made to Flood Zone 3b (the functional floodplain) as detailed in the section below.

For each reach and each Flood Zone, 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 as a result of the modelling technique used in its creation.

Functional Floodplain

The functional floodplain (Flood Zone 3b) has 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 RBC to consider its location when preparing LDF documents and other strategic documents.

For several watercourses within the study area, the EA hold modelled flood outlines for the 4% annual probability (1 in 25 year) event. Where this is the case, this data has been used to map the functional floodplain. Broadscale models are not available for the functional floodplain and therefore where the 1 in 25 year modelled flood outline is not available, Flood Zone 3a has been considered as a proxy to represent the functional floodplain 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. This is the approach recommended in the PPS25 Practice Guide.

Under PPS25 and the PPS25 Practice Guide, the functional floodplain is defined as ‘land where water has to flow or be stored in times of flood’, including water conveyance routes and flood storage areas. Furthermore, areas which would naturally form part of the functional floodplain but are prevented from flooding by existing infrastructure or solid buildings will not normally be defined as functional floodplain. In addition, Flood Zone 3b is determined considering the effects of flood risk management structures and other flood risk management infrastructure.

There are some reaches of the watercourse network in the study area where modelled flood outlines are not available for Flood Zone 3b and consequently the sub-regional SFRA has used the flood outline for Flood Zone 3a as a proxy in these locations. This approach has resulted in some very large areas being designated as functional floodplain. Development within Flood Zone 3b is only considered appropriate for Essential Infrastructure and Water Compatible vulnerability classifications (Table D.3, PPS25).

Due to the development restrictions within Flood Zone 3b and the potential implications of the use of Flood Zone 3a as a proxy flood outline, Flood Zone 3b has been trimmed and re-drawn, using professional judgement and in agreement with the EA, so that it conforms with the definition given in PPS25 (summarised above). It must be stressed that this re-definition has not been based on detailed river modelling and is designed as a pragmatic approach that allows districts to proceed with their LDF process without basing their decisions on potentially unsound data.

The methodology used to trim Flood Zone 3b was formulated in agreement with the EA. The following changes were undertaken to the Flood Zone 3b GIS layer:

River channels are part of the functional floodplain as they convey flood water. River channels and canals were identified using 1:10,000 scale Ordnance Survey maps. As agreed with the EA, the layer was altered to include any river channels and canals that were not represented in the existing layer.

The functional floodplain does not include land occupied by existing infrastructure or solid buildings – this includes the boundary of the land that the building occupies (as depicted on OS mapping and aerial photographs) as this could consist of walls, fences and other obstructions to flow. As a result, the Flood Zone 3b GIS layer was trimmed to exclude existing infrastructure (including roads and railway lines) and solid buildings, which were identified using 1:10,000 scale Ordnance Survey maps supported by online aerial photography.

- Flood Zone 3b is determined considering the effects of flood risk management structures. Consequently, areas protected by flood risk management structures with a SoP equal to or exceeding 20 year flood event are excluded from the floodplain. The EA provided outputs from the NFCDD as a GIS layer. This was used to determine the locations of flood risk management structures and the SoP. Where flood risk management structures are present and the SoP exceeds or is equal to the 20 year standard, the layer was trimmed to the defence line shown on the NFCDD GIS layer.
- Using the Flood Storage Area (FSA) GIS layer provided by the EA, formal FSAs were included in the layer as they form part of the functional floodplain.
- Areas that were shown to be undefended and free of existing built-up areas or essential infrastructure were included in the redefined Flood Zone 3b outline.

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 including the effects of climate change have been presented.

For several modelled fluvial reaches, climate change has been added to the 1% annual probability (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 RBC 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

The EAs Historic Flood Map has been presented on the detailed maps in Appendix B. It should be noted that the majority of these flood events have not been linked to return periods. Additional information for historical flooding was made available by RBC and LFRS. This data has been used to create a number of points, which have been presented on detailed maps in Appendix B.

DG5 data, providing information on broad locations of sewer flooding has been provided by UU. This data is presented as a map in Appendix B. The map serves a useful purpose to highlight to RBC that there are areas, some of which may be shown to be outside the Flood Zones, which have experienced flooding in the past and should be considered in the application of the Sequential Test.

Sewer and Storm Water Flooding

Limited information regarding incidents of sewer flooding has been provided by UU in the form of DG5 data. The locations of incidents of sewer flooding is presented in as a map in Appendix B and shows the number of incidents per broadscale post code area over a six month period. This map helps to highlight to RBC 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.

Flood Risk Management Structures

The EA flood risk management structures layer presents information from the NFCDD for the study area. The layer shows lengths of maintained channels, raised flood risk management structures (man-made), natural channels and culverted channels. It also provides details on the approximate SoP offered by flood risk management structures and the asset height.

Groundwater Vulnerability Mapping

The EA's groundwater vulnerability maps have been presented in a thematic map (Appendix H) 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 potential 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 SuDS map and review in Appendix D. Geology maps for the area are shown in Appendix H.

4.6 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 B indicates the geographical extent of Flood Zone 2, Flood Zone 3a and Flood Zone 3b for the Rossendale study area.

The detailed maps (Appendix B) clearly show that, whilst flood risk exists in areas of the study area, it does not pose a widespread issue. Where potential development sites are at risk from flooding, RBC must determine their suitability based on the Sequential Test and vulnerability classifications presented in Tables D1 and D2 of PPS25. Wherever possible RBC 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 Table D2 of PPS25), 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 D.

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 Practice Guide 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. Following the Sequential Test, if it is not possible for development to be located in zones of lower probability of flooding, the Exception Test can be applied (Table 5-3, Figure 5-1). The Exception Test provides a method of managing flood risk while still allowing necessary development to occur and should be informed by a Level 2 SFRA. 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 2.4 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 (3.3% annual probability) standard. Any storm event in excess of the 1 in 30-year return period storm would be expected to cause flooding. Contact with UU 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. PPS25 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 Borough.

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 the EA and LPA	Either > 1 in 20 (5%) or as agreed by 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)					

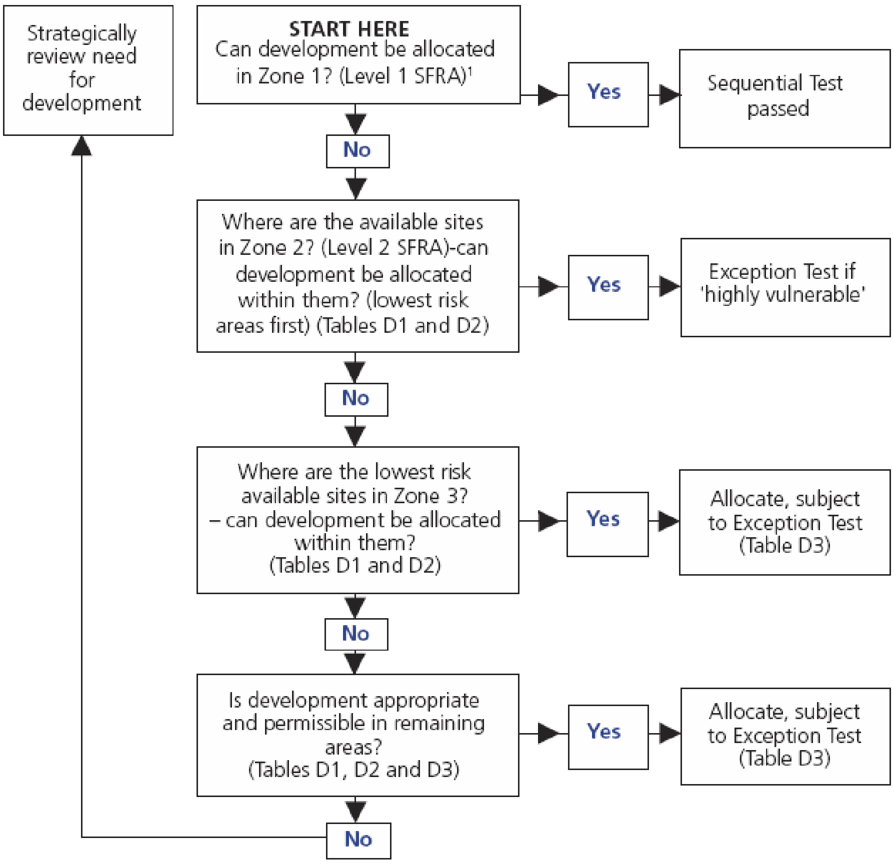

Figure 5-1: Application of the Sequential Test at the Local level for LDD preparation (Taken from PPS25 Practice Guide, Figure 4.1)

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 risk management structures 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 FRA[1]	FLOOD ZONE 2 FRA	FLOOD ZONE 3a FRA	FLOOD ZONE 3b 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*
⇩: *If passed proceed*
S: *Use only appropriate if it passes the sequential test*
E: *Use only appropriate if it passes the exception test*

FRA[1]*: Flood risk assessment should be carried out for sites of 1 hectare or more in FZ 1, to consider 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 B. 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 flood risk management structures 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 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 Zones 3a and 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 Flood Zone 2 or 3 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 Flood Zone 2 or 3. Consideration of flood hazard within Flood Zone 2 or 3 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 B are designed to assist RBC in determining the flood risk classification for each site and in completing the Sequential Test. This will aid the determination of the most suitable type of development for each site based on development vulnerability and flood risk. Certain sites have been identified as lying within Flood Zones 2 and 3 and, if 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 I 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 RBC 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 20m 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 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 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, 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 the effects of climate change may increase flood risk. For example if a site is clearly identified to be in Flood Zone 3a, the effects of climate change may be that the site lies within Flood Zone 3b. For application of the Sequential Test, where sites are located in Flood Zone 3 or at the boundary of Flood Zone 2 and 3 and the effects of climate change are not defined, 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 due to the effects of climate change the Sequential Test should be re-applied to determine if the proposed development is appropriate.

It should be noted that adopting this approach requires RBC to accept an element of risk when reviewing and allocating their development sites. For example, should RBC 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.

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,
- 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 all parts (a, b and c) of the Exception Test for each of the allocation sites proposed in an area considered to be at risk of flooding as part of a Level 2 SFRA,

- Following completion of the Sequential Test and parts a, b and c 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.

6.2 Flood Risk Assessment Guidance

6.2.1 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 (all sites over 1 ha) and located in Flood Zone 1. 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,
- Where a development site is located within 20m of the top of bank of a Main River, the EA should be consulted, regardless of Flood Zone classification.

6.2.2 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 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.

6.2.3 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.

6.2.4 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.

6.2.5 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 care home at risk of flooding from fluvial sources on Flood Zone maps alone. In such cases the results of hydraulic modelling are preferable to ensure details of flood flow velocity, onset of flooding and depth of floodwater is fully understood and that the proposed development incorporates appropriate mitigation measures.

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

6.2.6 Site-Specific Guidance

RBC 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 D. 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

PPS25 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 Flood Zone 2 or 3, 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. sockets located above flood level on walls, no carpet at ground floor level,
- Access and Egress routes must be at the 1 in 1000 year (0.1% annual probability) plus climate change or above level,
- 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,
- Site specific FRAs should ensure appropriate SuDS techniques are investigated according to local geology.

6.3 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 flood risk management structures.

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.

6.3.1 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, and the EA inform LPAs of the risk posed during the extreme event (1 in 1000 year). This allows the LPA to consult with the emergency services over the suitability of the access route. When considering plans for individual developments, emergency services should consider the potential for widespread flooding and the consequential impacts on their resources. 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.

6.3.2 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.

6.3.3 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.

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 site's amenity value both aesthetically and for recreation by providing attractive areas available for activities such as walking, cycling, water sports or wildlife watching.

Secondary Flood Risk Management Structures

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

Secondary flood risk management structures can relocate floodwaters away from certain areas or reduce the rate of flood inundation following a residual event. Examples of secondary flood risk management structures 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 risk management structures in order to provide secondary flood risk management structures. 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. Finished Flood Levels (FFLs) should be considered at the same time as access and egress (Section 6.3.1) to ensure that residents are not trapped by flood water.

The EA must be consulted regarding acceptable FFLs for proposed developments. 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

Flood resilience is a damage limitation measure to reduce the consequence of flooding and should not be used as justification for developing inappropriately in flood risk areas. The Association of British Insurers (ABI) in cooperation with the National Flood Forum has produced published guidance on how homeowners can improve the flood resilience of their properties (ABI, 2004). 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 ODPMs 2003 report, ‘Preparing for Floods’ (ODPM, 2003b).

Flood Warning and Emergency Procedures

Flood warning and emergency procedures are typically higher-level management strategies and should not be considered as a solution for flooding problems or a way of avoiding provision for safe and dry access and egress. In addition, when deriving flood warning and emergency procedures, the reluctance of residents to vacate premises upon receipt of a warning or during a flood event should not be under-estimated.

Emergency 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, (DCLG, 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.

Where these procedures already exist they should be updated to include the information generated by this SFRA. 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.

7 Recommendations for Level 2 SFRAs

7.1 What is a Level 2 SFRA?

As explained in Section 1.3.2, the mechanism for undertaking a more detailed study of flood risk for a development area is defined in PPS25 and the Practice Guide as a Level 2 SFRA. A Level 2 SFRA will use information gathered during this Level 1 SFRA to concentrate on a potential development area to determine detailed information on the level of flood risk so that sufficient evidence can be provided for the Exception Test to be applied.

This approach continues the hierarchical approach to flood risk defined in PPS25 and will provide RBC with more information to ensure that development follows the sequential approach. If applicable, it will allow them to apply the Exception Test and determine possible site layouts or policies that ensure flood risk is minimised to new development.

It is important to note that a Level 2 SFRA is not a replacement for a site specific FRA. Its purpose is strategic in nature to inform planning and policy decisions within the RBC area. There is no clear definition of the scale at which a Level 2 SFRA should be undertaken in PPS25 or the Practice Guide. However, a Level 2 SFRA can concentrate on individual towns and settlements or large development or regeneration area.

7.2 Level 2 SFRA Approach

7.2.1 The Sequential Approach

As noted in Section 5.1, LPAs should use a Level 1 SFRA to identify and allocate sites suitable for development in areas of least flood risk. The Practice Guide also states that the sequential approach to development and flood risk should be demonstrated initially through the Sequential Test. Guidance on applying the Sequential Test is included in Section 5.3.

The approach highlighted in the PPS25 Practice Guide for identifying where a Level 2 SFRA is required is for the LPA to undertake sequential testing as part of their development allocations process. Following the sequential test, if an allocation is still located within a medium to high flood risk area, a Level 2 SFRA will be required to provide sufficient information for the Exception Test to be applied. Table 5-3 shows that there are 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 and the Practice Guide, 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 including artificial, surface water and overland flow, sewer flooding and groundwater flooding.

7.2.2 The 'Hybrid' Approach

In many instances, LPAs are aware of areas 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 the Level 1 SFRA. In these circumstances, LPAs 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 could better inform the sequential approach recommended in PPS25 and allow RBC 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 and outside the area(s) of interest and, if necessary, the Exception Test is carried out.

7.3 RBC Level 2 SFRA Requirements

RBC has not yet completed the site allocations process and as a result it is not possible to identify sites that require Level 2 SFRAs. Due to the nature of the landscape within Rossendale, flood risk is mostly confined to the valleys, which is where urban areas have developed historically. Therefore, it is likely that some of RBC's development aspirations are located within flood risk areas and will require Level 2 SFRAs. However, the scope of Level 2 assessments will depend on the location of future site allocations and the nature of flood risk in that location. In some cases, it may be necessary for RBC to consider adopting a 'hybrid' approach to Level 2 SFRAs by carrying out the Level 2 assessment prior to undertaking the PPS25 sequential test.

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Appendix A: Historical Flood Events

Records of historical flooding within the Level 1 SFRA study area are presented in the table below. The date, location and source of flooding are provided.

Date	Watercourse(s) & Location(s)	Source of Flooding & Impact	Source of Information
Most well documented - floods of 1866, 1946, 1954, 1980, & 2007.	River Irwell - Rossendale Valley	Fluvial	Wikipedia 2008
Jul-1838	Cowpe Brook – Cowpe	Fluvial. Homes, shops and mills flooded. Bridges damaged.	CBHE
Aug-1849	Upper River Irwell - Bacup	Fluvial	CBHE
July-1870	Upper River Irwell - Bacup	Fluvial. Heavy lightning storm and steep valley sides brought 'catastrophic' results.	CBHE
Jul-1881	Upper River Irwell - Bacup	Fluvial. 'Catastrophic' results'. Mill properties along Burnley Road severely damaged.	CBHE
Aug-1884	Cowpe Brook - Cowpe, Waterfoot, Newchurch	Fluvial. Homes, shops and mills flooded. Bridge swept away.	CBHE
Aug-1891	Upper River Irwell - Bacup	Fluvial. Streets flooded 2ft deep, mills were stopped.	CBHE
Nov-1895	Upper River Irwell - Bacup	Fluvial. Quoted as 'greatest floods for 20 years'.	CBHE
Nov-1923	River Spodden - Whitworth	Fluvial. Heavy rain flooded houses.	CBHE
Jul-1964	Swinnel Brook & Tributary – Haslingden	Fluvial. Large scale flooding occurred.	RBC
Oct-1980	Limy Water - Stoneholme Road west of Mill, Crawshawbooth	Fluvial	EA
1995	River Irwell - Strongstry	Fluvial. 30 properties flooded.	Irwell CFMP 2008
1995	River Irwell - Irwell Vale	Fluvial. River Irwell flooded 11 properties within the Meadow Park Estate.	RBC
Jan-1995	River Irwell - Recreation ground south of R. Irwell, & North Street, Strongstry	Fluvial. Channel capacity exceeded (No Raised Defences).	EA
Jan-1995	Limy Water - Between Burnley Road & Lee Brook Close, Constable Lee	Fluvial. Channel capacity exceeded (No raised Defences)	EA
Jan-1995	River Irwell - North end of West Street, South of Newchurch, Rossendale Valley	Fluvial	EA
Oct-1998	Drain tributary of Limy Water - Agricultural fields, south of Loveclough	Fluvial. Channel capacity exceeded (No Raised Defences).	EA
Oct-1998	River Irwell - North Street, Strongstry	Fluvial. Channel capacity exceeded (No Raised Defences).	EA

Date	Watercourse(s) & Location(s)	Source of Flooding & Impact	Source of Information
Oct-1998	River Irwell - North Street, Strongstry	Fluvial. Flooded basements and houses, closed roads and flooded fields in Strongstry, near Stubbins.	Lancashire Evening Telegraph
Oct-1998	River Irwell - Bacup, Whitworth, Weir, Haslingden.	Fluvial. Flooding in Weir.	Lancashire Evening Telegraph
Oct-1998	River Irwell - Rawtenstall	Fluvial. Silted culvert flooded Burnley Road.	Lancashire Evening Telegraph
1999	Folly Clough Brook - Crawshawbooth	Fluvial. 50 properties flooded.	Irwell CFMP 2008
1999	Limy Water - Rawtenstall	Fluvial. 8 properties flooded.	Irwell CFMP 2008
Jan-1999	Limy Water - Loveclough Pavilion	Fluvial	EA
Mar-1999	Limy Water - Adjacent Burnley Road, west of Reeds Holme	Fluvial. Channel capacity exceeded (No Raised Defences).	EA
Jul-1999	Folly Clough Brook - Centre of Crawshawbooth	Fluvial. Channel capacity exceeded (No Raised Defences).	EA
Jul-1999	Adjacent Burnley Road, west of Reeds Holme	Fluvial - Limy Water - Channel capacity exceeded (No Raised Defences).	EA
Oct-1999	West of Sunny Bank Road, south west Haslingden	Overland Flow	EA
Oct-1999	Swinnel Brook - Junction of B6232 & Jubilee Road, Waterfoot, west Haslingden	Fluvial	EA
Jun-2000	River Spodden - Whitworth town centre, football ground, mills near Daniel Street	Fluvial	EA
2002	River Irwell - Irwell Vale	Fluvial. 11 properties flooded	Irwell CFMP 2008
2002	Folly Clough Brook - Crawshawbooth	Fluvial. 36 properties flooded.	Irwell CFMP 2008
Jun-2002	Limy Water - Crawshawbooth	Fluvial. Caused urban flooding.	CBHE
Jun-2002	River Irwell - North Street, Strongstry.	Fluvial. Channel capacity exceeded (No Raised Defences).	EA
Jun-2002	Unnamed Watercourse, a tributary of River Irwell - West of Stubbins Road, Strongstry.	Fluvial	EA
Jun-2002	River Irwell - Meadow Park road, Lumb Bridge west of Edenfield.	Fluvial & Surface Water. Channel capacity exceeded (No Raised Defences).	EA
Jun-2002	Musbury Brook - Track south west of Park Road, & West of Holcombe Road near Clarke Bridge, west of Helmshore.	Fluvial. Obstruction/blockage - Culvert.	EA

Date	Watercourse(s) & Location(s)	Source of Flooding & Impact	Source of Information
Jun-2002	At confluence of Musbury Brook with Upper River Ogden - Holcombe Road near Clarke Bridge, west of Helmshore.	Fluvial. Obstruction/blockage - Culvert.	EA
Jun-2002	Upper River Ogden - East of Holcombe Road near Clarke Bridge, west of Helmshore	Fluvial. Obstruction/blockage - Culvert	EA
Jun-2002	Upper River Ogden - Junction of Station Road & Bridge End Close, south west of Helmshore	Fluvial. Obstruction/blockage - Culvert	EA
Jun-2002	Upper River Ogden - West of Station Road, south west of Helmshore	Fluvial. Obstruction/blockage - Culvert	EA
Jun-2002	Upper River Ogden - Sunny Bank Close, south west of Helmshore	Fluvial. Channel capacity exceeded (No Raised Defences)	EA
Jun-2002	Limy Water - Loveclough Pavilion	Fluvial	EA
Jun-2002	Whitewell Brook - Buildings between Burnley Road, Charles Street & Taylor Avenue, Edgeside, Rawtenstall	Fluvial. Channel capacity exceeded (No Raised Defences). Flooded Mill buildings	EA
Jun-2002	River Irwell - Building at north end of West Street, South of Newchurch, Rossendale Valley	Fluvial	EA
Jun-2002	River Irwell - Bacup town centre, junction of Burnley Road, Yorkshire Street & St James Street	Fluvial. Channel capacity exceeded (No Raised Defences)	EA
Jun-2002	Swinnel Brook - Haslingden	Fluvial. Large scale flooding occurred	RBC
Jun-2002	River Irwell - Irwell Vale	Fluvial. River Irwell flooded 8 properties within the Meadow Park Estate	RBC
Jun-2002	Folly Clough Brook - Crawshawbooth town centre	Fluvial - Obstruction/blockage - Channel	EA
Jun-2002	Blackburn Road, Hud hey	Fluvial - Periodic overflow of culvert on private land adjacent Clough End Road	LCC
Jun-2002	Baron Street & Bacup Road - Rawtenstall	Fluvial - Periodic overflow of culvert onto Baron Street in times of high flow causing flooding on Bacup Road	LCC
Jun-2002	Broad Clough - Un-named watercourse Burnley Road., Bacup	Surface Water or Fluvial - Flooded track to rear of Broad Clough Villas	RBC

Date	Watercourse(s) & Location(s)	Source of Flooding & Impact	Source of Information
Jun-2002	Unnamed Non-Main Watercourse - Mill St & Holmes Lane , Bacup	Fluvial - Flooded Leisure Centre	RBC
Jun-2002	Balladen Clough - Waingate Road, Rawtenstall	Fluvial. Flooded The Manor	RBC
Jun-2002	Balladen Brook, Jubilee Way, Townsendfold, Rawtenstall	Fluvial. Holme Works flooded	RBC
Jun-2002	Limy Water - Between Burnley Road & Lee Brook Road, Constable Lee	Fluvial	RBC
Jun-2002	Hud Clough Brook - Facit, Whitworth	Fluvial - Facit Mill flooded	RBC
Jun-2002	Swinnel Brook, Hud Hey Road, Brook Street	Fluvial. Flooded Carr Mill	RBC
Jun-2002	Swinnel Brook, Waterside Road, St Crispin Way, B6232 - Haslingden	Fluvial. Roads flooded and buildings eitherside Waterside Road	RBC
Jun-2002	Limy Water - Junction A682 & Short Clough Lane between reeds Holme & Crawshawbooth	Fluvial. Blocked culvert	RBC
Jun-2002	North end of Bridge End Close, west Helmshore	Surface Water	RBC
Jun-2002	Alden Brook - Along Helmshore Road, south Helmshore	Fluvial. Adjacent Hotel	RBC
Jun-2002	River Irwell - Strongstry, Stubbins	Fluvial & Surface Water. Flooded recreation ground	RBC
Jun-2002	Unnamed watercourse, East View, Stubbins Street, Stubbins	Fluvial - collapsed culvert	RBC
Aug-2004	Cowpe Road - Cowpe	Pluvial flooding - Surface Water Runoff from sloping grassland	RBC
Aug-2004	Cowpe Brook- East of Cowpe Road, Cowpe	Fluvial	RBC
Aug-2004	Cowpe Brook - North of Cowpe Road, Cowpe	Fluvial	RBC
August 2004	Tor End Road & Helmshore Road, South West of Helmshore	Overland Flow - Run off from adjacent hillside in times of heavy rainfall causing flooding to Helmshore Road and fronting properties	LCC
Nov-2005	Unnamed watercourse - Brooklands Avenue, Haslingden	Fluvial - Obstruction/blockage - Channel	RBC
2006	River Irwell - Rossendale	Fluvial. Roads flooded	Irwell CFMP 2008
Jul-2006	River Spodden & Non-Main Watercourse - Knott Hill Street, Shawforth	Fluvial	RBC

Date	Watercourse(s) & Location(s)	Source of Flooding & Impact	Source of Information
Jul-2006	Burnley Road East, Piercy, Waterfoot	Sewer flooding. 2/07/2006	RBC
Jul-2006	Park Road, Waterfoot	Sewer flooding	RBC
Jul-2006	Sow Clough - Toll Bar Business Park, Stacksteads	Fluvial - Obstruction/blockage - Channel	RBC
Jul-2006	Shawclough Brook - Shawclough Road & Burnley Road East, Waterfoot	Fluvial - Overflow onto Shawclough Road in times of high flows causing flooding on Burnley Road East and the rear of properties	LCC
Jul-2006	Knowsley Clough Brook, Edgemoor Close & Moss Side Street, Shawforth	Fluvial. Culverts overtopped flooding houses	RBC
Jul-2006	Shawclough Brook - Shawclough Road, Shawclough Street, Burnley Road east, Tattersall Square, Waterfoot	Fluvial - Cellars flooded	RBC
Jan-2008	Marlborough Close & Mill Street, Whitworth	Pluvial flooding - Surface Water Runoff from sloping grassland	RBC
Jan-2008	Hall Carr Mill Cottages, Fallbarn Road - Rawtenstall	Pluvial flooding - Surface Water Runoff from sloping grassland	RBC
Jan-2008	M66 Beneath Woolpack Roundabout between Stubbins & Edenfield	Highway Flooding	HA
Jan-2008	A56 Between Stubbins & Edenfield	Highway Flooding	HA
Jan-2008	River Irwell - Irwell Vale	Fluvial. Meadow Park estate experienced flooding. Warnings given	Manchester Evening News
Jan-2008	River Irwell - Bacup	Fluvial. House along Rochdale Road	Manchester Evening News
Jan-2008	River Irwell - Cowpe	Fluvial. Buck Inn public house flooded	Manchester Evening News
Feb-2008	A56, West of Hall Park, Hud Hey	Highway Flooding	HA

Appendix B: SFRA Mapping

- **Detailed maps covering RBC administrative area:**
  Presents flood risk information obtained from the Environment Agency (EA), Rossendale Borough Council (RBC), the Highways Agency (HA), Lancashire Fire and Rescue Service (LF&RS), and the Lancashire County Council (LCC) Highways Department. Information on flood sources, limitations of data, sustainable drainage systems and FRA guidance is provided to the right hand side of each map. Further details presented in the maps can be found in Section 4.5 Table 5-2.

- **Flood Zone Confidence Maps:**
  Presents the level of confidence in flood zones as a result of the methods used to derive them (see Section 4.5.2 and the 'Notes' on the right hand side of the maps).

- **United Utilities DG5 Sewer Flooding Map:**
  Presents DG5 sewer flooding information provided by UU. The frequency of flood occurrences are separated into events that were inside properties (internal) and outside properties (external).

Appendix C: CFMP Policy Units

The River Irwell Catchment Flood Management Plan (CFMP) and River Ribble CFMP have been reviewed and the table below summarises the CFMP Policy Units relevant to the study area.

Table C-1 CFMP Policy Units

CFMP	Policy Units	Watercourse Catchments within study area	Key Settlements	Main Flooding Mechanisms	Causes Identified	Impacts Identified	Future Risk	Preferred Policy
River Irwell CFMP	Policy Unit 8 (Rossendale Valley)	Upper River Irwell Corridor - Greave Brook, Whitewell Brook, Limy Water and the River Ogden.	Bacup, Rawtenstall and Haslingden through to Stubbins, north of Ramsbottom.	Fluvial	Insufficient channel capacities and numerous blocked culverts, resulting from gravel sedimentation and shoaling, restrict flow and thus raise water levels leading to overtopping.	A flood depth increase of approximately 0.3m was determined in the vicinity of Stubbins, at the downstream south western extent of the catchment.	Upper Irwell Valley is where the highest increase in properties at risk of flooding was determined as a result of a large number of culverts, and a steep sided valley floodplain restricting dispersal of floodwater, considered the most significant contributing factor of the two.	Policy Option 5 - take further action to reduce flood risk (now and/or in the future).
				Surface Water Runoff	Discharged from surrounding steep fields and moorlands.			
				Surface Water Runoff	Heavy rainfall overwhelming the urban drainage system.			
	Policy Unit 9 (Rural Rossendale)	Upper River Irwell Catchment	Rural area of Rossendale within the Irwell Valley - fewer populated areas with less developed floodplain.	Flash Fluvial	Overtopping of small tributaries passing through many culverts of varying condition, and which suffer from debris blockage and siltation reducing their capacity.	Policy area not been modelled as part of the modelling study, and therefore the impact of climate change on flood levels has not been quantified. The overall assessment of flood risk of the existing situation is small.	Not considered to increase the flood risk significantly.	Policy Option 6 - take action to increase the frequency of flooding (where appropriate) to deliver benefits locally or elsewhere.
				Surface Water Runoff	Discharged from surrounding steep fields and moorlands following heavy rainfall. Low soil permeability, valley steepness and poor catchment vegetation management practices leading to accelerated runoff rates were considered contributing factors.			
	Policy Unit 18 (Rochdale, Whitworth and Littleborough)	Upper River Spodden Catchment	Whitworth, north of Rochdale.	Fluvial	12 culverts along the River Spodden. Channel capacity problems resulting from sedimentation constriction and blockage of culverts.	Approximately 90 properties are thought to be at risk in the town. Study area is sensitive to increases in flow.	Worst case urbanisation and climate change scenarios result in a 450 mm increase in peak water levels at Mitchell Hey (in Rochdale) where the Spodden joins the Roch downstream of Whitworth.	Policy Option 6 - take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).
River Ribble CFMP	Policy Unit 2 (Calder)	Wider River Calder Catchment	Upper rural land extending from the north and north west of Haslingden towards to the south of Accrington and Oswaldwhistle.	N/A	Only a few isolated flood risk problem areas in certain villages. The villages that are specified are not located within the RBC study area.	No specific flooding mechanisms have been identified. Therefore considered to be relatively low.	Flood risk is considered to be relatively low.	Policy Option 3 - continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase from this baseline).
	Policy Unit 2.2 (Accrington and Oswaldtwistle)	Woodnook Water Catchment	Entirely urban. Extends from the source of Woodnook Water north east of Rising Bridge and continues north west through Baxendale towards Accrington.	N/A	Fluvial flooding resulting from the under capacity/blockage of the numerous culverts along the River Hyndburn. Woodnook Water is a tributary of the River Hyndburn, however no specific flooding mechanisms have been identified in the study area.	No specific flooding mechanisms have been identified. Therefore considered to be relatively low.	Flood risk is considered to be relatively low.	Policy Option 4 - take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Appendix D: SuDS Map and 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 (3.3% annual probability, or 1 in 30 year) and the typical watercourse design standard flood (1% annual probability, or 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), PPS25 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 ensuring their effective operation up to and including the 1% annual probability (1 in 100 year) design standard flood (including an increase in peak rainfall of 30% to account for climate change.) 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 management 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 RBC area, enabling RBC 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 RBC and UU. 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 RBC, the EA (if the site is over 1ha in size or identified as situated within a critical drainage area), and UU 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, UU, and RBC. 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 cubic metre 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.

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.

The SuDS Map

The underlying ground conditions of a development site will often determine the type of SuDS that are suitable. 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.

In order to produce a map identifying broad areas of SuDS suitability, a number of data sources were queried:

- BGS Geology Data,
- Groundwater Vulnerability,
- Source Protection Zones.

Based on the results of querying the above datasets, three broad categories of SuDS techniques have been identified and presented on the map:

- Infiltration systems,
- Attenuation systems,
- Combined systems.

Any proposed SuDS methods should be planned and incorporated in accordance with relevant policy and guidance such as PPS25, National SuDS Working Group (2004), BRE 365, CIRIA report C522 for SuDS, CIRIA 523 (SuDS Best Practice Manual) and CIRIA C697 (the SuDS Manual).

Policy & Strategic Planning

The SuDS map is designed to be used at a strategic scale to give users of the SFRA an overview of the potential SuDS applicability across the borough. The map is based on permeability data at the 1:50,000 scale and groundwater vulnerability at the 1:100,000 scale. The map does not take into account slope, urban areas or more local ground conditions.

In conjunction with the Level 1 SFRA, it is envisaged that policy and strategic planners within RBC will use the SuDS map to specify SuDS requirements for strategic land allocations. For example, if a large strategic site is shown to be in a location where only attenuation SuDS techniques are suitable, the incorporation of a suitable system, such as a detention basin, should be included in the development brief and proposed layout design from an early stage in the development process.

As a result, the map is not intended to be used as a definitive and detailed specification on the use of SuDS across the district.

Development Control

The SuDS map can be used as a reference guide for Development Control to identify which SuDS techniques would be suitable for a development site and therefore allow the request for specific information from a site-specific FRA. In addition, the maps can be used by Development Control to advise developers which SuDS technique is thought to be suitable in an area. This is particularly prudent in situations where only attenuation techniques are suitable and therefore the subsequent land-take needs to be considered to incorporate this into the site layout design.

Following receipt of detailed site specific FRAs and consultation with the EA, it may be apparent that SuDS are not the most suitable way to address surface water runoff from a development. In these situations, development runoff would need to be discharged in accordance with Approved Document H: Drainage and Waste Disposal of the Building Regulations 2000, Section 3 or to British Standard BS EN 752 Drain and Sewer Systems for Outside Buildings, Part 4.

SuDS Map Limitations

It should be stressed that the purpose of the SuDS map is to provide a strategic tool to assist policy and development control planners in seeking runoff limitations. The map has been created using large scale datasets that make several assumptions and therefore has limitations when used in more local or site based situations.

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 the SuDS Map is provided as a guide only and it is essential that ground investigation takes place to confirm suitability of SuDS techniques.

Appendix E: Data Register

Table E-1 contains details of information received for the Level 1 SFRA. A level of confidence has been assigned to each data source.

Table E-1: Data Received

PROVIDER	TITLE	DESCRIPTION	CONFIDENCE
UU	**UU DG5 Data**	**UU DG5 Data to 4 Digit Postcodes**	**GOOD**
RBC	**RBC Land Drainage / Flood Information**	**Historical Flooding Areas**	**VERY GOOD**
RBC	**RBC Land Drainage / Flood Information**	**Irwell Vale Flood Warning Area**	**VERY GOOD**
RBC	**EA Known Flood Maps annotated by RBC - Drainage Information**	**Flooding Areas**	**VERY GOOD**
EA	**LiDAR Data**	**LiDAR Topographical Land Elevation Data**	**VERY GOOD**
RBC	**RBC Planning Documents**	**Planning - Various**	
RBC	Open Space Review Rev B June 2006	Planning Information	**GOOD**
RBC	Urban Potential Study 2005	Planning Information	**VERY GOOD**
RBC	Core Strategy Preferred Options Report 2006	Planning Information	**VERY GOOD**
RBC	Employment Land Study 2007	Planning Information	**VERY GOOD**
RBC	Equalities Impact Assessment Employment Study	Planning Information	**GOOD**
RBC	Rawtenstall Area Action Plan Final Addendum Report 10/2006	Planning Information	**VERY GOOD**
RBC	Revised Rawtenstall Area Action Plan Preferred Options Report 03/2006	Planning Information	**VERY GOOD**
RBC	Play Strategy for Rossendale 2007	Planning Information	**GOOD**
RBC	Local Plan Proposals Map Adopted 1995	Planning Information	**GOOD**
RBC	Open Space Strategy for Rosendale Rev C 2008	Planning Information	**VERY GOOD**
RBC	Rossendale Retail Capacity Study 2005 & Appendices	Planning Information	**VERY GOOD**
RBC	Statement of Community Involvement Adopted Version 2007	Planning Information	**GOOD**
RBC	Bacup, Stacksteads and Britannia Area Action Plan	Planning Information	**VERY GOOD**
RBC	**Data - Various**	**GIS Layers**	
RBC	Topo Area/Line/Point	GIS Layer - Map Info	**GOOD**
RBC	Rossendale Borough Boundary	GIS Layer - Map Info	**VERY GOOD**
RBC	Bndy Line	GIS Layer - Map Info	**VERY GOOD**
RBC	Carto Text/Symbol/Area	GIS Layer - Map Info	**GOOD**
RBC	Flood Zone 2	GIS Layer - Map Info	**FAIR**
RBC	Flood Zone 3	GIS Layer - Map Info	**FAIR**
RBC	Watercourse Centrelines	GIS Layer - Map Info	**GOOD**
RBC	Defences	GIS Layer - Map Info	**POOR**
RBC	Areas Benefitting from Defences	GIS Layer - Map Info	**FAIR**
RBC	Flood Storage Areas	GIS Layer - Map Info	**FAIR**
RBC	Historical Flood Mapping	GIS Layer - Map Info	**VERY GOOD**
RBC	Catalogue	GIS Layer - Map Info	**GOOD**

PROVIDER	TITLE	DESCRIPTION	CONFIDENCE
RBC	Urban Boundaries	GIS Layer - Map Info	GOOD
RBC	Green Belt Allocation	GIS Layer - Map Info	GOOD
RBC	Sites of Specific Scientific Interest (SSSI's)	GIS Layer - Map Info	GOOD
RBC	Local Nature Reserves	GIS Layer - Map Info	GOOD
RBC	**Data - Various**	**GIS Layers**	
RBC	1:10, 000 Raster/Tiles/E&W Grid	GIS Layer - Map Info	VERY GOOD
RBC	1:100, 000 Tiles	GIS Layer - Map Info	VERY GOOD
RBC	1:250, 000 Raster	GIS Layer - Map Info	VERY GOOD
RBC	Integrated Transport Network	GIS Layer - Map Info	GOOD
RBC	2001 Flood Outlines - Centrelines/Fluvial/Tidal	GIS Layer - Map Info	GOOD
RBC	Call for Sites	GIS Layer - Map Info	GOOD
RBC	Extant Housing 2007-08	GIS Layer - Map Info	GOOD
RBC	County Boundaries	GIS Layer - Map Info	VERY GOOD
RBC	Coastline/Simple Coastline E&W	GIS Layer - Map Info	GOOD
RBC	National Parks	GIS Layer - Map Info	GOOD
RBC	LPA's	GIS Layer - Map Info	VERY GOOD
RBC	Road Line/Link/Nodes/Route	GIS Layer - Map Info	GOOD
RBC	Rossendale Sites with SPC's - Potentially Contaminated Land	GIS Layer - Map Info	VERY GOOD
RBC	Upper Level Road/Bridge	GIS Layer - Map Info	GOOD
RBC	Background Raster Mapping	GIS Layer - Map Info	VERY GOOD
LCC	**LCC Highways Flooding Information**	**Flooding Areas**	VERY GOOD
Lancashire Fire and Rescue Service	**LF&RS Historical Flooding Information**	**Flooding Areas**	GOOD
EA	**EA Data**	**Modelling Cross Section Data**	GOOD
EA	River Irwell	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	Limy Water	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	Musbury Brook	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	River Croal	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	Whitewell Brook	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	Middle Brook	AutoCAD, HEC_RAS, ISIS, Photos	VERY GOOD
EA	**EA Data**	**Topographic Information**	
EA	COWP	AutoCAD	GOOD
EA	SPOD	AutoCAD	GOOD
EA	WHIT	AutoCAD	GOOD
EA	IRWE	AutoCAD	GOOD
EA	Hud Clough	AutoCAD	GOOD
EA	**EA Data**	**Various**	
EA	Defences & Structures	GIS Layer - Map Info	VERY GOOD
EA	Historical Flood Pins	PDF HWMs for Spodden and Irwell	VERY GOOD
EA	Substantiated flood events	GIS Layer	VERY GOOD
EA	Irwell Documents	Word Document- Irwell FR Viability Assessment	VERY GOOD
EA	Models and Levels	Cowpe Brook Isis Model Files and report	VERY GOOD

PROVIDER	TITLE	DESCRIPTION	CONFIDENCE
EA	Models and Levels	Irwell Model Review model files and report	VERY GOOD
EA	Models and Levels	Spodden 04 FRM model files and report	VERY GOOD
EA	Models and Levels	Whitewell Brook Isis and Jflow model update	VERY GOOD
EA	Ribble CFMP	PDF report	VERY GOOD
EA	Ribble ICMP	PDF report	VERY GOOD
EA	Survey data	GIS shapefiles	GOOD
EA	EA Main River	GIS shapefiles	VERY GOOD
EA	**Northern Manchester Catchment Abstraction Management Strategy**	**PDF report**	VERY GOOD
RBC	**2008 Data - Various**	**GIS Layers**	
RBC	Areas Benefitting from Defences	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	Watercourse Centrelines	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	Defences	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	Flood Storage Areas	GIS MapInfo MIF/TAB files & ESRI Shape files	GOOD
RBC	Historical Flood Mapping	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	Flood Zone 2	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	Flood Zone 3	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	County Boundaries	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	National Parks E&W	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	LPA's	GIS MapInfo MIF/TAB files & ESRI Shape files	VERY GOOD
RBC	EA Boundary	GIS MapInfo MIF/TAB files & ESRI Shape files	GOOD
RBC	OS Mapping	GIS Layer - Map Info	VERY GOOD
EA	**Detailed Modelled Flood Data**	**GIS Layers**	
EA	Cowpe Brook_FMU06_07	GIS ESRI Shape files	VERY GOOD
EA	Irwell Model Review and Update	GIS ESRI Shape files	VERY GOOD
EA	River Spodden FRM 2004	GIS ESRI Shape files	VERY GOOD
EA	Whitewell Brook FMU07_08	GIS ESRI Shape files	VERY GOOD
EA	**Groundwater Vulnerability Data**	**GIS Layers**	
EA	100km	100km Mapping	VERY GOOD
EA	100km Drift	100km Mapping	VERY GOOD
EA	**Source Protection Zone GIS Data**	**GIS Layers**	VERY GOOD
BGS	**Geological Map Data**	**GIS Layers**	
BGS	Bedrock - Rochdale & Manchester Polygons	50km Mapping MIF, MID, MapInfo Tabs	VERY GOOD
BGS	Superficial Drift - - Rochdale & Manchester Polygons	50km Mapping MIF, MID, MapInfo Tabs	VERY GOOD
BGS	Linear Features Rochdale & Manchester - Fault, Landform, Rock	50km Mapping MIF, MID, MapInfo Tabs	GOOD
BGS	Rochdale Mass Movement Polygons	50km Mapping MIF, MID, MapInfo Tabs	GOOD
BGS	Permeability - Bedrock	50km Mapping MIF, MID, MapInfo Tabs	VERY GOOD

PROVIDER	TITLE	DESCRIPTION	CONFIDENCE
BGS	Permeability - Superficial Drift	50km Mapping MIF, MID, MapInfo Tabs	VERY GOOD
BGS	Permeability - Mass Movement	50km Mapping MIF, MID, MapInfo Tabs	VERY GOOD

Appendix F: Contacts

Principal contacts for the Level 1 SFRA Steering Group are provided in the table below.

Organisation	Contact	Position	E-Mail
Rossendale Borough Council	Stephen Stray	Planning Manager	stephenstray@rossendalebc.gov.uk
	Anne Storah	Principal Planner	annestorah@rossendalebc.gov.uk
	Geoff Brown	Drainage Engineer	geoffbrown@rossendalebc.gov.uk
Environment Agency	Philip Carter	Planning Liaison Officer	Philip.Carter@environment-agency.gov.uk
	Andy Cameron	Development Control Engineer	Andrew.Cameron@environment-agency.gov.uk
Scott Wilson	Fay Tivey	Project Manager	Fay.Tivey@scottwilson.com
	Anita Longworth	Principal Planner	Anita.Longworth@scottwilson.com

Appendix G: GIS Data

GIS data used and created as part of the Level 1 SFRA are included in the table below. Details regarding the source, benefits, limitations and whether the GIS layer was included in the Level 1 SFRA are provided.

Type	Layer	Source	Description of Layer	Included (Y/N)	Comment	Benefits	Limitations
Fluvial	Environment Agency Broad-scale Flood Zone Maps	Provided as GIS layer by RBC	Polygon layer showing EA flood zone maps including Flood zone 2 and 3	Y	Flood Zones derived from a combination of both detailed and broadscale modelling techniques	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 flood defences; are commonly based on 5m resolution DTM; broadscale modelling software is commonly used and is generally thought to have inaccuracies. Typically watercourses with a catchment area less than 3km^2 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 and on first inspection it is suggested there is no flood risk.
	River centrelines	Provided as GIS layer	Polyline layer showing all major watercourses in the study area	Y		Identification of the watercourses	There are other watercourses that are not shown in the GIS layer that may present a significant flood source.
	Hydraulic model outputs: Cowpe Brook (100 yr, 1000 yr)	Provided as GIS layers by EA	Polygon data showing the modelled outlines of Cowpe 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 using detailed models and therefore the flood risk from these cannot be as accurately assessed.
	Hydraulic model outputs: Whitewell Brook (100 yr, 1000 yr)	Provided as GIS layers by EA	Polygon data showing the modelled outlines for Whitwell Brook	Y			
	Hydraulic model outputs: River Spodden Flood Risk Mapping Study (25 yr, 100 yr, 100 yr + 20%)	Provided as GIS layers by EA	Polygon data showing the modelled outlines of the River Spodden	Y			
	Hydraulic model outputs: River Irwell Model Review and Update (25 yr, 100 yr, 100 yr + 20%)	Provided as GIS layers by EA	Polygon data showing the modelled outlines of the River Irwell	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 or 1:25 yr modelled outlines available, these have been used to represent FFP, otherwise Flood Zone 3a has been used as a proxy (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 or 25yr 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.

Type	Layer	Source	Description of Layer	Included (Y/N)	Comment	Benefits	Limitations
	Flood Zone 3a	EA Flood Zone Maps	Polygon layer provided by the EA containing the best available information as of July 2008. No creation of new hybrid Flood Zone required (as with Flood Zone 3b and Flood Zone 3 plus climate change)	Y		Consistent with Flood Zone information presented on EA website.	Parts of the Flood Zone outline were derived using broadscale modelling techniques, which are generally accepted to be less accurate than those derived using detailed modelling techniques.
	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. Where modelled data is not available EA broad-scale FZ2 has been used. (with agreement from EA and the Council)	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 outline has been used. This could be overly conservative and, where possible, data should be updated as and when available.
	Flood Zone 2	EA Flood Zone Maps	Polygon layer provided by the EA containing the best available information as of July 2008. No creation of new Flood Zone required (as with Flood Zone 3b and Flood Zone 3 plus climate change)	Y		Consistent with Flood Zone information presented on EA website.	Parts of the Flood Zone outline were derived using broadscale modelling techniques, which are generally accepted to be less accurate than those derived using detailed modelling techniques.
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 SFRA.
Other	Sewer Flooding History	DG5 data registers provided by United Utilities	Data layer showing the number of flooding incidents within the last 6 months per 5-digit post code area.	Y		Indicates areas that may be prone to flooding as have experienced flooding within a postcode area.	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 RBC	Polygon layer showing locations of recorded historic flood events	N (provided to RBC separately)		Indicates areas which have been recorded as having been flooded	Date and source of flooding is not always recorded.
Mitigation	Flood Defences	NFCDD GIS layer provided by the EA	Polyline layer presenting information on river channels such as maintained channel, purpose-built defences natural channel.	Y		Indicates which areas the flood warning system covers.	Shows defences along reaches of watercourse where defences may not be present (for example may be a maintained channel but visually, the layer indicates that there are flood defences)
Mapping	OS Mapping	RBC provided OS Mapping under contractor license	1:10k, 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 respectively

Appendix H: Groundwater Vulnerability and Geology Mapping

- **Bedrock Map:**
  Presents British Geological Survey bedrock geology data for the study area.

- **Superficial Deposits Map:**
  Presents British Geological Survey superficial deposits data for the study area.

- **Permeability Maps:**
  Presents British Geological Survey permeability data for the study area. The minimum and maximum permeability is presented for both the bedrock and superficial deposits.

- **Groundwater Vulnerability Map:**
  Presents Environment Agency Groundwater Vulnerability Data for the study area. See Section 4.5.2 for further details.

Appendix I: SFRA Maintenance and Update

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 G, 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 E and G 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 RBC 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 RBC, Ordnance Survey, UU 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 Practice 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 RBC, EA, and UU. 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 J: SFRA Version Register

The table below provides the version history of the Level 1 SFRA. It is imperative that the most up-to-date version of the Level 1 SFRA is used.

Version	Date Issued	Amendments Made	Stakeholders Notified	Document written by:	Document Checked by:	Document Approved by:
D1	October 2008	Interim Draft Level 1 SFRA	Yes	HB, FT and LR	AW	DD
D2	November 2008	Draft Level 1 SFRA (incorporating comments from RBC and the EA)	Yes	FT	AW	DD
F1	February 2009	Final Level 1 SFRA (incorporating comments from RBC and the EA)	Yes	FT	AW	JR
F2	May 2009	Final Level 1 SFRA (incorporating additional comments from RBC)	Yes	FT	AW	JR