Flood and Water Management

Submitted to
Staffordshire Moorlands
District Council

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Staffordshire Moorlands Level 1 Strategic Flood Risk Assessment Update

Final Report
October 2015

Staffordshire Moorlands Level 1 Strategic Flood Risk Assessment Update

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Rev No	Comments	Checked by	Approved by	Date
0	Draft	HB	AW	29/07/2015
1	Final	HB	AW	01/10/2015

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Job No: 47074340 Date Created: October 2015

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List of Acronyms

ABD	Areas Benefiting from Defences
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AStGWF	Areas Susceptible to Groundwater Flooding
AStSWF	Areas Susceptible to Surface Water Flooding
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CRT	Canal and River Trust
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Flood and Rural Affairs
FCERM	National Strategy for Flood and Coastal Erosion Risk Management
FMfSW	Flood Map for Surface Water
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWD	Flood Warning Direct
FWEP	Flood Warning and Evacuation Plan
FWMA	Flood and Water Management Act 2010
GES	Good Ecological Status
GIS	Geographical Information System
HFM	Historic Flood Map
IDB	Internal Drainage Board
LDF	Local Development Framework
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
NPPF	National Planning Policy Framework
NS	National Standards
PFRA	Preliminary Flood Risk Assessment
SMDC	Staffordshire Moorlands District Council
PPG	Planning Practice Guidance
PPS	Planning Policy Statement
RBMP	River Basin Management Plan
SA	Sustainability Appraisal
SCC	Staffordshire County Council
SFRA	Strategic Flood Risk Assessment
SMDC	Staffordshire Moorlands District Council
SPZ	Source Protection Zone
ST	Severn Trent Water
SuDS	Sustainable Drainage Systems
uFMfSW	Updated Flood Map for Surface Water
UU	Unitied Utilities
WFD	Water Framework Directive

Glossary of Terms

TERM	DEFINITION
1D Hydraulic Model	Hydraulic model which computes flow in a single dimension, suitable for representing systems with a defined flow direction such as river channels, pipes and culverts
2D Hydraulic Model	Hydraulic model which computes flow in multiple dimensions, suitable for representing systems without a defined flow direction including topographic surfaces such as floodplains
Annual probability	Annual probability of occurrence in any one year, expressed as a percentage. For example, a 1% annual probability event has a 1 in 100 chance of occurring in any year.
Areas Benefitting from Defences (ABD)	Areas Benefiting from Flood Defences shows those areas that would benefit from the presence of formal flood defences in the event of flooding from rivers with a 1% (1 in 100) chance in any given year. If the defences were not there, these areas would be flooded.
Asset Information Management System (AIMS)	Environment Agency database of assets associated with main rivers including defences, structures and channel types. Information regarding location, standard of service, dimensions and condition.
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan (CFMP)	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions. For fluvial events a 20% increase in river flow is applied and for rainfall events, a 30% increase. These climate change values are based upon information within the NPPF and Planning Practice Guidance.
Culvert	A channel or pipe that carries water below the level of the ground.
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
Exception Test	A tool that should be applied following the application of the sequential test. Conditions need to be met before the Exception Test can be applied.
Flood Defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Resistant	Measures to prevent flood water entering a building or damaging its fabric. This has the same meaning as flood proof.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption).
Flood Storage Area	An area of land designated to attenuate/store flood water.
Flood Zone	Flood Zones show the probability of flooding, ignoring the presence of existing defences

TERM	DEFINITION
Fluvial	Relating to the actions, processes and behaviour of a watercourse (river or stream).
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Lead Local Flood Authority (LLFA)	As defined by the Flood and Water Management Act, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area. Essex County Council is therefore the LLFA.
Local Planning Authority (LPA)	Body that is responsible for controlling planning and development through the planning system.
Main River	Watercourse defined on a 'main river map designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for main rivers. However overall responsibility for maintenance lies with the riparian owner.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Ordinary Watercourse	A watercourse that does not form part of a main river. This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
Risk	Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense.
Sequential Test	A tool that aims to steer vulnerable development to areas of lowest flood risk.
Sewer Flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Source Protection Zone (SPZ)	Defined areas in which certain types of development are restricted to ensure that groundwater sources remain free from contaminants.
Surface Water	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Sustainable Drainage Systems (SuDS)	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Topographic survey	A survey of ground levels.

1 Introduction

1.1 Terms of Reference

AECOM were commissioned by Staffordshire Moorlands District Council (SMDC) in April 2015 to review and revise the Level 1 Strategic Flood Risk Assessment (SFRA) for the Staffordshire Moorlands District administrative area.

1.2 Project Aims and Objectives

The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance (PPG) for Flood Risk and Coastal Change[2] emphasise the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process.

The NPPF outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning. Figure 1-1 overleaf, reproduced from the PPG, illustrates how flood risk should be taken into account in the preparation of a Local Plan.

The original Level 1 SFRA was produced for SMDC in collaboration with the Stafford, Lichfield and Tamworth local authorities by in 2008[3]. The SFRA was produced to satisfy the Sustainability Appraisal (SA) of the Development Plan Documents which make up the Local Development Framework (LDF) and outline the spatial planning strategy for the District. A key commitment made by the Council in the Core Strategy is to undertake an early review of the Core Strategy by 2017, extending the plan period to 2031 to ensure that future provision will continue to adequately meet objectively assessed needs and reflect development potential. This is to become part of a single Local Plan, combined with the work currently underway on site specific allocations.

The Local Plan covers only that part of the District for which SMDC has responsibility as a LPA and therefore excludes the Peak District National Park which is covered by a separate LDF prepared by the Peak District National Park Authority.

Since the publication of the original Level 1 SFRA, there have been a number of changes in legislation and guidance relating to planning and flood risk. The introduction of the Localism Act in 2011 was intended to create a planning system oriented around consideration of local planning issues. Planning Policy Statements (PPS), covering all aspects of national planning policy have since been replaced by the NPPF including Planning Policy Statement 25 (PPS25) Development and Flood Risk[4]. Its accompanying PPS25 Practice Guidance[5] document relating to flood risk, has been recently replaced by the PPG. Furthermore, the wider planning system has been subject to considerable change since 2008 with the withdrawal of the previous regional planning framework and the revocation of Regional Spatial Strategies (RSS) in 2010.

As well as legislative and planning policy changes, a number of new and revised datasets have been made available since the release of the original Level 1 SFRA. Environment Agency flood risk mapping has been revised and updated national surface water flood risk mapping has been released by the Environment Agency. These can both be used by LPAs in their SFRAs.

[1] Department for Communities and Local Government (2012) *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] Department for Communities and Local Government (2014) *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
[3] Halcrow (January 2008), Staffordshire Moorlands District Council Strategic Flood Risk Assessment for Local Development Framework, Level 1 Final.
[4] Department for Communities and Local Government (2010) *'Planning Policy Statement 25: Development and Flood Risk,* TSO: London.
[5] Department for Communities and Local Government (2009) *'Planning Policy Statement 25: Development and Flood Risk Practice Guide'.* TSO: London.

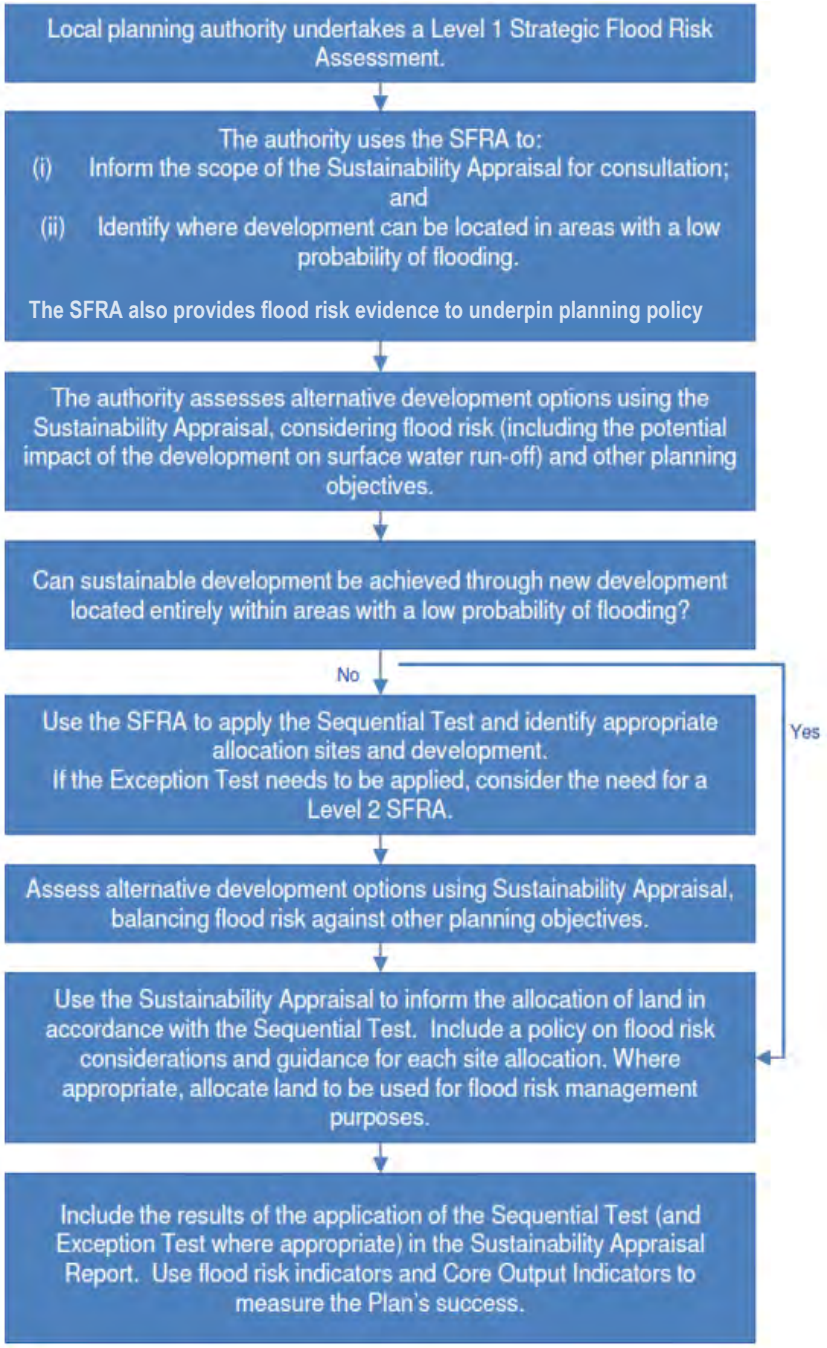


Figure 1-1: Taking flood risk into account in the preparation of a Local Plan (Adapted from the Planning Practice Guidance for Flood Risk and Coastal Change, p6)

The objectives of the Level 1 SFRA update are to:

- Collate and analyse the most up to date flood risk information across the SMDC administrative area, and incorporate the findings from more recent studies;
- Provide an up to date, robust flood risk evidence base to inform SMDC's Local Plan, taking into account all sources of flooding;
- Provide an up to date evidence base for applying the Sequential Test and Exception Test to inform and enable the sequential approach towards spatial planning, as required by NPPF; and
- Support prudent decision-making by Development Management Officers on a day-to-day basis and satisfy the Sustainability Appraisal.

AECOM has prepared this SFRA in such a way that it will provide relevant and easily accessible information for applicants preparing site-specific flood risk assessments (FRAs), as well as provide guidance on the suitability of different types of Sustainable Drainage Systems (SuDS) throughout the District (see Figure 1-1).

1.3 User Guide

It is anticipated that the SFRA will have a number of end users, each with different requirements. This Section describes how to use the SFRA and how to navigate the report and mapping deliverables.

The SMDC SFRA report is set out as follows:

- Section 2: Study Area Overview
- Section 3: Legislative and Planning Policy Context
- Section 4: Flood Risk Sources within Staffordshire Moorlands
- Section 5: Flood Risk Management Policy Recommendations
- Section 6: Guidance on the Application of the Sequential and Exception Tests
- Section 7: Guidance for Preparing Site Specific FRAs
- Section 8: Guidance on the Application of Sustainable Drainage Systems (SuDS)
- Appendix A: Data Register
- Appendix B: Level 1 SFRA Flood Risk Mapping Figures

Section 4 provides a strategic assessment of flood risk from all sources within Staffordshire Moorlands. The suite of figures included within Appendix B should be consulted for further information.

Section 5 outlines a number of flood risk management objectives and policy considerations which may be adopted by SMDC as formal policies within the Local Plan.

SMDC is required to carry out the Sequential Test when allocating future development sites as part of the Local Plan process. Section 6 provides detailed guidance on the application of the Sequential Test, including how it should be carried out by developers promoting development on Windfall Sites. The strategic assessment of flood risk presented in Section 4 will inform the Sequential Test carried out by SMDC.

It should be noted that this document is strategic in nature and only provides an overview of flood risk within the Staffordshire Moorlands District. The document should be used as a starting point for developers and SMDC's Development Management Officers to gain an understanding of flood risk within the District. SMDC should ensure that an appropriate site-specific assessment of flood risk is provided within a Flood Risk Assessment (FRA) accompanying all planning applications, where required by the NPPF, PPG and this Level 1 SFRA. Section 7 provides guidance for prospective developers and SMDC on the contents of a site-specific FRA.

As discussed in Section 2, SMDC will be required to oversee the use of SuDS for new development through enforcement of the planning process. Section 8 provides SMDC, as well as developers, with an overview of the potential use of SuDS within Staffordshire Moorlands District.

1.4 Level 1 SFRA Methodology

This Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable SMDC to apply the Sequential Test to the sites identified in the Core Strategy as potentially suitable for development and to identify whether the Exception Test may be required for specific sites (leading to the need for a Level 2 SFRA). The main tasks in preparing the Level 1 SFRA are described below.

1.4.1 Establishing Key Stakeholders

A project Inception Meeting was held to establish relationships between the project team; SMDC, Staffordshire County Council (SCC) (the Lead Local Flood Authority) and the Environment Agency to aid collaborative working and the exchange of available information and datasets. SMDC provided an overview of the current planning context with respect to the preparation of the Local Plan, and summarised the project

aims and objectives. The main flood risk issues in the area were identified and discussed. Other key stakeholders for data provision were identified; Canal and River Trust, Severn Trent Water, United Utilities, Highways Agency and neighbouring LPAs.

1.4.2 Data Collection and Analysis

Under Section 10 of the NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources. Flooding from the sea is not relevant to the study area.

In order to provide this assessment of all sources of flooding in the District, an extensive set of datasets was obtained from the stakeholder organisations. This information was subject to a quality review and gap analysis to determine the best datasets for inclusion in the Level 1 SFRA update. Further details of the datasets are included within the data register in Appendix A.

1.4.3 Strategic Flood Risk Maps

A series of GIS maps were produced using the data gathered during the initial part of the study. The mapping deliverables provided in Appendix B are identified in Table 1-1.

Table 1-1: Strategic Flood Risk Maps in Appendix B

FIGURE NUMBER	FIGURE TITLE
1 (Inset Maps 1a - 1f)	Level 1 SFRA Potential Development Sites
2	Topography
3	Surface Waterbodies
4	Historic Flooding Incidents
5a	Aquifer Designation Map - Bedrock Geology
5b	Aquifer Designation Map - Superficial Geology
6 (Inset Maps 6a – 6f)	Fluvial Flood Zones
7 (Inset Maps 7a – 7f)	Updated Flood Map for Surface Water
8	Areas Susceptible to Groundwater Flooding
9	Groundwater Vulnerability and Source Protection Zones
10	Historical Sewer Flooding Incidents
11	Flood Alert and Flood Warning Areas

1.4.4 Providing Suitable Guidance

Sections of this report provide specific guidance for SMDC on policy considerations, the application of the Sequential Test, guidance on the preparation of site specific FRAs and guidance of the application of SuDS in the District.

1.4.5 Need for a Level 2 SFRA

Following the application of the Sequential Test by SMDC, there may be an insufficient number of suitably available sites for development within areas identified to be at low risk of flooding and it may become necessary to consider the application of the Exception Test. Where this is necessary, the scope of the SFRA may need to be widened to a Level 2 assessment.

The increased scope Level 2 SFRA will need to consider the detailed nature of the risk characteristics within a Flood Zone including flood probability, flood depth, flood velocity, rate of onset of flooding and the duration of flooding. This may require interrogation of 2D modelling and breach / overtopping analysis for certain locations.

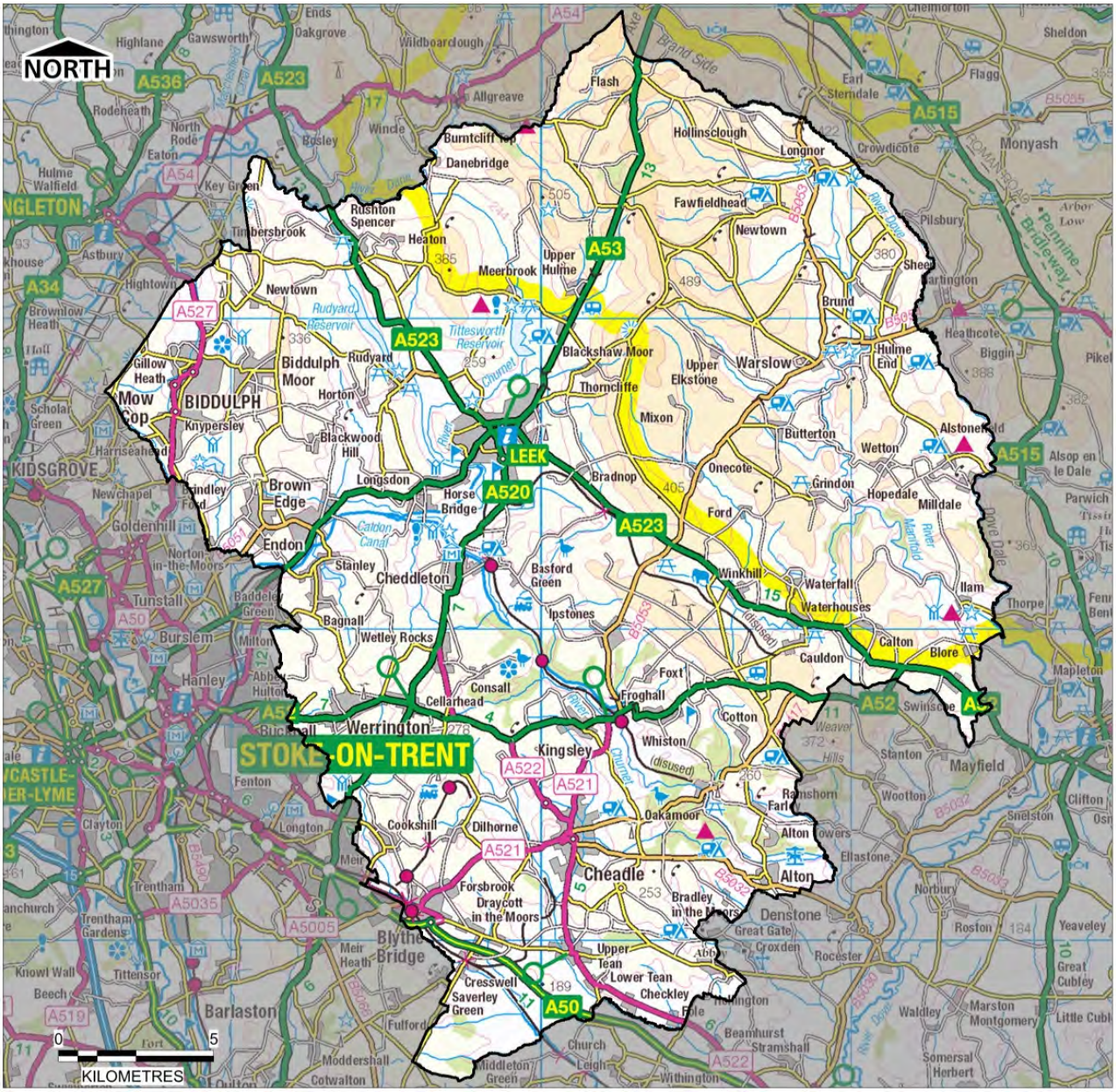
The scope of a Level 2 SFRA cannot fully be determined until the Sequential Test has been undertaken by SMDC on all possible site allocations.

2 Study Area Overview

This Section provides an overview of Staffordshire Moorlands District with respect to flood risk.

2.1 Location

The study area of this Level 1 SFRA is defined by the entire administrative boundary of SMDC as shown in Figure 2-1.



Contains Ordnance Survey 1: 250, 000 scale Raster mapping © Crown copyright, all rights reserved. License number 0100018384. Staffordshire Moorlands District Council 2015.

Figure 2-1: Staffordshire Moorlands Level 1 SFRA Study Area

The Staffordshire Moorlands District is located in the north-east of the Staffordshire County and is bordered by the administrative areas of:

- Cheshire East Council
- Newcastle Borough Council
- Stoke on Trent City Council
- Stafford Borough Council
- East Staffordshire Borough Council
- Derbyshire Dales District
- High Peak Borough Council

The District covers an area of approximately 576 km^2. The three main towns are Leek, Biddulph and Cheadle. Approximately a third of the District (approximately 200 km^2) lies within the border of the Peak District National Park. The designation 'National Park' means that there are planning restrictions to protect the area from inappropriate development, and the National Park Authority ultimately makes planning decisions in this area.

2.1.1 Level 1 SFRA Potential Development Sites

The locations of 242 potential future residential development sites as identified in the emerging Staffordshire Local Plan are shown in Appendix B Figure 1. These sites have been reviewed for the purposes of this Level 1 SFRA.

2.2 Topography

Topography has a large influence over the water cycle and flood risk within Staffordshire Moorlands. As illustrated in Appendix B Figure 2, much of the north and east of the District falls within the Peak District, within which the highest point of Staffordshire Moorlands is located (approximately 520 mAOD) in the vicinity of the village of Flash. From the far north east of the District, moorland hills and ridges occur along the central spine of the South West Peak, which includes distinctive hill and ridge summits, including the steep slopes of the Roaches and Morridge.

Along the border of the Peak District, the landscape is steeply sloping, with plateaus and valleys, including Butterton Moor and Grindon Moor, and the steep sided valleys associated with the River Manifold and River Dove.

The landscape in the remaining area of the District to the south and west is strongly undulating or sloping, comprising steep-sided valleys cut by small scale streams. The lowest point within the District (approximately 90 mAOD) is located in the River Churnet Valley towards Alton, where the landscape consists of deeply incised wooded valleys with narrow winding watercourses. The valley continues north west, around Leek, and into the north west of the District via Rudyard Reservoir. To the west, higher land around Biddulph Moor comprises of undulating slopes with localised steep sided valleys. In the far south of the District, the undulation of the topography is gentler with flat open valleys.

2.3 Geology

The underlying geology can influence the presence and nature of groundwater in an area, and therefore the potential flood risk from groundwater. The geology can also impact on the potential for infiltration based drainage systems. In general, towards the north of the District the peaty soils retain moisture and when saturated, can result in periods of standing water and localised flooding. Further south, within the lower lying areas around the floodplains, the soils are loamy containing clays and are prone to waterlogging. The geological information was obtained from the Environment Agency in the form of their Aquifer Designation maps generated from British Geological Survey data. Appendix B Figure 5a illustrates the underlying bedrock geology and Figure 5b shows the superficial deposits within the District as defined by the Environment Agency's Aquifer Designation maps.

The underlying bedrock geology within the District consists of a number of different formations, but largely consists of Sandstones and Mudstones, such as the Millstone Grit Group, Bowland High Group and Craven Group, interspersed with Carboniferous limestone and coal measure sequences. The north of the District is

characterised by the White Peak, an area of limestone overlain by sands and grits with dramatic landforms such as the Roaches and Ramshaw Rocks, surrounded by moorlands.

To the south of the District, the geology comprises a mixture of conglomerates, sandstones and clay rich argillaceous rocks. Limestone underlies much of the eastern boundary of the District associated with the White Peak Character Area, where a number of Limestone quarries are situated.

Superficial deposits of predominantly Till are found in the west of the District towards Stoke-on-Trent and Biddulph in the north west. Stretches of alluvium, alluvial fan deposits and river terrace deposits underlie the main rivers and many of the ordinary watercourses within the District, with some areas of Head deposits and Peat found in the east and north east within the Peak District.

2.4 Watercourses

2.4.1 Main Rivers

Appendix B Figure 3 identifies the locations of key waterbodies within the District including designated main rivers (see Table 2-1) defined as watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Flood and Rural Affairs (Defra). The Environment Agency has permissive powers to carry out works necessary for flood defence purposes on these rivers. The overall responsibility for maintenance however, lies with the riparian owner.

Table 2-1: Main Rivers within the Staffordshire Moorlands District

NAME	APPROX. CATCHMENT AREA WITHIN DISTRICT (km^2)	CATCHMENT DESCRIPTION
River Churnet	231	The River Churnet rises in the Peak District National Park, flowing south through the District around the major settlement of Leek. The topography of the catchment is of moderate relief with mixed geology. Land use is largely low grade agriculture or pasture. Major tributaries include Endon Brook and Combes Brook. South of Cheddleton, the river is canalised for approximately 1.6km as the Caldon Canal, before returning to natural river channel, flowing south out of the District and joining the River Dove.
River Dane	58	The River Dane borders the north of the District for approximately 15 km flowing west, with its source in the Peak District. A predominantly rural catchment with a steep topography and mixed geology.
River Tean	48	The River Tean rises to the east of Stoke on Trent and flows south east out of the District, before joining the River Dove north of Uttoxeter in East Staffordshire. The catchment is largely rural, except for the town of Cheadle. The Cecilly Brook is a major tributary.
River Blithe	42	Catchment drains the most southerly region of the District, rising to the south of Stoke-on-Trent and flowing south east out of the District and ultimately draining into the River Dove, south of Uttoxeter. Land use is largely mixed arable farming and grassland. Fors Brook is a major tributary.
Biddulph Brook	27	Biddulph Brook and its associated catchment drains a small area to the far west of the District, around the town of Biddulph, ultimately draining to the River Dane east of Congleton.

The locality of the District in the upper catchments of watercourses and the associated steep topography results in a 'flashy' hydrology, whereby watercourses (the majority of which rise in the Peak District) have steep sided valleys and narrow floodplains.

The Shropshire and Staffordshire Local Flood Risk Management Strategy (see Section 3.4.2), identifies that the Staffordshire Moorlands District contains approximately 12% of the combined length of main rivers found within the County of Staffordshire. In contrast, the District contains the greatest combined length of ordinary watercourses than any of the other eight Districts/Boroughs within the County, containing nearly a third (30%) of the ordinary watercourses found within the County.

2.4.2 Ordinary Watercourses

Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows, above ground or culverted, which is not designated as a main river. Due to the significant length of ordinary watercourses within the District, a list of the named ordinary watercourses has been provided below. This list is not comprehensive however, as the majority of ordinary watercourses are unnamed.

- Warslow Brook
- River Manifold
- Ravensclough Brook
- Horton Brook
- Ellis Hill Brook
- Combes Brook
- Black Brook
- Warilow Brook
- River Hamps
- Rad Brook
- Hoo Brook
- Dingle Brook
- Broadgate Hall Brook
- Biddulph Brook
- Shirley Brook
- River Dove
- Oakenclough
- Head of Trent
- Cotton Brook
- Blake Brook

Appendix B Figure 3 identifies the locations of key waterbodies within the District including these ordinary watercourses.

2.5 Artificial Water Bodies

2.5.1 Canals and Feeders

In addition to the natural watercourses described, the Caldon Canal also runs through the District in a roughly south-north direction. At Horse Bridge, it turns west towards Stoke-on-Trent and passes Hazelhurst locks, where the Leek Branch of the canal begins and travels east towards Leek for approximately 4.6 km. In addition to the canal, a number of feeder channels from associated reservoirs exist within the District including the Rudyard Feeder, Stanley Feeder and Knypersley Feeder.

2.5.2 Lakes and Reservoirs

As a result of the topography and hydrology of the District, a number of lakes and reservoirs have been built or impounded for the supply of drinking water and industry. These lakes and reservoirs are listed in Table 2-2 along with the responsible owner.

Table 2-2: Lakes and Reservoirs within the Staffordshire Moorlands District

WATERBODY NAME	APPROX. SIZE (HA)	OWNER / OPERATOR
Hales Hall Pool	1.4	SMDC
Ladderedge Storage Reservoir[6]	0.8	ST
Knypersley Reservoir	13.6	CRT
Rudyard Lake / Reservoir	63.2	CRT
Serpentine	4.9	SCC
Stanley Pool	11.4	CRT
Tittesworth Reservoir	72.2	ST

[6] Severn Trent Water (2015) Tittesworth Water. Available at: http://www.stwater.co.uk/leisure-and-learning/reservoir-locations/tittesworth-water/*/tab/about/

Appendix B Figure 3 identifies the locations of key waterbodies within the District including the canals and reservoirs.

2.6 Hydrogeology

Aquifer designation relates to the importance of aquifers as groundwater resources such as drinking water supply, as well as for supporting surface water flow[7]. The use of infiltration techniques will be dependent on the ground and groundwater conditions. However, other SuDS techniques may be suitable even if groundwater conditions preclude infiltration.

The Environment Agency provides the following definitions for the Aquifer Designations:

- **Principal Aquifer** – *"layers of rock or drift deposits that…usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer"*;
- **Secondary A Aquifer** – "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers"*;

Factors that will influence the vulnerability of an aquifer to contamination include whether the aquifer is classed as confined or unconfined; the depth of the aquifer; whether a pathway exists to the aquifer i.e. if impermeable layers lie above an aquifer; and the soil vulnerability.

Some strata have a high leaching potential and have very little ability to slow or halt the progress of contaminants and transmit them readily to the underlying aquifer. Other strata have a low leaching potential and are thus either impermeable or have a number of natural factors that can slow or stop the leaching of contaminants. Principal Aquifers with a high vulnerability tend to be those with a more permeable surface geology.

It is important to note that Aquifer Designation mapping is intended to be used at a strategic scale and further site-level investigation may be necessary.

The majority of the District is designated by the Environment Agency as a Secondary A Aquifer associated with the bedrock geology, with some smaller areas designated as Principal Aquifers (see Appendix B Figure 5a). The Alluvium and River Terrace Deposits within Staffordshire Moorlands District located in corridors along the River Churnet, River Tean, River Manifold and River Blithe, are designated as Secondary A aquifers. The Head deposits associated with the River Churnet, Blake Brook and the River Hamps are defined as Secondary (undifferentiated) aquifers (see Appendix B Figure 5b).

[7] Environment Agency (2015) Aquifer Designation Maps. Available at: http://apps.environment-agency.gov.uk/wiyby/117020.aspx

3 Legislative and Planning Policy Context

3.1 Introduction

Since the previous SMDC Level 1 was completed, updates to national planning policy and flood risk guidance have emerged. This Section highlights the main updates and the impacts they have on the SFRA. The information presented should be used by SMDC to establish robust policies in relation to flood risk as part of their emerging Local Plan.

3.2 National Planning Policy Framework (2012)

The NPPF[1] was published on 27th March 2012 together with accompanying Technical Guidance. The NPPF revoked most of the previous Planning Policy Statements (PPS) and Planning Policy Guidance. However, the NPPF did not revoke the PPS25: Development and Flood Risk Practice Guide[5]. This was then revoked on the 6th March 2014 along with the NPPF Technical Guidance, when it was replaced by the Flood Risk and Coastal Change[2] section of the PPG.

The NPPF consists of a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities.

The overall approach to flood risk is broadly summarised in NPPF Paragraph 103:

"*When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:*

- *Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location, and*
- *Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."*

Further detail regarding the Sequential and Exception Tests is included in Section 6.

3.3 Planning Practice Guidance (2014)

The NPPF is supported by a series of Planning Practice Documents referred to as the PPG[2]. This PPG: Flood Risk and Coastal change document outlines how LPAs should use the SFRA, as follows:

- SFRAs should assess the flood risk to an area from all sources, both in the present day, and in the future. The impacts of climate change should be considered when assessing future flood risk;
- The impact on flood risk of future development and changes to land use should also be considered;
- The SFRA should provide the foundation from which to apply the Sequential and Exception Tests in the development allocation and development management process (see Table 6-1 and Table 6-2). 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 a Level 2 SFRA) to provide the information necessary for application of the Exception Test;
- The SFRA should inform the sustainability appraisal of the Local Plan and Site Allocations Development Plan Document';
- The SFRA should outline requirements for site-specific FRAs, with specific requirements for particular locations;

- The SFRA should define the flood risk in relation to emergency planning's capacity to manage flooding;
- Opportunities to decrease the existing flood risk within the study areas should be explored, such as surface water management, provision of flood storage and managing conveyance of flood flows.

SFRAs should be prepared in consultation with the Environment Agency, emergency response and drainage authority functions of the LPA, Lead Local Flood Authorities (LLFAs) and where appropriate Internal Drainage Boards (IDBs).

3.4 The Flood and Water Management Act (2010)

Following the devastating national floods of 2007, one of the recommendations from Sir Michael Pitt's review[8] was that "*the role of local authorities should be enhanced so that they take on responsibility for leading the co-ordination of flood risk management in their areas*".

The Flood and Water Management Act (FWMA)[9] (2010) brings in new roles and responsibilities for local authorities. In particular, the Act defines the role of the LLFA, which includes Unitary Authorities or County Councils. Staffordshire County Council (SCC) is the LLFA for Staffordshire, which includes Staffordshire Moorlands District. LLFAs are encouraged to bring together relevant bodies and stakeholders to effectively manage local flood risk, which may include County, City and Borough/District Councils, IDBs, highways authorities, water companies and the Environment Agency. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses).

The Act also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility for a strategic overview of the management of all sources of flooding and coastal erosion remains that of the Environment Agency. The Agency also has operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.

3.4.1 National Strategy for Flood and Coastal Erosion Risk Management

In accordance with the Act, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM)[10] in England. This Strategy provides a framework for the work of all flood and coastal erosion risk management authorities.

The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It sets the context for, and informs the production of local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk.

3.4.2 Shropshire and Staffordshire draft Local Flood Risk Management Strategy

As LLFA, SCC has a statutory duty under the FWMA to develop, maintain, apply and monitor a strategy for local flood risk management. In July 2014, SCC along with Shropshire County Council published their joint Local Flood Risk Management Strategy[11] (LFRMS) which sets out their approach for the management of flood risk associated with local sources of flooding such as surface water, ordinary watercourses and groundwater. Part 2 of the report sets out the policies and procedures specific to Staffordshire. Consultation began in September 2014 and responses are currently being used to finalise the LFRMS.

3.4.3 River Trent Catchment Flood Management Plan

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

[8] Cabinet Office (2008) The Pitt Review - Learning Lessons from the 2007 Floods
[9] HMSO (2010) The Flood and Water Management Act
[10] Defra, Environment Agency (2011) The National Flood and Coastal Erosion Risk Management Strategy for England.
[11] Shropshire County Council, Staffordshire County Council (2014) Shropshire and Staffordshire Local Flood Risk Management Strategy. Available at: http://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Flood-Risk-Management-Strategy.aspx

The CFMPs are used to inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive (WFD), so that future development in the catchment is sustainable in terms of flood risk. CFMPs will remain active, with their future need as strategic plans for river and estuary flooding being reviewed in 2015 and 2016 as Flood Risk Management Plans become active (see Section 3.6.2 and 3.6.3). The policies listed within the CFMP's and used to identify the appropriate approach to flood risk management across all CFMPs, will continue to be used in the FRMPs.

The approach that the Environment Agency would like to see taken to flood risk management within Staffordshire Moorlands is currently outlined in the River Trent CFMP (2010)[12]. The CFMP aims to identify flood risk management policies for the catchment and sets out the preferred plan for sustainable flood risk management in the Trent region over the next 50 to 100 years. The River Trent CFMP identifies different policies for different 'sub-areas' of the River Trent catchment. These policies are considered using a catchment approach rather than for independent sub-areas.

The general approach to be taken is to accept the existing risk but take action to ensure that risk is not increased from the current level, for example due to the potential impacts of climate change. The CFMP outlines key messages for the Peaks and Moorlands policy unit:

- Reduce unsustainable long-term dependence on raised flood defences, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains;
- Reduce the number of people at risk from deep and fast flowing waters or fast onset of flooding through the town of Leek;
- Sustain and improve the status of environmentally designated areas through appropriate frequency, extent and duration of flooding, including using existing and future flood storage areas and floodplains more to benefit nature conservation;
- Support and encourage land management and land use in the River Derwent and River Dove catchments that will reduce runoff rates from upland areas;
- Identify potential sites for Biodiversity Action Plan (BAP) habitat creation and sustain existing sites.

Staffordshire Moorlands falls into the 'Peaks and Moorlands' policy unit and the preferred policy for SMDC in the CFMP is Policy 6 – 'Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits'. Proposed actions to implement this policy, and which are relevant to this SFRA include:

- Investigating opportunities for storing or reducing conveyance upstream of urban areas;
- Study options and feasibility of using water supply reservoirs within the upper reaches of the River Churnet to provide some support to flood risk management;
- Identification of locations where flood attenuation ponds or wetland areas could be developed with associated habitat improvement;
- Progress land use changes which will provide flood risk management benefits; and
- Develop a land use management plan for the Peaks and Moorlands.

3.5 NPPF PPG for Sustainable Drainage Systems (2015)

Following a consultation by Defra on the delivery of SuDS[13], in April 2014 the Department for Communities and Local Government (DCLG) issued a Written Ministerial Statement[14] outlining the Government's response regarding the future of SuDS. This was followed by a consultation exercise carried out in December 2014[15] by DCLG on the proposal to make LLFAs statutory consultees for planning applications with regards to surface

[12] Environment Agency (December 2010) River Trent Catchment Flood Management Plan
[13] Defra / DCLG (September 2014) Delivering Sustainable Drainage Systems: Consultation
[14] Department for Communities and Local Government (April 2014) House of Commons Written Statement (HCWS161) Sustainable Drainage Systems.
[15] DCLG (December 2014) Consultation on Further changes to statutory consultee arrangements for the planning application process

water management, and the Government published its formal response in March 2015[16]. The PPG has subsequently been amended to reflect the new approach to implementation of SuDS in development.

The proposed approach is to strengthen the planning system as a way of delivering SuDS, rather than implement Schedule 3 of the FWMA, as written, which would have established a new SuDS Approval Body that would have sat outside the existing planning system.

From 6th April 2015, LPAs are required to ensure that local planning policies and decisions on planning applications relating to major development[17] include SuDS for the management of run-off, unless demonstrated to be inappropriate. Minor developments with drainage implications would continue to be subject to existing planning policy (Section 103 of the NPPF) and smaller developments in flood risk areas should still give priority to the use of SuDS.

The PPG has been amended to state:

> *"Sustainable drainage systems may not be practicable for some forms of development (for example, mineral extraction). New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering major development, sustainable drainage systems should be provided unless demonstrated to be inappropriate."*

LPAs should consult the relevant LLFA when considering major development. In considering planning applications SMDC will need to:

- Consult SCC, as the LLFA, on the management of surface water for major development (request a copy of SCC's LLFA Planning Consultation Guidance and refer to their consultation matrix to determine if/when SCC should be consulted on statutory or non-statutory issues);
- Satisfy themselves that the proposed minimum standards of operation are appropriate; and
- Ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

LPAs are also advised to consult as appropriate:

- The relevant sewerage undertaker where a connection with a public sewer is proposed;
- The Environment Agency, if the drainage system directly or indirectly involves the discharge of water into a main river;
- The relevant highway authority for an affected road;
- The Canal and River Trust, if the drainage system may directly or indirectly involve the discharge of water into or under a waterway managed by them;
- An Internal Drainage Board (IDB), if the drainage system may directly or indirectly involve the discharge of water into an ordinary watercourse (within the meaning of section 72 of the Land Drainage Act 1991) within the board's district."

The decision on whether a sustainable drainage system would be inappropriate in relation to a particular development proposal is a matter of judgement for the LPA. In making this judgement the LPA will seek advice from the relevant flood risk management bodies, principally the LLFA.

From 6th April 2015 SCC, as the LLFA, has become a statutory consultee for planning applications for major developments that have a drainage implication. As a statutory consultee, SCC is under a duty to respond to the LPA and report on their performance on providing a substantive response within deadlines set out in legislation.

[16] Department for Communities and Local Government (March 2015) Further changes to statutory consultee arrangements for the planning application process: Government response to consultation.
[17] The definition for Major and Minor developments are set out in the Town and Country Planning Order 2010

3.6 Flood Risk Regulations (2009)

As well as the duties under the Act to prepare a LFRMS, SCC have legal obligations under the EU Floods Directive[18] that was transposed into UK Law through the Flood Risk Regulations 2009[19] ('the Regulations').

3.6.1 Preliminary Flood Risk Assessment

Under the Regulations, all LLFAs were required to prepare a PFRA report. This is a high level screening exercise to identify areas of significant risk as Indicative Flood Risk Areas across England where 30,000 people or more are at risk from flooding for reporting to Europe.

SCC prepared a PFRA[20] to provide a high level overview of flood risk from local flood sources and includes flooding from surface water (i.e. rainfall resulting in overland runoff), groundwater, ordinary watercourses (smaller watercourses and ditches) and canals. It excludes flood risk from main rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency.

The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report was used to help SCC in the development of their LFRMS required under the FWMA.

3.6.2 Humber River Basin District draft Flood Risk Management Plan

Under the EU Floods Directive and UK Flood Risk Regulations, LLFAs must prepare Flood Risk Management Plans (FRMPs) in formally identified Flood Risk Areas where the risk of flooding from local sources is significant (i.e. surface water, groundwater, ordinary watercourses), and the Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs.

There are no formally defined Flood Risk Areas within Staffordshire Moorlands District, therefore SCC are not required to prepare a FRMP. As such, the draft Humber River Basin District FRMP[21] has been published for consultation by the Environment Agency and sets out the proposed measures to manage flood risk in the Humber River Basin District from 2015 to 2021 and beyond. The first cycle of FRMPs are due to be published in December 2015.

The draft Humber River Basin District FRMP covers the majority of Staffordshire Moorlands District and identifies objectives, measures and actions for each catchment. Staffordshire Moorlands District is mostly covered by two catchments of the Humber RBD: Dove Catchment; and Trent Valley Staffordshire Catchment. On-going, agreed and proposed measures to manage flood risk from 2015 to 2021 and beyond are identified for each catchment in the draft FRMP. The draft on-going and proposed measures for the two catchments covering Staffordshire Moorlands District are summarised below. There are no agreed measures further than those already on-going or proposed for Staffordshire Moorlands District.

Draft Proposed Measures: Dove Catchment

- Access/Egress - Ensure development is safe. For residential developments to be classed as safe, dry pedestrian egress out of the floodplain and emergency vehicular access should be possible;
- Development behind defences - Within defended the areas the maximum water level should be assessed from a breach analysis;
- Development behind defences - Properties situated within close proximity to formal defences or water retaining structures (reservoirs/canals) will require a detailed breach and overtopping assessment to ensure that the potential risk to life can be safely managed throughout the lifetime of the development;
- De-culverting - Where possible, avoid further culverting and building over of culverts. All new developments with culverts running through their site should seek to de-culvert for flood risk management conservation benefit. Where this is not possible for larger, deeper culverts in the study area, an assessment of its structural integrity should be made, with any remedial actions taken prior to the development of the site. In addition, a maintenance regime should be agreed to reduce the likelihood of blockage;

[18] European Union (2007) EU Floods Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT
[19] HSMO (2009) The Flood Risk Regulations. Available at: http://www.legislation.gov.uk/uksi/2009/3042/contents/made
[20] Royal Haskoning (2011) Staffordshire County Council PFRA
[21] Environment Agency (October 2014) Humber River Basin District Consultation on the draft Flood Risk Management Plan. Available at: https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063510

- Flood Risk Reduction - Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas;
- Existing Assets - An assessment of the condition of existing assets (For example, bridges, culverts, river walls) should be made. Refurbishment or/and renewal should be investigated to ensure the lifetime is commensurate with lifetime of the development. Developer contributions could be sought for this purpose;
- Basement - Basements should not be used for habitable purposes. Where basements are permitted for commercial use, it is necessary to ensure that the basement access points are situated 300 mm above the 1 in 100 year flood level plus climate change;
- Easement - Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip.

The final plans are due to be published in December 2015 and the proposed measures may differ from those included in the draft documents.

Draft On-going Measures: Trent Valley Staffordshire Catchment

- In Brown Edge, promote awareness and local action on flood risk activities, while investigating potential flood mitigation measures.

3.6.3 North West River Basin District draft Flood Risk Management Plan

The draft North West River Basin District FRMP[22] covers the far north and north west of Staffordshire Moorlands District, within one catchment: Weaver and Gowy Catchment. There are no draft on-going or draft proposed measures for this catchment proposed for Staffordshire Moorlands District.

3.7 Staffordshire Moorlands District Council Local Plan (2014)

The Local Plan will consist of a number of Development Plan Documents (DPDs) which outline the spatial planning strategy for the District. The Core Strategy provides the framework for future Local Plan documents which identify specific sites for development in the District (Site Allocations DPD) and provide detailed guidance to supplement the policies (Supplementary Planning Documents).

3.7.1 Adopted Core Strategy Development Plan Document

The SMDC Core Strategy[23] was adopted in March 2014, and is a strategic District wide plan which influences how and where Staffordshire Moorlands will develop in the future. It provides the overarching strategy for planning policies in the District, including a number of policies relevant to flood risk and management, and water quality:

Policy SD1 – Sustainable Use of Resources

The Council will require all development to make sustainable use of resources, and adapt to climate change. This will be achieved by:

Giving encouragement to development on previously developed land in sustainable locations in allocating land for development and determining planning applications, except where:

- a previously developed site performs poorly in sustainability terms and could not be made otherwise acceptable;
- development upon a previously developed site would cause harm to some asset of acknowledged importance or if it would create an unacceptable flood risk.

[22] Environment Agency (October 2014) North West River Basin District Consultation on the draft Flood Risk Management Plan. Available at: https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063510
[23] Staffordshire Moorlands District Council (2014) Core Strategy Development Plan Document

Policy SD4 – Pollution and Flood Risk

Development proposed within the floodplain will be guided to first make use of areas at no or low risk of flooding before areas at higher risk, where this is viable or possible and compatible with other polices aimed at achieving a sustainable pattern of development. Development deemed acceptable within areas at risk of flooding due to national or other policies or other material considerations, must be subject to a flood risk assessment. Additionally, approved schemes must be designed and controlled to mitigate the effects of flooding on the site and the potential impact of the development on flooding elsewhere in the floodplain. In all cases, schemes will be determined after having considered both individual and cumulative impacts.

When considering planning applications and future allocations in the Site Allocations DPD, the Council will also have regard to all relevant Catchment Flood Management Plans affecting the District, Flood Risk Management Plans and Local Flood Risk Management Strategies.

Policy C3 – Green Infrastructure

The Council will, through partnership working with local communities, organisations, landowners and developers, develop an integrated network of high quality and multi-functional green infrastructure that will:

- Support and improve the provision of open space, sport and recreational facilities for local communities and enhance the settings of neighbourhoods;
- Link existing and potential sites of nature conservation value and historic landscape features, create new wildlife habitats, increase biodiversity, and increase tree cover where it is appropriate to the landscape;
- Enhance the natural, man-made and cultural features that are crucial to the local landscape and create opportunities for the restoration of degraded landscapes and the enhancement of the urban fringe;
- Mitigate the negative effects of climate change and maximise potential climate change benefits including effective flood risk and waterways management;
- Create appropriate access for a wide range of users to enjoy the countryside, including improved linkages to and provision of formal and informal recreation opportunities and accessible woodland areas, encouraging walking, cycling and horse riding;
- Contribute to the diversification of the local economy and tourist development through the enhancement of existing, and provision of new facilities.

The Council will identify, protect and enhance Green Infrastructure assets through the Site Allocations DPD and the Green Infrastructure Strategy.

3.7.2 Adopted Biddulph Town Centre Area Action Plan Development Plan Document

The Biddulph Town Centre Area Action Plan (AAP) DPD[24] adopted in February 2007 will be incorporated and replaced by the Local Plan for Staffordshire Moorlands. The AAP has 'saved' some general policies, those of relevance to this SFRA have been provided below.

F4 – Drainage

Planning permission will not be granted for development proposals which would inhibit or damage the drainage function of the natural watercourse system, or cause or aggravate flooding problems at the site or further downstream unless adequate mitigating measures are carried out prior to the development coming into use. This will include development:

- in areas which form part of the floodplain and areas at risk from flooding;
- preventing access to watercourses for maintenance;
- giving rise to substantial changes in the characteristics of surface water run-off; and
- causing adverse effects upon the integrity of fluvial defences.

[24] Staffordshire Moorlands District Council (February 2007) Biddulph Town Centre Area Action Plan Development Plan Document. Available at: http://www.staffsmoorlands.gov.uk/sm/council-services/area-action-plans/biddulph-town-centre-area-action-plan

3.8 Peak District National Park Management Plan (2012 – 2017)

The Peak District National Park Management Plan[25] aims to encourage integrated approaches that make the best use of resources, meet the needs of the communities, conserve and enhance the National Park. The plan seeks to address the need to manage the increasing demands and pressures on the services provided by natural systems (i.e. flood storage) in order to promote sustained economic growth, prospering communities and personal wellbeing.

ES3 Environmental Goods

The Peak District landscape will be managed by farmers and other land managers to increase the potential economic return from public goods, such as clean water, carbon storage and renewables.

Farming and land management in the National Park will have a growing role in the provision of environmental goods and services. This includes the maintenance of essential ecological systems such as soils, watercourses and habitats. River basin management helps reduce flood risks and ensures that water supplied from the National Park is cleaner.

3.9 Water Framework Directive (WFD) (2000)

SMDC have a duty to consider the WFD in all plans and decision making processes, and have the opportunity to deliver wider environmental objectives and requirements, as set out in the Water Framework Directive[26]. The WFD was transposed into UK national law through The Water Environment Regulations 2003[27], and states that SMDC should have regard to the River Basin Management Plans (RBMPs) when exercising its functions as a public body.

The Environment Agency is responsible for preparing RBMPs for river basin districts in England and Wales. The plans outline the characteristics of the river basin district, identify the pressures that the local water environment faces, and specify the actions that will be taken to address any problems before 2015.

3.9.1 Humber River Basin Management Plan

In 2009 the Environment Agency published their River Basin Management Plan for the Humber River Basin District[28]. The Dove catchment, within the Humber River Basin District, includes the River Dove, Churnet Manifold and Hamps, covering much of the Staffordshire Moorlands District. Within the Dove catchment, only 12 out of 37 river water bodies are artificial or heavily modified as a consequence of development, flood risk management, navigation and water supply. As a result, 68% of the assessed water bodies within the Dove catchment are regarded as having an ecological status of at least “good”.

Flood risk management activities are expected to have a significant impact on the ability of the UK to comply with the requirements of the WFD, as flood protection can involve substantial alteration to the natural properties of a river.

3.9.2 North West River Basin Management Plan

In 2009 the Environment Agency published their River Basin Management Plan for the North West River Basin District[29]. A small portion of the Weaver Gowy catchment, within the North West River Basin District, includes the Biddulph Brook and River Dane in the north west of the Staffordshire Moorlands District, both of which were assessed as having “good” ecological status.

[25] Peak District National Park Authority (2012) A Partnership for Progress. Available at http://www.peakdistrict.gov.uk/__data/assets/pdf_file/0005/274298/npmp-summary.pdf
[26] European Union (2000) Water Framework Directive. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT
[27] HMSO (2003) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Available at: http://www.legislation.gov.uk/uksi/2003/3242/contents/made
[28] Environment Agency (2009) River Basin Management Plan – Humber River Basin District. Available at: https://www.gov.uk/government/publications/river-basin-management-plan-humber-district
[29] Environment Agency (2009) River Basin Management Plan – North West River Basin District. Available at: https://www.gov.uk/government/publications/north-west-district-river-basin-management-plan

4 Flood Risk Sources within Staffordshire Moorlands

4.1 Introduction

This Section provides the strategic assessment of flood risk across the District from each of the sources of flooding outlined in the NPPF. For each source of flooding, the datasets used for the assessment are described, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read in conjunction with the mapping in Appendix B.

4.2 Overview of Historic Flooding

As the LLFA, SCC routinely receives and records details of flooding incidents throughout the County of Staffordshire, with records dating back to 1979. A review of the flood incidents relevant to Staffordshire Moorlands has been carried out to provide an indication as to when the most significant flooding occurred. The greatest numbers of flood incidents (>20 recorded incidents) were reported in 2006, 2003, 2004 and 2009. The incidents were found to occur across the District, but predominantly outside of the area within the Peak District and concentrated around the more urbanised areas including Biddulph, Endon, Cheddleton and Cheadle.

Through a search of local media sources, more recent flood events have been reported, including as recent as June 2014 when flash floods were reported on the A53 in Leek[30] caused by heavy rainfall which overwhelmed the drains.

Flash flooding also occurred in July[31] and August[32] 2012 along the A53 (which was closed by police as a result of the flooding) as well as reports in Endon, Blythe Bridge, Stockton Brook and Brown Edge. Later in the year (October), flood warnings were issued in Leek and Waterhouses for the watercourses River Churnet and River Hamps respectively, following heavy rainfall overnight.

Although not as recent, severe flooding in the summer of 2007 was also reported in the media, with reports of flooding in Blackshaw Moor, Cheadle Road (A520) and Rushton Spencer[33]. The flooding experienced generated changes in the way flooding is managed locally and nationally, with the Government commissioning 'The Pitt Review – Learning Lessons from the 2007 Floods[34]', and subsequently enacting the FWMA 2010[9] in response to recommendations of The Pitt Review. Flooding from all sources was experienced across the County of Staffordshire, and it is estimated in the PFRA[20] that around 500 properties were flooded.

4.3 Flooding from Rivers (Fluvial)

The Environment Agency's 'Detailed River Network' dataset has been used to identify watercourses in the study area and their designation (i.e. main river or ordinary watercourse). There are numerous designated main rivers and ordinary watercourses within the District, these have been described and listed in Table 2-1 and in Section 2.4.

[30] The Sentinel (June 9th 2014) Flash flood causes delays near Leek. Available at: http://www.stokesentinel.co.uk/Flash-flood-causes-delays-near-Leek/story-21208306-detail/story.html
[31] BBC News (10th July 2012) Flooding blocks Staffordshire roads. Available at: http://www.bbc.co.uk/news/uk-england-stoke-staffordshire-18779333.
[32] The Sentinel (August 30th 2012) Torrential rain causes flash flooding across Staffordshire. Available at: http://www.stokesentinel.co.uk/Torrential-rain-causes-flash-flooding/story-16789230-detail/story.html
[33] Leek Post & Time (5th July 2007) Floods leave workers and drivers stranded. Available at: http://www.leek-news.co.uk/Floods-leave-workers-drivers-stranded/story-20126649-detail/story.html
[34] Cabinet Office (2008) Sir Michael Pitt Report 'Learning lessons learned from the 2007 floods'. Available at: http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

4.3.1 Historic Records of Fluvial Flooding

The Environment Agency Historic Flood Map and Recorded Flood Outlines datasets were obtained to support this Level 1 SFRA Update. The datasets include outlines for three major fluvial events known to have impacted the District, these being November 1959 and December 1964 on the River Churnet, November 1977 on the River Tean and August 1987 on the River Blithe. The combined Historic Flood Map outline is shown in Appendix B Figure 4.

The draft FRMP for the Humber River Basin District[21] does not make specific reference to flood events affecting the area covered by Staffordshire Moorlands, but does refer to the rapid run-off from the Peak District and Staffordshire Moors which results in the sudden onset of flooding in downstream towns and villages. The narrow valleys in the uplands also mean that settlements tend to be concentrated near rivers and bridges and other constrictions along the watercourses can further exacerbate the flooding within the towns and villages.

Hydrological and hydraulic modelling reports for the Fors Brook and River Blithe provided some limited information on historic flood events. Approximately 16 properties were affected by flooding of the Fors Brook in 1977 due to a blocked culvert, and 18 properties in 1976 at Poplar Close[37]. On the River Blithe, flood events have been recorded in 1987, October and November 1998 and November 2000, but no are locations specified in the report[38].

4.3.2 NPPF Flood Zones

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 4-1 and presented on the 'Flood Map for Planning (Rivers and Sea)' available on the Environment Agency website. These Flood Zones have also been presented in Appendix B Figures 6a – 6f.

The settlements of Cheddleton, Leek and Cheadle are identified in the Trent CFMP[12] as having the most properties at risk during a 1% AEP fluvial flood event, with Cheddleton having 100 – 250 properties, and Leek and Cheadle having less than 100 properties at risk.

Table 4-1: Fluvial Flood Zones (extracted from the PPG, 2014)

FLOOD ZONE	FLUVIAL FLOOD ZONE DEFINITION	PROBABILITY OF FLOODING
Flood Zone 1	Land having a less than a 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 chance of flooding in any one year). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP (1 in 1,000 chance of flooding in any one year).	Medium
Flood Zone 3a	Land having a 1% AEP 1 in 100 chance of flooding in any one year) or greater.	High
Flood Zone 3b (Functional Floodplain)	Land where water has to flow or be stored in times of flood based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a. The identification of the functional floodplain takes into account local circumstances, but for the purposes of this SFRA, land modelled to flood during a 5% AEP (1 in 20 chance of flooding in any one year) or greater has been mapped.	Very High

4.3.3 Flood Map for Planning (Rivers and Sea)

The 'Flood Map for Planning (Rivers and the Sea)' dataset is available on the Environment Agency website[35] and provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. It is the main reference for planning purposes as it contains the most up-to-date publically available dataset for Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 4-1.

The map was first developed in 2004 using national generalised modelling and is routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events.

It should be noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea. This map takes into account the presence of flood defences and so provides a more realistic overview of flood risk compared to the Flood Map for Planning, which assumes no flood defences. While flood defences reduce the level of risk they don't completely remove it as they can be overtopped or fail either due to extreme weather conditions, or poor maintenance. As a result the maps may show areas behind defences which still have some risk of flooding.

This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information for planning considerations.

4.3.4 Hydraulic Modelling Studies

Table 4-2 provides a summary of the hydraulic modelling studies that have been undertaken for the main rivers in the Staffordshire Moorlands District and used to inform the 'Flood Map for Planning (Rivers and Sea)'.

Table 4-2: Hydraulic models for main rivers in Staffordshire Moorlands

WATERCOURSE	MODELLING STUDY	DATE
Cecilly Brook[36]	1D hydraulic model for Cecilly Brook beginning at Froghall Road before the watercourse is culverted, and continues south to its confluence with the River Tean.	2006
Fors Brook[37]	Coverage: 1D/2D hydraulic model for Fors Brook from immediately upstream of Willow Way at the farthest extent of the Fors Brook urban area, to its confluence with the River Blithe downstream of the railway line.	2009
River Blithe[38]	Coverage: 1D hydraulic model for the River Blithe from its upstream extent located north of Blythe Bridge, approximately 120m upstream of the Old Mill Channel, to the downstream extent located south of the A50 bridge near Bridestone Farm.	2006
River Churnet[39]	Coverage: River Churnet A 1D model was constructed for the River Churnet channel, extending from Tittesworth Reservoir down to the confluence with the River Dove, and a 2D model included the River Churnet floodplain from Tittesworth Reservoir to Basford Bridge. Includes Endon Brook and Leek Brook.	2014

It should be noted that the scope of the modelling studies covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers are not included in the models. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' (for catchments >3 km^2) is likely to be the result of the earlier national generalised modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site whilst preparing a site-specific FRA. A challenge to the Environment Agency Flood Map would need to be made if such further detailed modelling demonstrated differing results.

[35] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx
[36] Capita Symonds (2006) MD677 Cecilly Brook SFRM
[37] Capita Symonds (2009) MD807 Fors Brook
[38] Capita Symonds (2006) MD678 River Blithe SFRM
[39] Royal HaskoningDHV (June 2014) River Churnet Hazard Mapping Report

Only a small proportion of rivers in the District are designated as main rivers, and therefore, many other rivers (main and ordinary) have not been modelled in any detail. In these circumstances, it may be a requirement for developers to consider acquiring detailed hydraulic modelling as part of their site specific FRA in order to adequately consider flood risk. This approach is also recommended as part of the site specific FRA guidance provided in Section 7.

4.3.5 Functional Floodplain (Flood Zone 3b)

The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. LPAs should identify areas of Functional Floodplain within their SFRA and in discussion with the Environment Agency and LLFA.

The PPG states that the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood during a 5% AEP or greater event, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) event, should provide a starting point for consideration and discussions to identify the functional floodplain.

The PPG states that *'areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be defined as functional floodplain'*. There may be opportunities to reinstate areas which can operate as functional floodplain through the use of previously developed land adjacent to watercourses to provide space for flood water to reduce the risk to new and existing development.

It was agreed with the Environment Agency at the SFRA project inception meeting that the 5% AEP (1 in 20 chance of flooding in any one year) defended outline provided by the modelling studies listed in Table 4-2 would be used to define Flood Zone 3b. Where this is not available, the 4% AEP (1 in 25 chance of flooding in any one year) modelled event outline would be used. Where neither of these are available, a precautionary approach will be adopted, by assuming that the extent of Flood Zone 3b is equal to Flood Zone 3a.

For the purposes of this SFRA, the Functional Floodplain is therefore defined as:

> *Land where water has to flow or be stored in times of flood based on flood modelling of a 5%/4% AEP event (1 in 20/25 chance respectively of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a.*

The PPG recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight' areas of existing urban development. It may not be practical to refuse all future development within existing urban areas falling within land which would flood during a 5% AEP event, and therefore careful consideration must be given to future sustainability.

A review of the areas across the District that are at risk of flooding during a 5% AEP (1 in 20 chance of flooding in any one year) event was carried out. The extent of the floodplain for much of the River Churnet is limited by the steep sided Churnet Valley through which the river flows.

Along the majority of the River Churnet and its main tributaries (Endon Brook and Leek Brook) Flood Zone 3b is largely constrained within areas immediately adjacent to the watercourse, with the exception of the following:

- an area to the north of Leek, where the land associated with Brough Park Fields Nature Reserve and land adjacent to the weir and flood alleviation channel is shown to flood during a 5% AEP event.
- wetland areas associated with Ladderedge Country Park upstream of the A53 and land downstream of the confluence with Combes Brook adjacent to the Churnet Valley Railway.
- across Blythe Marsh associated with Fors Brook.

The extent of Flood Zone 3b (4% AEP or 1 in 25 chance of flooding in any one year) associated with the Cecilly Brook in Cheadle and the River Blithe upstream of the A50 bridge remains within close proximity to the respective watercourse.

No functional floodplain has been modelled for the River Tean or the River Blithe downstream of the A50 bridge. The extent of the 1% AEP (1 in 100 chance of flooding in any one year) outline should therefore be used as a proxy for Flood Zone 3b in these areas.

4.3.6 Communities at Risk

The 'communities at risk' project was established to identify communities at risk of flooding from rivers and the sea. The analysis considered property number thresholds (residential and business), within a given geographical proximity to determine the size of each community area. Communities were defined by identifying all properties at risk within the fluvial and pluvial floodplain then applying a buffer around those properties to create communities. Rural areas were given a 50 m buffer zone and urban areas were given a buffer zone of 35 m, but as such not all of the properties within each community are necessarily at risk. There needed to be at least 10 properties within a group to be defined as a community.

The communities at risk dataset, illustrated in Appendix B Figures 6a to 6f, is a tool used by the Environment Agency to focus funding and engagement. The dataset is not a fundamental consideration within the planning system but could be used to inform where developments may not be feasible. Primarily the dataset should be used to identify opportunities where communities could be protected or where a developer may be able to contribute to the protection of a local community. It can also be used to identify opportunities where schemes can be put in place to protect against both fluvial and surface water flood risk potentially combining a number of funding sources to secure a better outcome.

4.3.7 Climate Change

Rising global temperatures is considered to be the most obvious consequence of climate change, however, in relation to Staffordshire Moorlands, its impact on changing weather patterns and the hydrological cycle is likely to be more significant. Predicted increases in peak rainfall intensity and river flow could result in more frequent and severe flash flood events and increased soil and river bank erosion, raising the risk of landslides. It is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

The recommended national precautionary sensitivity ranges for peak rainfall intensity and peak river flow suitable for use in the planning system are currently being revised to reflect the latest climate projections in UKCP09 and wider flood risk research published since 2009. The allowances and guidance as provided by the Environment Agency[40] should be used whilst the allowances are being revised; however the allowances numbers for planners are subject to change following publication of the approved allowances for climate change in autumn 2015 and will subsequently become out of date.

The allowances and guidance for changes to river flood flows and extreme rainfall intensity relevant to Staffordshire Moorlands have been provided in Table 4-3 and Table 4-4 respectively.

Table 4-3: Table Changes to river flood flows by river basin district compared to a 1961-90 baseline

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2020s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2050s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080s
Humber			
Upper end estimate	25%	30%	50%
Change factor	10%	15%	20%
Lower end estimate	-5%	0%	5%
NW England			
Upper end estimate	25%	35%	65%
Change factor	15%	20%	30%
Lower end estimate	5%	10%	10%

[40] Environment Agency (2015) 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities'. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297379/geho0711btzu-e-e.pdf

Table 4-4: Change to extreme rainfall intensity compared to a 1961-90 baseline

APPLIES ACROSS ALL OF ENGLAND	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2020s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2050s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080s
Upper end estimate	10%	20%	40%
Change factor	5%	10%	20%
Lower end estimate	0	5%	10%

For changes beyond the 2080s, it is recommended that the 2080s changes are used. The 2020s covers the period 2015 to 2039, the 2050s the period 2040 to 2069, and the 2080s the period 2070 and 2099.

As part of the hydraulic modelling studies listed in Table 4-2, simulations have been run for the 1 in 100 year event including an allowance for the implications of climate change (1% AEP+CC) based on these allowances. It should be noted that whilst the modelling of the annual probability events to generate the NPPF Flood Zones (and Flood Map for Planning) do not account for the presence of flood defences, the simulations including an allowance for climate change do tend to include the presence of existing flood defences.

These simulations are available for the following watercourses:

- Cecilly Brook,
- River Blithe,
- Fors Brook, and
- River Churnet.

The flood outline for the 1% AEP (1 in 100 year event) including climate change has been mapped for these watercourses in Appendix B Figures 6a – 6f.

It is clear that climate change will not markedly increase the extent of river flooding within most areas of the District, largely as a result of the confined floodplains within steep sided valleys, particularly notable along much of the River Churnet, where the 1% AEP flood outline differs only marginally from the 1% AEP including climate change outline. The Trent CFMP (Section 3.4.3) also states that flood risk in the Staffordshire Moorlands is not expected to increase in the future.

4.4 Flooding from Surface Water (Pluvial)

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding.

A subset of surface water flooding is typically referred to as highway flooding, which can be defined as flooding caused by heavy rainfall or overflowing from blocked drains and gullies causing water to pond within the highway network. Responsibility for management of this type of flooding depends on the ownership of the highway being flooded.

The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well as other available information, such as from the Highway Authority and/or the LLFA. SCC encourages early consultation as part of the planning application process to discuss any known local surface water flood risk issues (see Section 5.3).

4.4.1 Historic Records of Surface Water Flooding

The LFRMS makes reference to the many areas within The Moorlands where the steep topography, combined with low permeability soils, can exacerbate surface water flood risk. Changes in agricultural land management practices can also increase rates of surface water runoff. Typical issues that can have a significant impact include crop selection, removal of hedges and ditches and soil compaction from grazing and machinery.

Records of historic flooding incidents have been provided by SCC with approximately 24 incidents recorded as surface water flooding, from 1996 to 2014. The records show a relatively good correlation with the

uFMfSW, but it should be noted that some recorded flood incidents are located outside of areas shown to be at risk of surface water flooding in the uFMfSW. It is also likely that additional flood incidents have occurred and have not been reported for various reasons. Such incidents by their very nature are not shown in historic flood records. These incidents of historic flooding should therefore be interpreted with caution, as some areas within the District may appear to have significantly more historic flood incidents when compared to other areas.

Records of flooding on the highways and roads with the District, operated and maintained by SCC, have also been provided by SCC and total 21 incidents; however the majority of records do not have a corresponding date. Highways England was also consulted as part of the SFRA update and has provided information on incidents relating to flooding and standing water on the strategic road network within the County of Staffordshire. The A50 is the only major trunk road within the District, approximately 7 km in total, managed by Highways England, for which no incidents of flooding have been recorded.

It should also be noted that 74 incidents of flooding whose source is unknown and 58 incidents of flooding from multiple sources have been recorded by SCC, and it is likely that many of these records include an element of surface water. No specific records of historic surface water flooding were provided by the Environment Agency for consideration in this SFRA.

4.4.2 Environment Agency updated Flood Map for Surface Water (uFMfSW)

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual exceedance probability (AEP) events: 3.3% AEP (1 in 30 chance of flooding in any one year), 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP (1 in 1,000 chance of flooding in any one year). The latest version of the mapping, published in 2013, is referred to as the 'updated Flood Map for Surface Water' (uFMfSW) and the extents have been made available to planning authorities as GIS layers. This dataset is also available on the Environment Agency website, and is referred to as 'Risk of Flooding from Surface Water'.

The uFMfSW provides all relevant stakeholders, such as the Environment Agency, SMDC, SCC and the public access to information on surface water flood risk which is consistent across England and Wales[41]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists SCC (as the LLFA) in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within the District which may have a surface water flood risk. The mapping is presented in Appendix B Figures 7a – 7f in combination with historical surface water flooding data recorded by SCC.

The modelling represents a significant improvement on previous mapping, namely the FMfSW (2010) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2009), for example:

- Increased model resolution to 2m grid;
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as flyovers;
- Use of a range of storm scenarios; and
- Incorporation of appropriate local mapping, knowledge and flood incident records.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas;
- It does not show the susceptibility of individual properties to surface water flooding;
- The mapping has significant limitations for use in flat catchments;
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses;
- In a number of areas, modelling has not been validated due to a lack of surface water flood records; and
- As with all models, the uFMfSW is affected by a lack of, or inaccuracies, in available data.

[41] Environment Agency (2013) 'What is the updated Flood Map for Surface Water?'

This dataset provides an indication of the potential for surface water flooding and identifies that a widespread risk is present across most parts of the District. A review of the dataset and its coverage within the District was undertaken and it was concluded that areas shown to be at most risk from surface water flooding are largely associated with the fluvial floodplains and coincide with reservoirs.

The following describes those areas shown to be at particular risk from potential surface water flow paths and areas of surface water ponding, although the following list is by no means exhaustive:

- Within Biddulph, flow paths are shown to occur for all modelled events along the A527 from the roundabout with Dorset Drive in the west to the roundabout with Congleton Road in the east. Other flow paths shown to occur for the 1% AEP are seen along Pennine Way in the east of the town, Shepherd Street and High Street in the south and along the National Cycle Route 55 in the west;
- To the east of Biddulph the higher land around Biddulph Moor with undulating slopes results in narrow flow paths associated with the small ordinary watercourses and arable drainage ditches of the Horton Brook;
- Further south in Endon and around the Endon Brook, large areas of surface water ponding is shown to the west of Post Lane, to the south of Orford Road and in the field to the south of the A53 / Park Lane junction. Along the A53, ponding in Endon Bank and a flow path from the junction with Basnetts Wood to the junction with Brookfield Avenue are visible;
- Within Leek, flow paths along the A53 from the A520 junction flowing south before ponding is likely to occur in the supermarket car park and in Barnfields Industrial Estate. To the north of Leek, between Abbey Green, large areas of ponding occur in the River Churnet floodplain, flowing across agricultural land and the Brough Park Field Nature Reserve. A flow path occurring in all modelled events begins on Springfield Road flowing north west across the A53, north of the Buxton and Leek college and down Brow Hill towards Hamil Drive. A second flow path in the same area flows down Mill Street towards Harrison Park Stadium (Macclesfield Road);
- To the south of Leek, the A520 is crossed by surface water flow paths associated with the Leek Brook;
- In the west and south west of the District, the strongly undulating or sloping landscape, cut by small scale steep sided stream valleys again restricts surface water flow paths and eliminates the potential for large areas of ponding. Flow paths in the upper tributaries of the Cecilly Brook are shown in Kingsley on the junction between the A52 and Sunny Side;
- The flow path continues south along the Cecilly Brook into Cheadle, and from the north of Harewood Park into the fields just north of Oakamoor Road. Within Cheadle, surface water is predicted to flow during a 1% AEP event along the A522, Ashbourne Road, Attlee Road and Oakamoor Road;
- Surface water ponding is also largely restricted to the River Tean, River Blithe and Fors Brook narrow floodplains, with the exception of a flow path shown to occur to the east of Forsbrook village through fields in Blythe Marsh;
- Much of the District to the east and within the Peak District is not shown to be at significant risk of surface water flooding, predominantly as a result of the elevated topography and steep slopes. However, topography of this nature poses a much higher risk during intense rainfall and can generate sudden and fast flowing overland flow with little or no warning. These events would be localised occurrences and are therefore unlikely to be picked up by the Environment Agency's national scale modelling.

4.4.3 Communities at Risk

As described in Section 4.3.6, the Environment Agencies 'communities at risk' dataset, illustrated in Appendix B Figures 7a to 7f, can be used to identify opportunities where schemes can be put in place to protect against both fluvial and surface water flood risk potentially combining a number of funding sources to secure a better outcome.

4.4.4 Climate Change

The uFMfSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken; 3.3% AEP, 1% AEP and 0.1% AEP and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

4.5 Flooding from Groundwater

Groundwater flooding usually occurs in areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground. Where emergence of groundwater occurs these areas would be at greatest risk and the impact of any such occurrence would potentially be exacerbated by the influence of climate change.

4.5.1 Historic Records of Groundwater Flooding

Across both Shropshire and Staffordshire, the LFRMS[11] states that there is currently no evidence to suggest that groundwater flooding is a major problem within Staffordshire and anticipates that groundwater flooding issues are likely to be localised in their nature, affecting only a small number of properties. This is reinforced by the Humber FRMP[21], in which no historic records of property flooding from groundwater sources were recorded in the catchment.

Only one incident of potential groundwater flooding reported in Leek in July 2013 has been recorded by SCC, however, the report states it is not known whether the source is groundwater or surface water flow. No records of groundwater flooding have been provided by the Environment Agency.

4.5.2 Areas Susceptible to Groundwater Flooding

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

Appendix B Figure 8 presents the Environment Agency's dataset Areas Susceptible to Groundwater Flooding (AStGWF), which indicates where groundwater may emerge due to certain geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead should be used at a strategic level to indicate areas for further investigation.

The mapping indicates that land in proximity to the Tittesworth Reservoir, to the south and east of Cheadle and around Endon are shown to be more susceptible to groundwater flooding. These areas correlate closely with where the sources to rivers are located, including the River Churnet, Cecilly Brook, Endon Brook and Horton Brook. Outside of these areas much of the land within the District, in particular land within the Peak District, is shown to have less than 25% of each 1km grid square as being susceptible to groundwater flooding.

4.6 Flooding from Sewers

The majority of the District is served by Severn Trent Water (ST) as the sewerage undertaker, with the exception of areas along the north and north west District boundary (including the town of Biddulph) which is served by United Utilities (UU). Both sewerage undertakers have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is provided as the DG5 Flood Register. The register includes records of flooding from foul sewers, combined sewers and surface water sewers which are maintained by the respective sewerage undertaker.

During heavy rainfall, flooding from the sewer system may occur if:

1. The rainfall event exceeds the capacity of the sewer system/drainage system:
   - Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While ST, as the sewerage undertaker for Staffordshire Moorlands, is concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event. Older sewer systems may have an effective design standard of less than 3.3%

AEP (1 in 30 years), due to changes in design standard, new development and urban creep. Due to the nature of sewer flooding, the scale of flooding events is generally small.

2. The system becomes blocked by debris or sediment:
   - Over time there is potential that surface water sewers become blocked by a build-up of sediment and debris (e.g. litter). Additionally, foul and combined sewers may become blocked by sewer misuse, including the presence of fats, oils and grease (FOG) and sanitary products.
3. The system surcharges due to high water levels in receiving watercourses:
   - Within the District there is potential for surface water outfalls to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers (i.e. containing both foul and storm water), if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

The impact of any such occurrence would potentially be exacerbated by the influence of climate change

4.6.1 Historic Records of Sewer Flooding

ST has provided an extract from their DG5 Flood Register for the District. Due to data protection requirements the data has not been provided at individual property level, and has therefore been mapped at a scale greater than 1:100,000 (Appendix B Figure 10).

ST DG5 flood records and records of historic sewer flooding received from SCC (also including pre-2010 United Utilities DG5 records) show that internal and external sewer flooding of properties is generally concentrated in the urban areas of the District, including Leek, Biddulph, Endon and Werrington. A total of 25 external sewer flooding incidents have been recorded throughout Leek between 1990 and 2008, predominantly in the areas to the south along Newcastle Road and Cheadle Road, and in the north around the Macclesfield Road area.

Outside of Leek, 18 records between 1997 and 2012 are shown in Endon along Leek Road, of which 8 incidents occurred in 2012. No records of sewer flooding (both internally and externally) have been made in Cheadle, with the exception of 12 recorded incidents on Tean Road in the southern extent, and three records in the north western extent of the town.

A significant number of records in Biddulph are shown in Appendix B Figure 10, largely associated with the surcharging of combined sewers maintained by UU. However, these DG5 sewer records have been extracted from historic flood data provided by SCC, and therefore do not represent UU's most up to date DG5 Flood Register.

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As part of the SFRA Level 1 Update, UU were contacted in May 2015 requesting the most up to date DG5 Flood Register for the Staffordshire Moorlands District. At the time of writing, no DG5 Flood Register had been provided by UU. It is recommended that SMDC continue to pursue sewer flood risk information from UU and their DG5 Flood Register information be incorporated into any future updates to this 'living document' SFRA.

Fewer incidents of internal flooding have been recorded within the District, with the greatest number of recorded incidents (seven incidents) in Werrington between 1996 and 2004. No records of internal flooding exist within the towns of Cheadle, Endon and the majority of the villages within the District.

It should be noted that records only appear on the DG5 register where they have been reported to ST, and as such they may not include all instances of sewer flooding. Furthermore given that ST target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future.

4.7 Flooding from Reservoirs, Canals and other Artificial Sources

The NPPF states that the potential flood risks associated with artificial structures need to be considered as part of an SFRA. Man-made/artificial sources of flooding include canals and impounded reservoirs where water is retained above natural ground level, and operational and redundant industrial processes (including mining, quarrying and sand and gravel extraction), as they may result in an increase in floodwater depths and velocities in the event of failure, overtopping or breach.

Canal flooding may occur as a result of their capacities being exceeded and/or as a result of raised embankment failure. The latter can happen suddenly resulting in rapidly flowing, deep water that can cause significant threat to life and major property damage.

Canal embankment failure has been known to happen occasionally but the impact is not considered to be as extensive as a failure of a reservoir dam as studies have shown that maximum discharges are limited to the volume held within the canal cross section between two locks. This residual risk is managed by the Canal and River Trust (CRT).

Canals are considered to be controlled water bodies so flood risk is deemed to be minimal unless overtopped in storm conditions. There is, however, a residual risk of structural failure. The CRT is not a flood defence body, although they do manage some critical flood defence structures including flood gates.

Reservoir flooding may occur as a result of the capacity of the facility being exceeded and/or as a result of dam or embankment failure. The latter can happen suddenly resulting in rapidly flowing, deep water that can cause significant threat to life and major property damage.

Reservoir flooding is extremely unlikely to happen and reservoirs in the UK have an extremely good safety record; indeed there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers on a regular basis. It is therefore assumed that these reservoirs are regularly inspected and essential safety work is carried out. These reservoirs therefore present a managed residual risk.

SCC is responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for all forms of flooding, including reservoir flooding and ensuring communities are well prepared.

4.7.1 Historic Records of Flooding from Artificial Sources

As a consequence of the Districts industrial heritage, a number of man-made/artificial sources of flooding exist within the District, most notably the Caldon Canal. SCC has provided 15 records of flooding from artificial sources, all of which are associated with canals and canal feeders, from 1979 to 2010. Overflows from canals and feeder channels are found to be common due to flows from land drainage channels and their frequent lack of overflows. In these instances, the flooding is therefore a result of a combination of sources, for example sudden and heavy rainfall rapidly increasing flows in ordinary watercourses, flowing or overflowing into a canal feeder and whose capacity is subsequently exceeded.

Major bank breaches have also occurred, leading to rapid and deep flooding of adjacent land. The most recent incident was reported in local media[42] in November 2009, when an embankment on the Caldon Canal between Leek Tunnel and Bridge Nine failed flooding adjacent agricultural land. Records of overtopping as a result of inadequate maintenance have been noted on the Rudyard Feeder to the east of Leek, as well as the Dane Feeder near Rushton Spencer. In the Churnet Valley, south of Cheddleton, some of the breaches of the Caldon Canal have been associated with river scour of embankments as a result of the close proximity of the canal to the River Churnet.

In 2006, families near Hales Hall Pool in Cheadle were evacuated following floods and the threat of a breach of the dam. In December 2009, subsequent improvement works were carried out on the dam[43]. Problems have also occurred downstream of the Rudyard Reservoir with properties along Rudyard Road being affected by storm overflows from the reservoir.

[42] The Sentinel (21st November 2009) Boaters left high and dry after canal bursts its banks to flood land. Available at: http://www.stokesentinel.co.uk/Boaters-left-high-dry-canal-bursts-banks-flood-land/story-12513897-detail/story.html
[43] The Sentinel (17th December 2009) Dam plugs flooding fear. Available at: http://www.stokesentinel.co.uk/Dam-plugs-flooding-fear/story-12503345-detail/story.html

Overtopping and breach incidents have been provided by the CRT and are illustrated in Appendix B, Figure 4. Additional information as provided by the CRT also states that at the junction with the River Churnet, operational issues occur if the river parallel to the downstream end of this lock flight is in flood. It is reported by the CRT that water can back up and flood out of the lower lock, and possibly the next lock upstream. The CRT state that there are no actions to mitigate this, but just ensure the lock gates are closed once the water recedes, to prevent the canal pounds from draining upstream of the flooded lock(s).

From Consall Forge down to the terminus, the CRT report an issue with the freeboard in the upper pound and high flows in the river section which affect the operation when the river is in flood. It is reported that there may be clearance issues under the bridges at Consall Forge at higher water levels. Typically the navigation in the river will be shut at water levels exceeding 300 mm to weir crest level on safety grounds.

4.7.2 Environment Agency Risk of Flooding from Reservoirs Map

The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The latter can happen suddenly resulting in rapidly flowing, deep water that can cause significant threat to life and major property damage.

The PPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

The 'Risk of Flooding from Reservoirs' map on the Environment Agency's website[44] illustrates the maximum potential extent of inundation from breach failure of any reservoirs subject to the Reservoirs Act 1975 modelled as part of the Reservoir Inundation Mapping (RIM) modelling project (2011). The map illustrates the 'worst case' scenario and it is very unlikely that flooding of this scale would actually occur. Reservoirs included within this modelling project included those characterised by >= 25,000 m^3 of water impounded above the adjacent ground level. The mapping shows that the following reservoirs pose a potential risk of flooding in the Staffordshire Moorlands District:

- Hales Hall Pool;
- Ladderedge Storage Reservoir;
- Knypersley Reservoir;
- Rudyard Lake / Reservoir;
- Serpentine;
- Stanley Pool; and
- Tittesworth Reservoir.

To the north of Leek, an area containing Abbey Green, Bridge End and the A523 is shown to be at risk from Tittesworth only. Continuing downstream along the River Churnet west and south of Leek, the valley including Ladderedge Country Park, the A53, Barnfields and Leekbrook are at risk of flooding from failure of both the Rudyard Reservoir and the Tittesworth Reservoir.

From Stanley Pool, the area at risk of flooding associated with the reservoir is predominantly contained within the Endon Brook floodplain, affecting only a small portion of eastern Endon. The area at risk is narrow containing little to no development alongside the Endon Brook, continuing east to the confluence with the River Churnet.

From the confluence to approximately the Consall train station, the River Churnet valley is at risk of flooding from the Stanley Pool, Tittesworth and Rudyard Reservoirs. Flood risk from Tittesworth and Rudyard Reservoirs continues from Consall to just east of Alton where the River Churnet departs from the District, and includes the settlements of Froghall and Oakamoor, and roads including the A52 and B5417 in the respective settlements.

[44] Environment Agency (2015) What's in Your Backyard? 'Risk of Flooding from Reservoirs' map. Available at: http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?&topic=reservoir#x=357683&y=355134&scale=2

The Serpentine Lake feeds into the Knypersley Reservoir. Both bodies of water pose a risk of flooding to the areas associated closely with the Head of Trent watercourse, flowing directly south towards Stoke on Trent. Much of the land affected is currently agricultural land. A small area in the west of Horse Bridge is shown to be at risk of flooding associated with Ladderedge storage reservoir. The floodplain along the Cecilly Brook and River Tean is largely at risk of flooding from Hales Hall Pool in Cheadle. Development at most risk includes the residential area immediately downstream of the reservoir on Rudyard Way, Hales Hall Road and Ullswater Drive.

4.8 Flood Risk Management Measures

Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences, and reduce the impact through influencing development in flood risk areas, flood warning and emergency response.

4.8.1 Flood Defences

Flood defences are structures which affect flow in times of flooding and therefore reduce the risk of water from entering property. They generally fall into one of two categories; 'formal' or 'informal'.

A 'formal' flood defence is a structure which has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the FWMA, the Environment Agency has powers to construct and maintain defences to help protect against flooding. SCC has similar powers on ordinary watercourses within Staffordshire Moorlands.

An 'informal' defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

A study of informal flood defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

In accordance with the scope of a Level 1 SFRA, a high level review of formal flood defences has been carried out using data from the Environment Agency Asset Information Management System (AIMS). This dataset contains details of formal flood defence assets associated with main rivers and provides a good starting point for identifying significant local defences and potential areas benefiting from defences, but the quantity and quality of information provided differs considerably between structures. The AIMS is intended to provide a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA or site-specific FRA where the need arises). The details of flood defences within the District, including the Standard of Protection (SoP), are provided in Table 4-5.

It should also be noted that, whilst not included within the Environment Agency's AIMS, a flood defence structure exists on the River Churnet, located immediately upstream of Abbey Green Road to the north of Leek. The structure, a 40 m long weir, is represented within the Churnet Hazard Mapping report[39] as a spill unit distributing flows between the main channel and the flood alleviation bypass channel.

Table 4-5: AIMS Flood Defences within Staffordshire Moorlands

WATERCOURSE	TOWN	OWNER	TYPE	LENGTH (m)	SOP (YEARS)
Endon Brook	Denford	Environment Agency	Embankment	110	100
Endon Brook	Denford	Environment Agency	Reinforced concrete stone faced floodwall	41	100
Endon Brook	Denford	Private	Road bridge abutment	21	100
Endon Brook	Endon	Environment Agency	Embankment	26	100
Endon Brook	Endon	Environment Agency	Wall	30	100
River Tean	Upper Tean	Local Authority	Red brick floodwall	120	100
River Tean	Upper Tean	Environment Agency	Earth embankment	48	100
River Tean	Upper Tean	Environment Agency	Masonry wall	48	100
River Tean	Lower Tean	Environment Agency	Mill Lane embankment	63	100
Fors Brook	Blythe Marsh	Environment Agency	Embankment	20	100
Fors Brook	Blythe Marsh	Environment Agency	Embankment	9	100

4.8.2 Proposed Schemes

Scheme outlines have been provided for three schemes suggested by SCC within the District. The schemes form part of the Medium Term Plan proposed by the Regional Flood and Coastal Committee for the Trent catchment. These are:

- **Lower Tean** – Scheme to divert an existing watercourse around the village to reduce persistent flooding problems. Construction is to be completed this year.
- **Brown Edge** – Scheme to divert an existing watercourse around the village to reduce persistent flooding problems, with hydraulic modelling planned to take place in 2017/18 to determine the course of the diversion.
- **Endon (Village Brook)** – Scheme to reduce flooding from Village Brook that runs through the existing village, with modelling planned to take place in 2017/18.

4.8.3 Residual Risk

In producing Flood Zone maps the Environment Agency takes the presence of defences into account by showing Areas Benefitting from Defence (ABDs). These areas can be deemed areas at risk of a defence overtopping or from failure. It can therefore also be described as a residual risk zone. Residual flood risks can arise due to:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system or culvert, overtopping of an upstream storage area, or failure of a pumped drainage system;
- A severe flood event that exceeds a flood management design standard and results in, for example, overtopping.

There is one ABD of 0.2 hectares within the District, located in Blythe Marsh just south of the A521. With each defence, including lakes and reservoirs, there is a residual risk of overtopping, breach or blockage, which

could result in significant damage to buildings and highway infrastructure as well as posing danger to life. The residual risk as a result of failure of the various reservoirs in the District is discussed in Section 4.7.

There is a residual risk of overtopping or breach of the Caldon Canal. The area at risk from these events is discussed in Section 4.7. Although the risk of failure is small, the potential for a large volume of water to be released quickly means that the hazard downstream of these structures is high. Where possible, development should therefore be avoided immediately behind raised embankments of the canal where a breach could occur. Where no other development sites are available a detailed breach and overtopping analysis will be necessary to determine the flood hazard and rapid inundation area, and this should be included in the scope of the Level 2 SFRA. Until such an assessment is carried out, it is recommended that a breach assessment be carried out as part of a site-specific FRA to support any planning applications for sites immediately behind raised embankments of the canal.

Flood defences and culverted section of watercourses are mapped in Appendix B Figures 6a – 6f. These should be referenced by those proposing development to identify the possibility of localised residual risks as well as opportunities for de-culverting and restoring the natural channel (known as day-lighting).

4.8.4 Flood Warning Systems

The Environment Agency provides a free flood warning service for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency free flood warning service can provide advance notice of flooding and can provide time to prepare for a potential flood event.

The Environment Agency issue flood warnings to homes and businesses when flooding to properties is expected. Upon receipt of a flood warning, occupants should take immediate action. The Environment Agency also issue flood alerts when flooding to low lying land and roads is expected. Flood alerts cover larger areas than flood warnings and are issued more frequently. Upon receipt of an alert, occupants should be prepared for flooding and to take action. Flood warnings and flood alerts are signed up to separately, however when signing up for flood warnings homes and businesses must agree to receive flood alerts.

In the District, it is difficult for the Environment Agency to achieve a two hour lead time in Waterhouses due to the fast response of the River Hamps, as the floodplain is narrow and the catchment receives a high amount of rainfall over steep terrain. In addition, the Leek Brook is designated as Rapid Response Catchments due to a combination of factors including its time to peak and in-channel velocity. Whilst a Flood warning cannot be provided for this watercourse, the Environment Agency encourages communities in the affected areas to plan and prepare for flooding.

If a flood alert from groundwater is available this does not mean that a particular property is definitely at risk. It is very difficult to predict the exact location of flooding from groundwater as it is often related to local geology. To help people, the Environment Agency provides flood alerts for large areas that could be affected if groundwater levels were high.

Flood alert and flood warning areas can be viewed on the Environment Agency website[45] and were obtained as GIS layers to support this Level 1 SFRA Update. These are presented in Appendix B Figure 11. Within Staffordshire Moorlands there are six Flood Alert Areas and 17 Flood Warning Areas listed below. All stages of warning are disseminated via Floodline Warnings Direct (FWD), a free service that provides warnings to registered customers by telephone, mobile, email, SMS text message and fax.

- River Churnet at Leek (ref. 033FWF3CHUR001) inc. Abbey green Road, Macclesfield Road, Thomas Street, Grace Street and Wall Bridge;
- River Churnet at Cheddleton (ref. 033FWF3CHUR002) inc. Cheadle Road and Churnetside Business Park;
- River Churnet at Froghall inc. Consall Forge (ref. 033FWF3CHUR003);
- River Churnet at Oakamoor (ref. 033FWF3CHUR004) inc. The Square, Mill Road, Stoney Dale and Red Road;
- River Churnet at Alton (ref. 033FWF3CHUR005) inc. Red Road and Station Road;

[45] Environment Agency (2015) Flood Warning and Alert Areas. Available at: http://apps.environment-agency.gov.uk/wiyby/37835.aspx

- River Churnet at Leebrook (ref. 033FWF3CHUR008) inc. Primrose Close, Tulip Way and Wardel Gardens;
- River Blithe at Blythe Bridge (ref. 033FWF3BLITHE01) inc. Uttoxeter Road, Roman Road, Blythe View and Blythe Bridge Mil;
- River Blithe at Blythe Park Industrial Estate, Cresswell (ref. 033FWF3BLITHE02) inc. Aldbrough House;
- River Tean at Upper Tean, Lower Tean and Checkley (ref. 033FWF3TEAN001);
- River Tean at Fole and Beamhurst (ref. 033FWF3TEAN002) including the A522;
- River Tean at Adderly (ref. 033FWF3TEAN005);
- River Tean at Brookhouses (ref. 033FWF3TEAN006);
- Cecilly Brook at Cheadle (ref. 033FWF3CECL01);
- River Dove from Coldwall Bridge to Okeover (ref. 033FWF3DOVE001) inc. Dove Cottage, Okeover Mill and Manor House;
- Ford Green Brook at Fegg Hayes, Bradeley and Sneyd Green (ref. 033FWF3FGREEN01) Stoke on Trent inc. Catherine Road in Fegg Hayes, Tudor Rose Way and Station Crescent in Bradeley and Milton Road in Sneyd Green; and
- River Hamps at Waterhouses (ref. 033FWF3HAMPS001) inc. Leek Road area

Further information on Flood Warnings in force, and Flood Warning and Alert Areas can be found from the Environment Agency website.

4.8.5 Flood Response Plan

SCC's Emergency Planning Department is responsible for the production, maintenance, and development of plans for an integrated response to any major emergency. This involves working closely with the emergency services, other Council departments, neighbouring local authorities, voluntary agencies and industry to ensure that any response to a major incident is carefully managed to ensure a return to normality as quickly as possible. SCC classifies flooding as an emergency situation and has a Multi-Agency Flood Plan (MAFP) which is both a strategic and a tactical plan for all key officers to promote multi-agency flood preparation and response. All departments should have emergency procedures in place to guide staff in their tasks where they differ from their normal work practices, such as providing care for evacuees at Emergency Rest Centres.

SMDC's website provides advice on flooding and directs users to the Environment Agency's website to view the flood warnings in place (as described in Section 4.8.4) and to view properties at risk of flooding from main rivers (as described in Section 4.3). The Council's website also provides a link to the Environment Agency's website for advice on how to protect homes from flooding, and provides information on what to do in event of a flood. The Council keeps a stock of 365 sandbags and 50 Aqua Sacs[46] which can be obtained out of hours by calling the Council's Call Centre phone number 0345 605 3010.

It is recommended that SMDC work with the Environment Agency to promote the awareness of flood risk to maximise the number of people signed up to the FWD service. Within the District particular attention should be given to vulnerable people including those with impaired hearing or sight and those with restricted mobility.

With respect to new developments, those proposing the development should take advice from the SCC emergency planning officers and for large-scale developments, the emergency services, when producing an evacuation plan as part of a FRA. As a minimum these plans should include information on:

- How flood warning is to be provided:
  - Availability of existing warning systems;
  - Rate of onset of flooding and available warning time; and
  - Method of dissemination of flood warning.

[46] An alternative to traditional sandbags which comprises of a heavy duty Jute sack and a cotton liner and contains a super-absorbent Polymer which can absorb 13 litres of water creating an inflated "sandbag".

- What will be done to protect the infrastructure and contents:
  - How more easily damaged items could be relocated;
  - The potential time taken to respond to a flood warning;
  - Ensuring safe occupancy and access to and from the development;
  - Occupant awareness of the potential frequency and duration of flood events;
  - Provision of safe (i.e. dry) access to and from the development within Flood Zones 2 and 3 up to the 1% AEP + climate change event;
  - Ability to maintain key services during an event;
  - Vulnerability of occupants and whether rescue by emergency services may be necessary and feasible;
  - Expected time taken to re-establish normal practices following a flood event; and
  - Within areas of surface water flood risk, provision of access in areas where flood waters pose a hazard no greater than "very low" in accordance with the Defra / Environment Agency technical guidance document FD2320/TR2[47].

[47] Defra / Environment Agency (2005) Flood Risk Guidance for New Development Phase 2: Framework and Guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools. R&D Technical Report FD2320/TR2

5 Flood Risk Management Policy Recommendations

5.1 Policy Considerations

A key aim of a SFRA is to define flood risk management objectives and identify key policy considerations. It should be noted that it is ultimately the responsibility of the Council to formally formulate these policies and implement them.

It is recommended that the following flood risk objectives are taken into account during the policy making process. Guidance on how these objectives can be met throughout the development control process for individual development sites is included within Section 7.5.

5.1.1 Flood Risk Objective 1: To Seek Flood Risk Reduction through Spatial Planning and Site Design:

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to Flood Zone 1;
- Within Flood Zone 1 highest priority should be given to areas with the lowest level of flood risk from all sources within the Flood Zone;
- Use the Sequential approach within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits;
- Avoid development immediately downstream of flood storage reservoirs which will be high hazard areas in the event of failure;
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features as part of a large scale land management scheme;
- Identify long-term opportunities to remove development from the floodplain through land swapping;
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels); and
- Ensure development is 'safe'. Dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. The Environment Agency states that dry pedestrian access/egress should be possible for the 1 in 100 year return period event, and residual risk, i.e. the risks remaining after taking the sequential approach and taking mitigating actions, during the 1 in 1000 year event, should also be 'safe'. In areas of surface water flood risk in Flood Zone 1, access and egress should be provided in areas where flood waters pose a hazard no greater than "very low" in accordance with Defra / Environment Agency document FD2320/TR2[47]. Internal flooding should be avoided through application of the sequential approach to location of development within a site, raising of finished floor levels and/or incorporation of flood resilient/resistant measures.

5.1.2 Flood Risk Objective 2: To Ensure Surface Water Runoff from New Developments remains at Greenfield Rates:

- The NPPF and PPG set out the requirement in future for all major development to include SuDS, enforced through the planning system.
- All sites require the following:
  - Use of SuDS (where possible use of strategic SuDS should be made);
  - Post development surface water runoff and peak flow rates for all sites should be restricted to the greenfield discharge rate plus a reduction of at least 20% to take account of climate change;

  - Brownfield sites should seek to discharge surface water from the redeveloped site at greenfield rates wherever possible. At the least, betterment should be offered (in terms of reduced runoff) for all redeveloped sites. Developers proposing to develop brownfield sites should contact the LLFA to further discuss acceptable runoff rates at the earliest opportunity;
  - 1 in 100 year attenuation taking into account climate change.
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites;
- Promote environmental stewardship schemes to reduce water and soil runoff from agricultural land;
- Surface water drainage proposals should have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission.

5.1.3 Flood Risk Objective 3: To Enhance and Restore the River Corridor:

- Those proposing development should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bio-engineered river walls, raising bridge soffits to take into account climate change);
- Avoid further culverting and building over culverts. Where practical, all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit. Any culverting or works affecting the flow of a watercourse requires the prior written consent of either the Environment Agency (for main rivers), or SCC (for ordinary watercourses) under the terms of the Land Drainage/Water Resources Act 1991 and FWMA. These regulatory bodies seek to avoid culverting, and their Consent for such works will not normally be granted except as a means of access;
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip for development by all main rivers including those where the Flood Zone does not exist. Under the terms of the Water Resources Act 1991 and/or the Environment Agency Byelaws the prior written consent of the Environment Agency is required for any proposed works or structures in, under, over or within 8 m from a main river asset or structure. This is to allow easy maintenance of the watercourse, and includes consent for fencing, planting and temporary structures;
- It is encouraged, where possible, to retain a 5 m wide undeveloped strip along all ordinary watercourses.

5.1.4 Flood Risk Objective 4: To Protect and Promote Areas for Future Flood Alleviation Schemes:

- Safeguard greenfield functional floodplain (our greatest flood risk management asset) from future development, and reinstate areas of functional floodplain which have been previously developed (e.g. reduce building footprints or relocate to lower flood risk zones). This will help to utilise its potential to influence and alleviate flooding elsewhere within the river catchment;
- Develop appropriate flood risk management policies for the brownfield functional floodplain, focusing on risk reduction;
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas;
- Seek opportunities to make space for water to accommodate climate change.

5.1.5 Flood Risk Objective 5: To Improve Flood Awareness and Emergency Planning:

- Encourage communities near the Leek Brook (Rapid Response Catchment) to plan and prepare for flooding;
- Seek to improve the emergency planning process within SMDC and SCC using the outputs from the SFRA;
- Encourage all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to the FWD service operated by the Environment Agency;
- Ensure robust emergency (evacuation) plans are implemented for new developments in flood risk areas.

5.2 Council Specific Policy Recommendations

It is recommended that the aforementioned policy considerations are included in the SMDC's policies. In addition the Council should seek to incorporate the flood risk management policies as detailed in the Trent CFMP, and listed in Section 3.4.3.

It is recommended that consideration is also given to flood risk management measures which are relevant to the District (River Dove catchment). Such measures are currently contained within the draft Humber FRMP and are detailed in Section 3.6.2. These measures, once published, can help guide specific flood risk management policies within the District.

5.2.1 Partnership Funding

It is recommended that opportunities for collaboration or joint funding are sought with developers and other stakeholders such as the water companies early in the planning phase of a development. As flooding can occur from a number of different sources large scale land management practices may require inputs from several stakeholders and key partners, funding from a number of sources and coordination of effort to adequately manage the risks. It is essential that the scale and type of flood risk to an area is understood prior to instigating mitigation or management measures, and collaborative approaches to schemes be investigated to make efficiencies, for example where another scheme is already proposed in an area.

The mechanism for allocating Defra Flood Defence Grant in Aid (FDGiA) funding, requires that flood risk to existing properties cannot be double counted. A bid for funding to reduce flood risk to existing properties can therefore only be submitted once against each property. It is therefore essential that where there is an opportunity to reduce flood risk to existing properties from both fluvial and pluvial sources that a joint approach is taken by SMDC, the Environment Agency and SCC to ensure that any scheme deals with the risk from both sources of flooding.

Improving the resilience of local communities to flooding can be achieved through raising awareness of simple measures and systems that can be installed in new developments. Developers may, for example, be encouraged to install simple systems such as water butts to capture roof runoff. Alternatively, rainwater harvesting systems could be installed in new large publically owned developments such as council offices, schools or hospitals.

It is recommended that a general approach to improving community resilience is promoted across the study area, particularly in areas that have been identified as being at risk.

Defra provides advice on ascertaining partnership funding and collaborative delivery of local flood risk management[48]. SMDC should seek to involve SCC officers with flood risk management responsibilities in planning negotiations from the earliest stages as drainage issues need to be identified and addressed at or even before master planning stage to ensure that adequate space is allocated within the site. Developers should be encouraged to make drainage planning a high priority and remove uncertainty about adoption and maintenance (see Sections 8.5 and 8.6).

5.2.2 Promoting Natural Flood Management

Natural Flood Management (NFM) is defined as the alteration, restoration or use of landscape features as a means of reducing flood risk amongst other benefits including improvements to ecology, water quality and carbon sequestration.

NFM strategies vary depending on the location and distribution within a catchment, however the aim remains the same; to reduce the downstream maximum water level of a flood (the flood peak) or to delay the arrival of the flood peak downstream, in order to increase the time available to prepare for a flood. The Parliamentary Office of Science and Technology[49] reviewed the underlying mechanisms of an effective NFM strategy, which can include a combination of the following:

[48] Defra. (March 2012). Partnership funding and collaborative delivery of local flood risk management: a practical resource for LLFAs - FD2643. Available at http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17085&FromSearch=Y&Publisher=1&SearchText=fd2643&SortString=ProjectCode&SortOrder=Asc&Paging=10

[49] The Parliamentary Office of Science and Technology (2011) Natural Flood Management. Available at: www.parliament.uk/briefing-papers/POST-PN-396.pdf

- ***Storing water*** *by using, and maintaining the capacity of, ponds, ditches, embanked reservoirs, channels or land*
- ***Increasing soil infiltration****, potentially reducing surface runoff, although this can be offset by greater subsurface flows. Free-draining soil will make saturation less likely, and evaporation from soil can also make space for water*
- ***Slowing water*** *by increasing resistance to its flow, for example, by planting floodplain or riverside woods,*
- ***Reducing water flow connectivity*** *by interrupting surface flows of water, for example, by water storage or planting buffer strips of grass or trees.*

Approximately one third of the District lies within the Peak District National Park, in which the headwaters of four major rivers of the region arise from (Churnet, Dane, Dove and Manifold), presenting significant opportunity for SMDC to work collaboratively with the Environment Agency, the Peak District National Park Authority and individual land owners to not only reduce flood risk but also achieve wider environmental objectives.

The multiple beneficial outcomes of new NFM schemes or strategies could also open up more avenues of internal revenue than purely flood risk management, particularly where measures address existing issues within the Staffordshire Moorlands District and Peak District, such as managing the environment and heritage, improving health and wellbeing, and improving existing communities.

5.3 Draft Staffordshire County Council SuDS Handbook

A draft SuDS Handbook is currently being developed by SCC that aims to provide direction to relevant design guidance for the successful implementation of SuDS and, once adopted, will be the basis against which planning consultations from LPAs will be assessed. It will outline the key design principles, different SuDS components, construction and maintenance methods, and lists the key information required by SCC for planning applications. The guidance will be based upon the DEFRA Non-Statutory Technical Standards (March 2015), the NPPF and the PPG.

It is recommended that SCC, as the LLFA, are contacted by any potential developers at the early stages of any planning application to determine SCC's requirements for such mitigation and the status of this document to inform the design process.

5.4 Sensitive Development Locations

The Core Strategy identifies the settlements of Leek, Biddulph and Cheadle to accommodate the bulk of the District's housing, employment and retail needs. Potential development sites in these settlements are mostly peripheral with some smaller infill development. There are few locations in which development would significantly increase fluvial flood risk elsewhere, due to the majority of potentially suitable sites for development being located within Flood Zone 1, and only a few sites are partially within Flood Zone 2 or 3. However, much of the peripheral development is proposed on agricultural land (greenfield) on the outskirts of the aforementioned towns, posing a greater risk to increase surface water flood risk within the town and further downstream as a result of increased surface water runoff and reduced infiltration.

SCC highlighted through consultation that should any sites along the northern boundary of Endon be taken forward, they would like to talk to any potential developers as early as possible as this area demonstrates real opportunity to solve the current overland flow route known to cause flooding problems at Mayfair Grove, Endon. This area also provides opportunity for partnership funding to deliver a future flood management scheme.

The remaining potential development sites are located in the rural areas of the District around larger villages. Due to their significantly smaller scale, they pose a much lower risk of increasing fluvial and/or surface water flooding.

It should therefore be considered that, throughout the District, any development (including developments in Low Probability Flood Zone 1) which does not incorporate SuDS may increase the risk of surface water and/or fluvial flooding both on-site and off-site (downstream). As such effective planning policies should be implemented in accordance with the SuDS recommendations provided in this SFRA.

6 Guidance for Applying the Sequential and Exception Tests

6.1 Sequential Test

The Sequential Test is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk, so avoiding the development of sites that are inappropriate on flood risk grounds. Where this cannot be avoided, application of an Exception Test allows for the possibility of some development in flood risk areas taking place if flood risk is clearly outweighed by other sustainability drivers.

The Sequential Test is applied at all stages of the planning process, both between different Flood Zones and within a Flood Zone. 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.

6.2 Applying the Sequential Test – Plan-Making

For the Local Plan, SMDC (as LPA) must demonstrate that it has considered a range of possible options. The Flood Zone and vulnerability information from the SFRA allows these options to be Sequentially Tested in terms of flood risk and, where necessary, an Exception Test applied in the site allocation process.

Figure 6-1 illustrates the approach for applying the Sequential Test that SMDC should adopt in the preparation of the Local Plan. The Sequential Test should be undertaken by SMDC and accurately documented to ensure decision processes are consistent and transparent.

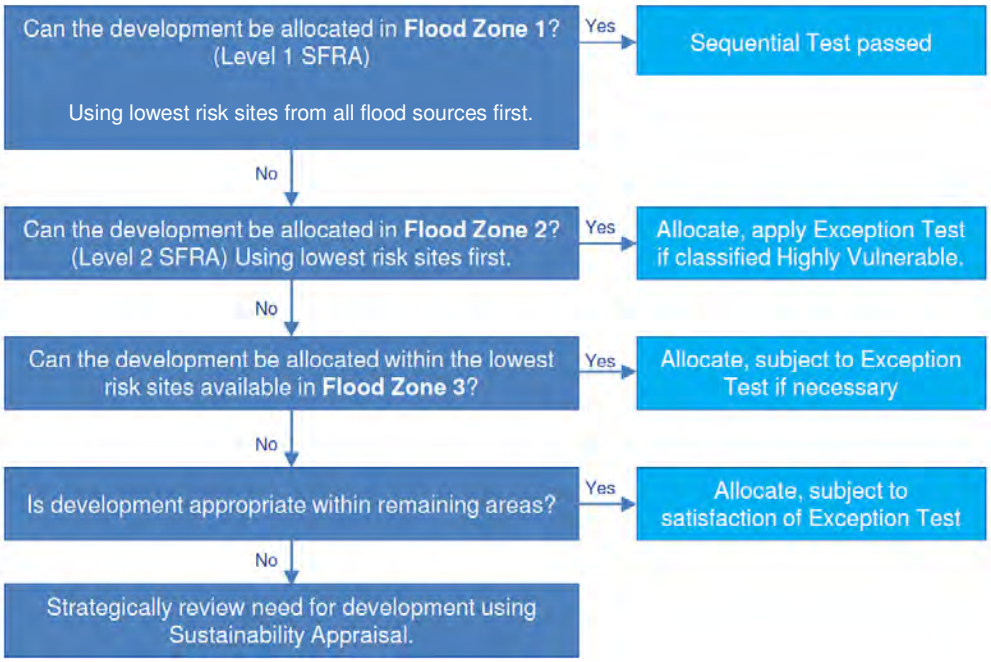

Figure 6-1: Application of Sequential Test for Local Plan Preparation

The Sequential Test requires an understanding of the Flood Zones in the District and the vulnerability classification of proposed forms of development. Flood Zone definitions are provided in and mapped in Appendix B Figures 6a – 6f (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency's website). A summary of the vulnerability classifications, as defined in the PPG, is presented in Table 6-1.

Table 6-1: Flood Risk Vulnerability Classification (PPG, 2014)

VULNERABILITY CLASSIFICATION	DEVELOPMENT USES
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • 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 6-2 demonstrates which types of development are appropriate within each Flood Zone and where the Exception Test is required.

Table 6-2: Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)

FLOOD RISK VULNERABILITY CLASSIFICATION		ESSENTIAL INFRASTRUCTURE	WATER COMPATIBLE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×

Notes to Table 6-2:

- ***This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;***
- *The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;*
- *Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.*

Key:

✓ - Development is appropriate

× - Development should not be permitted

† - In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

** - In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

The NPPF acknowledges that some areas will (also) be at risk of flooding from sources other than fluvial. All sources must be considered when planning for new development including: flooding from land or surface water runoff; groundwater; sewers; and artificial sources.

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

Particular care should also be taken with the siting of Highly Vulnerable developments through Change of Use applications, whereby the Sequential and Exception Tests are not considered to apply. Consulting SCC and the Environment Agency in these circumstances is recommended.

6.2.1 Recommended stages for LPA application of the Sequential Test in Plan-Making

1. Assign potential developments with a vulnerability classification (Table 6-1). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
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 Flood Map for Planning (Rivers and Sea). 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:
   - 100 years up to 2115 for residential developments; and
   - Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
5. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, Flood Zones ignoring defences should be used.
6. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1. If these cannot be located in Flood Zone 1, either because the identified sites are unsuitable on other sustainability grounds, or there are insufficient sites in Flood Zone 1, then sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. 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. Within each Flood Zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.
7. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. 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. As with Highly Vulnerable development, within each Flood Zone More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.
8. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider allocating those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b (Functional Floodplain).
9. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.
10. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.
11. On completion of the Sequential Test, the LPA may have to consider the risks posed to a site within a Flood Zone in more detail in a Level 2 SFRA. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone. Consideration of flood hazard within a Flood Zone would include:
    - Flood risk management measures,
    - The rate of inundation,
    - 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 tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendix B.

6.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified through the Local Plan process. They are sites which do not have planning permission, but could be available for development. 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 and expected future trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

6.3 Applying the Sequential Test – Planning Applications

As illustrated in Figure 6-2 the flood risk Sequential Test can be considered adequately demonstrated if (1) the Sequential Test has already been carried out for the site for the same development type at the Local Plan level **and** (2) the development vulnerability is appropriate to the Flood Zone as set out in Figure 6-2.

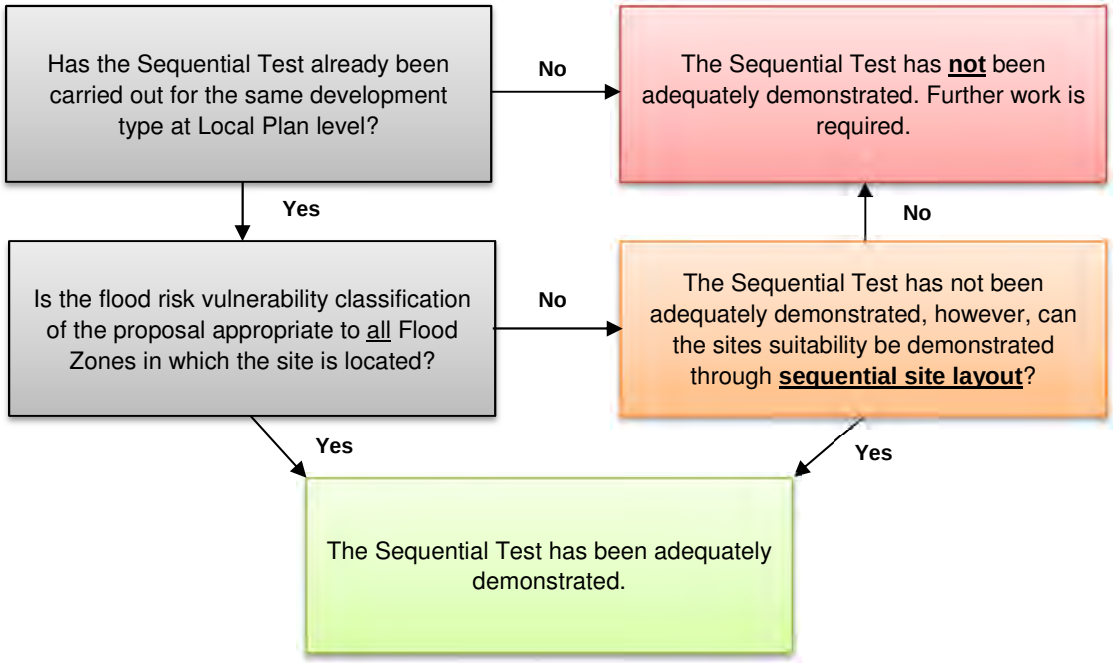

Figure 6-2: Determining when the Sequential Test is required for Planning Applications

If the answer to the first criteria is 'yes', but is 'no' for the second, it may be possible to make the site suitable for the proposed use by applying a sequential approach to the development site layout. Further guidance on how to apply a sequential approach is provided in Section 6.3.2.

If the answer to either of these two criteria is 'no', then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications'[50] sets out the procedure as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies);
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan;
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources;
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is

[50] Environment Agency (April 2012) Demonstrating the flood risk Sequential Test for Planning Applications, Version 3.1

allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s);

- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed;
- Where necessary, as indicated by Table 6-2, apply an Exception Test;
- Apply the Sequential approach to locating development within the site, as described in Section 6.2.

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately SMDC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

6.3.1 Sequential Test Exemptions

The Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
  - minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250 m^2;
  - alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
  - householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from rivers or the sea) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change);
- Redevelopment of existing properties (e.g. replacement dwellings), provided they;
  - Will not be placed at an unacceptable level of flood risk, irrespective of the risk posed to the existing dwelling;
  - Do not increase the number of dwellings in an area of flood risk (i.e. replacing a single dwelling with an apartment block); and
  - Do not increase the net footprint of the building(s) unless accompanied by adequate floodplain compensation or suitable under floor voids.
- Redevelopment, for example replacement dwellings, will be expected to meet current Flood Risk Management best practice standards. Where this is not feasible due to conflicting planning reasons, designs should be as close to best practice as possible. Under no circumstances will a worsening of flood risk compared to the existing case be accepted.

6.3.2 Sequential Approach to Site Layout

It is important to acknowledge that some proposed development sites may only partially fall within Flood Zone 2, 3a or 3b, and as a result, may be discarded at an early stage of the Sequential Test. This Section provides some guidance on how allowances that could be made by identifying those portions of proposed development sites located within these Flood Zones.

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Development should be sequentially allocated within the site boundary to areas firstly within Flood Zone 1 (Low Probability) and then Flood Zone 2 (Medium Probability) where 'less vulnerable' development uses would be more appropriate. Residential developments ('more vulnerable') should be restricted to areas at low probability of flooding and the following types of 'water compatible' development can be placed on lower ground with a higher probability of flooding (Flood Zones 3a and 3b):

- Car parks;
- Green Infrastructure (i.e. open spaces, proposed landscaped areas, nature conservation);
- Outdoor sports and recreation;
- Flood control infrastructure; and
- Water and sewerage transmission infrastructure.

Should development pressure create a need to develop within the areas within Flood Zone 3 (plus an allowance for climate change) appropriate minimum floor levels to adopt in agreement with the Environment Agency should be determined. It is required that any flood volume displaced as a result of development within the entire Flood Zone 3 plus an allowance for climate change envelope (encapsulating Flood Zones 3a (High Probability) and 3b (Functional Floodplain)) be compensated for elsewhere within the site boundary on a 'level for level' and 'volume for volume' basis. Any proposed layout and location for such compensation should take into account the flow routing to ensure adequate conveyance.

Appropriate mitigation measures should be incorporated that do not increase the risk of flooding to surrounding areas, and where opportunity exists, aim to reduce flood risk to surrounding areas.

In additional to mitigating the impact of any fluvial flows displaced as described above, consideration should be given to the impact of any development on pluvial flow routes and areas susceptible to ponding (see Appendix B Figure 7a – 7f) informed by a review of the local topography, geology and any structures that may influence the movement of water over the surface. Following the sequential approach to the layout of buildings, provision of SuDS (see Section 8) will assist in mitigating any increase in risk from surface water to surrounding areas.

6.4 Exception Test

The Exception Test, as set out in paragraph 102 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

The purpose of an Exception Test is to ensure that certain new development (Table 6-2) is only permitted in Flood Zone 2 and Flood Zone 3 where flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

Paragraphs 023 to 025 state that for the PPG states that or an Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk; and
- A site-specific Flood Risk Assessment, informed by a Level 2 SFRA where one has been prepared, must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted in the Local Plan.

When determining planning applications, SMDC should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required an Exception Test, it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
- Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of SuDS.

There are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk from floods;
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
- Mitigating the potential impacts of flooding through design and resilient construction.

In order to determine part 1) of an Exception Test, applicants should assess their scheme against the objectives within the Staffordshire Moorlands Core Strategy Sustainability Appraisal Report[51].

6.4.1 Exemptions

It is noted that applications for minor development and change of use are exempt from an Exception Test (see Notes to the Flood Risk Vulnerability and Flood Zone 'Compatibility' table (PPG, 2014)[2]); however site-specific FRAs are still required, as detailed in Section 7.

[51] SMDC (2014) Staffordshire Moorlands Core Strategy Sustainability Appraisal Report. Available at: http://www.staffsmoorlands.gov.uk/sites/default/files/documents/pages/Core%20Strategy%20Sustainability%20Appraisal%20Report%20March%202014.pdf

7 Guidance for Preparing Site-Specific FRAs

7.1 Overview

This Level 1 SFRA update provides a high level assessment of the flood risk posed to Staffordshire Moorlands. However, this document has a strategic scope and therefore it is essential that site-specific FRAs are also developed for individual development proposals where required, and that where necessary and appropriate, suitable mitigation measures are incorporated.

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and, where possible, will reduce flood risk overall in accordance with the NPPF and PPG.

7.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- For proposals of 1 hectare or greater in Flood Zone 1;
- All proposals for new development (including minor development[52] and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency); and,
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The Environment Agency Guidance Note[53] for FRAs in Flood Zone 1 should be consulted for advice on the approach and content of a site-specific FRA.

7.3 What should a Flood Risk Assessment address?

The NPPF states that site-specific FRAs should always be proportionate to the degree of flood risk and make optimum use of readily available information, for example the mapping presented within this SFRA. FRAs should also be appropriate to the scale, nature and location of the development.

The PPG outlines the objectives of a site-specific FRA are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

The CIRIA publication C624[54] presents a staged approach to the preparation of site-specific FRAs, and identifies typical sources of information that can be used. A summary of the three levels of FRAs is described in Table 7-1.

[52] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[53] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311502/LIT_9193.pdf

Table 7-1: Levels of Site-Specific Flood Risk Assessment

DESCRIPTION
Level 1 Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical **sources of information** include: • SFRA; • Flood Map for Planning (Rivers and Sea); • Local flood risk policy documentation (such as RBD Flood Risk Management Plan, Catchment Flood Risk Management Plan, Shoreline Management Plan and Local Flood Risk Management Strategy); and • Standing Advice: https://www.gov.uk/flood-risk-assessment-local-planning-authorities
Level 2 Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. • The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
Level 3 Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures.

Table 7-2 is based on the checklist for site specific FRAs provided in the PPG. Where appropriate, references have been added to determine where the information can be found to support each required item.

Table 7-2: Site-Specific Flood Risk Assessment Checklist (Planning Practice Guidance)

1. Development description and location	
1a. What type of development is proposed (e.g., new development, an extension to existing development, a change of use etc.) and where will it be located?	☐
1b. What is its flood risk vulnerability classification? Refer to Section 6.2, Table 6-1.	☐
1c. Is the proposed development consistent with the Local Plan for the area? SDC is currently carrying out a review of the SDC Core Strategy and Development Policies and is due to start work on its Local Plan in 2015. The existing Core Strategy and Development Policies should be referred to on the SDC website: http://www.selby.gov.uk/core-strategy and seek advice from SMDC if necessary	☐
1d. What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type? Consult SMDC to determine if the site has been included in the Sequential Test once this has been carried out. If not, refer to Section 6.3 for guidance on undertaking the Sequential Test for individual development sites and to determine whether the Exception Test is required.	☐
1e. Will your proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? This is particularly relevant to minor developments (alterations & extensions) & changes of use.	☐
2. Definition of the flood hazard	
2a. What sources of flooding could affect the site? Refer to Section 4.	☐

[54] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.

2b. For each identified source under 2a above, can you describe how flooding would occur, with reference to any historic records where these are available? Refer to Section 4.	☐
2c. What are the existing surface water drainage arrangements for the site? Undertake a site survey to determine specific details and seek advice from Severn Trent Water and United Utilities.	☐
3. Probability	
3a. Which Flood Zone is the site within? Refer to Section 4.	☐
3b. Does the SFRA show the same or a different Flood Zone compared with the Environment Agency's flood map? Refer to the Flood Map for Planning (Rivers and Sea) on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby. If different you should seek advice from the local planning authority and, if necessary, the local Environment Agency office.	☐
3c. What is the probability of the site flooding, taking account of the maps of Flood Risk from Rivers and the Sea and from surface water, on the Environment Agency's website, and the SFRA, and of any further flood risk information for the site? Refer to mapping in Appendix B, as well as the Flood Map for Planning (Rivers and Sea) and the Flood Risk from Surface Water mapping (uFMfSW) on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby.	☐
3d. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?	☐
4. Climate change	
How is flood risk at the site likely to be affected by climate change? Refer to Section 4.3.7 and 4.4.4 for a description of how climate change will impact fluvial and surface water flooding.	☐
5. Detailed development proposals	
Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (including providing details of the development layout)? Refer to Section 6.3 regarding the use of the sequential approach within development sites.	☐
6. Flood risk management measures	
How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime? Refer to Section 7.5 for details regarding finished floor levels, basement dwellings, flood resilient design, car parking considerations, and provision of safe access / egress.	☐
7. Off-site impacts	
7a. How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?	☐
7b. How will you prevent run-off from the completed development causing an impact elsewhere? Refer to Section 5 regarding Flood Risk Management Objective 2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
7c. Are there any opportunities offered by the development to reduce flood risk elsewhere? Refer to Section 5 regarding Flood Risk Management Objective 2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
8. Residual risks	
8a. What flood-related risks will remain after you have implemented the measures to protect the site from flooding? In addition, how will implemented measures be maintained? See Sections 7.5, 8.5 and 8.6.	☐
8b. How, and by whom, will these risks be managed over the lifetime of the development? (E.g., flood warning and evacuation procedures). Refer to Section 7.5.12 for details regarding flood warning and flood evacuation plans.	☐

7.3.1 Proposed Development in Low Probability Flood Zone 1

FRAs within Flood Zone 1 should primarily take consideration of how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems. This is to ensure surface water generated by the site is managed in a sustainable manner and does not increase the burden on existing infrastructure and/or flood risk to neighbouring property. The assessment of surface water flood risk should take account for the impact of climate change over the lifetime of the development. SuDS techniques must be employed to ensure there is no increase in flooding elsewhere.

The uFMfSW dataset (Appendix B Figures 7a – 7f) should be used to indicate broad areas with a potential surface water flood risk. More detailed site investigations will also be required to determine local conditions and suitability of drainage techniques. Appendix B Figure 8 and Figure 9 should be used to provide an indication of areas where there may be a risk of groundwater flooding and where infiltration SuDS may be viable. The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular 'zones' of the area. These recommendations should form the basis for the site-specific FRA.

7.3.2 Proposed Development within Medium Probability Zone 2

For all sites within Medium Probability Flood Zone 2, a Level 2 Scoping FRA should be prepared based upon readily available existing flooding information, sourced from the Environment Agency. If a significant flood risk from other sources (e.g. surface water, groundwater or sewer flooding) is identified then a more detailed FRA should be prepared. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed throughout, for example through the provision of raised floor levels and the provision of planned evacuation routes or safe havens.

SuDS techniques must be employed on all sites in line with paragraph 103 of the PPG, regardless of the Flood Zone that they sit within. If a site is located within Flood Zone 2 or 3, where possible the SuDS features associated with that site should be located outside of high risk fluvial Flood Zones to ensure sufficient capacity during surface water events which coincide with fluvial flooding.

7.3.3 Proposed Development in Flood Zone 3a High Probability

All FRAs supporting proposed development within High Probability Flood Zone 3a should assess the proposed development against all elements of the Council's flood policy, and include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will require discussion with SMDC, the Environment Agency, SCC as the LLFA, ST and UU to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change), i.e. maximum water levels, flow paths and flood extents within the property and surrounding area.
    - The design life of the proposed development should be considered with respect to climate change as 100 years (up to 2115) for residential developments. Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
    - For sites within the floodplain of main rivers, applicants should consult the Environment Agency to obtain information on the modelled flood levels associated with these watercourses. Where this information is of suitable quality, modelled flood levels for the relevant annual probability events should be compared with site topographic information to more accurately determine the flood risk to the site.
- 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 risk, further investigation may be required. For example, where hydraulic modelling is not available for ordinary watercourses, the scope of the FRA should be increased to include modelling to ensure details of flooding mechanisms are fully understood and that the proposed development incorporates appropriate mitigation measures;

- The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment to be carried out by a suitably qualified engineer;
- Opportunities for new developments to deliver reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features;
- The FRA should consider the vulnerability of those that could occupy and use the development including arrangements for safe access. The FRA should also take account of the vulnerability classification (Table 6-1) and the status of the site in relation to the Sequential and Exception Tests;
- The localised risk of flooding that may occur. This is typically associated with local catchment runoff following intense rainfall;
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning;
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum;
- It is essential that developers thoroughly review the existing and future structural integrity of informal defences, if present, upon which the development will rely (i.e. over the lifetime of the development), and ensure that emergency planning measures are in place to minimise risk to life in the unlikely event of a defence failure. This would be particularly important for development that could potentially be affected as a result of a breach of any reservoirs or canals in the District.
- SuDS techniques must be employed to ensure no worsening of existing flooding problems elsewhere within the area;
- At all stages, the LPA, and where necessary the Environment Agency, and/or the Statutory Water Undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for Planning Applications.

7.4 Proposed Development in Flood Zone 3b Functional Floodplain

In line with the NPPF, development will not normally be allowed in the Functional Floodplain unless it is classified as a 'Water Compatible' or 'Essential Infrastructure' use. Table 6-1 from the NPPF (Section 6.2), details the type of developments classified as 'Water Compatible' or 'Essential Infrastructure.'

7.5 Guidance on Flood Risk Management Measures

7.5.1 Sequential approach within development sites

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development and to ensure flood risk is not increased elsewhere. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding. Whilst traditionally applied to the risk of river flooding, this approach should also be implemented when considering the risk of surface water flooding across a site.

7.5.2 Finished Floor Levels

Where developing in fluvial flood risk areas is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) land uses, is to ensure internal floor levels are raised a freeboard distance above peak flood water levels. Finished floor levels should be set a minimum of 600 mm above the 1% AEP (1 in 100 chance of flooding in any one year) plus climate change peak flood level. The peak flood water level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. In areas of surface water flood risk, finished floor levels should be set at 600 mm above the surrounding ground level as a precautionary measure unless evidence of the expected flood depths is provided.

The Environment Agency recommends finished flood levels are set at 600 mm above the 1% AEP plus climate change flood level for Less Vulnerable development in Flood Zones 2 and 3. Where this is not possible flood resilient/resistant measures should be incorporated to provide appropriate property-level protection. Requirements for a freeboard above the peak flood level for finished internal floor levels within Less Vulnerable commercial and industrial units vary, depending upon the proposals. For such land uses, finished internal floor levels may not be required to be raised. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site.

With respect to residential accommodation and in accordance with Tables 1, 2, and 3 of the PPG, basement accommodation, single storey accommodation, and multi-storey buildings with ground floor sleeping accommodation should not be permitted, or allocated, in Flood Zone 3. Sleeping accommodation should be restricted to the first floor or above to offer the required 'safe places'. However, internal ground floors below this level could be occupied by either Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).

Further consultation with the Environment Agency will therefore be required during the undertaking of any detailed FRA. For both Less and More Vulnerable developments where internal access to higher floors is provided, the associated plans showing this should be included within any site-specific FRA.

Hotels are classed as More Vulnerable land uses, however, where it is not viable to raise finished floor levels, internal access to higher floors must be provided to give safe refuge to all occupants during times of flood. Sleeping accommodation should be set a minimum of 300mm above the 0.1% AEP plus climate change peak flood level.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood proofing (resistance) measures are implemented up to an agreed level. There are also circumstances where flood proofing (resilience) measures should be considered first. These are described further below.

7.5.3 Basement Dwellings

Basement dwellings are classified as Highly Vulnerable and as such they are not permitted within Flood Zones 3a and 3b. They must pass the Sequential and Exception Tests should they be proposed for Flood Zone 2. Basement dwellings should therefore be discouraged within areas at risk of fluvial, surface water or groundwater flooding. Where they are constructed, access must be situated 300mm above the design flood level, and waterproof construction techniques should be employed to avoid seepage during flood events. An assessment of groundwater conditions will also be required to inform the structural integrity of the basement construction. Similar problems can also occur where excessive surface water ponding occurs close to the sides of buildings, leading to significant infiltration. Surface water flow paths should be assessed to ensure that this does not occur, and to inform the strategic location of SuDS and techniques to route flows around the edge of buildings.

FRAs should address the potential impact of large basements on groundwater flooding. Below-ground structures have the potential to impede the flow of groundwater, increasing flood risk up-gradient.

7.5.4 Flood Resistant and Resilient Design

In order to mitigate any potential flood damage, there are a range of flood resilient construction techniques that can be implemented in new developments. The Department for Communities and Local Government (CLG) have published a document 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[55], the aim of which is to provide guidance to developers and designers on how to improve the resilience of new properties in low or residual flood risk areas, through the use of suitable materials and construction details. Figure 7-1 provides a summary of different design strategies depending on the depth of floodwater that could be experienced.

[55] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction

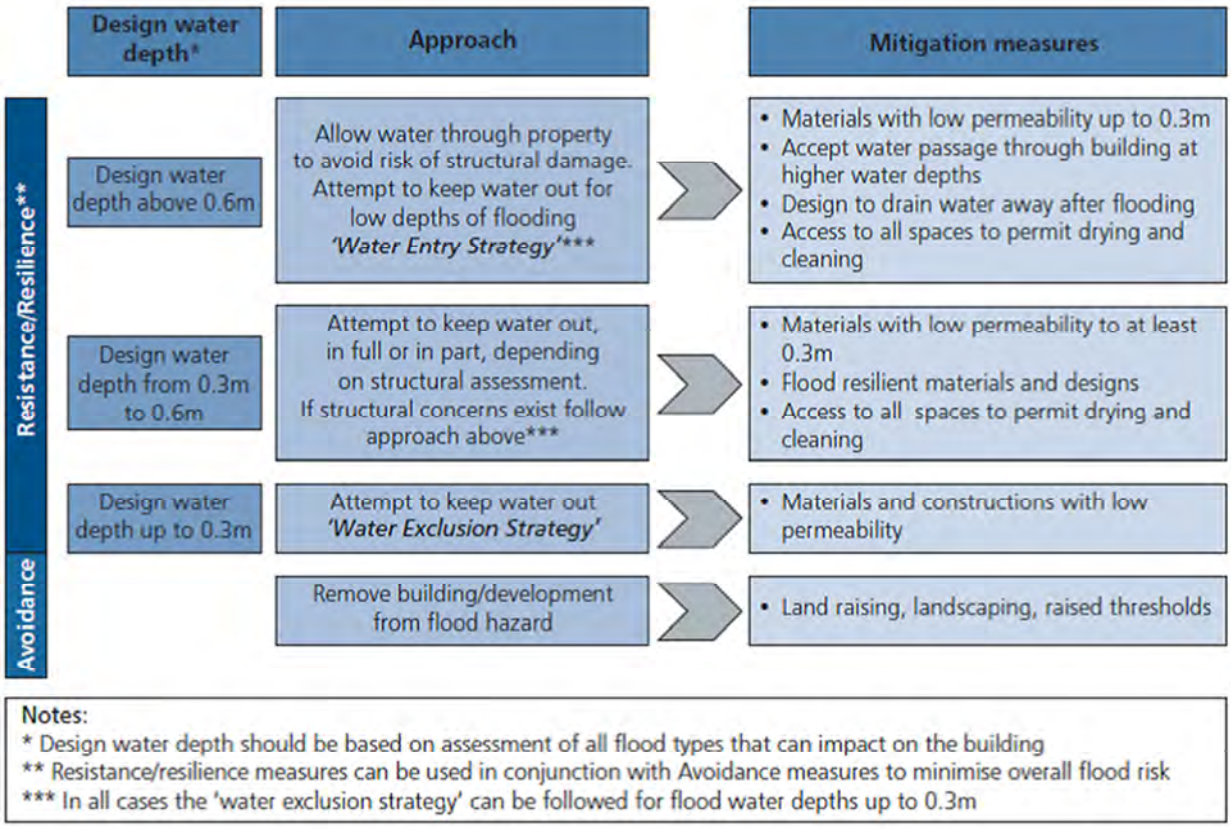

Figure 7-1: Rationale for Flood Resilient Design Strategies, Improving Flood Performance, (Figure 4.1 from CLG 2007)

A number of design strategies are detailed including the Water Exclusion Strategy and Water Entry Strategy. Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3 m.

For flood depths greater than 0.6 m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, i.e. the Water Entry Strategy.

The principle behind the Water Entry Strategy is not only to allow water through the property to avoid the risk of structural damage, but also to implement careful design in order to minimise damage and allow rapid re-occupancy of the building. The NPPF considers these measures to be appropriate for both changes of use and for Less Vulnerable uses where temporary disruption is acceptable and suitable flood warning is received.

Materials will be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 300 mm above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' (CLG, 2007).

Where finished floor levels cannot be raised to the recommended height due to ridge height restriction or disabled access, the reasons for this should be clearly stated and appropriate flood resilient/resistant measures should be provided to 300 mm above the 1% AEP plus climate change flood level.

7.5.5 Green Infrastructure and Urban Blue Corridors

Urban Blue Corridors present the opportunity to link into existing networks of Green Infrastructure to provide dynamic hydraulic and ecological corridors in the urban environment and provide multifunctional use. This can be done in tandem with delivering environmental, social and economic benefits.

Green Infrastructure is defined as *"a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities."*[56]

Definitions for Green Infrastructure vary in the degree to which they refer to 'Blue' infrastructure elements. The Natural England Green Infrastructure Guidance[57] recognises rivers and streams within a Green Infrastructure typology, whereas other definitions make specific reference to water resources forming part of the Green Infrastructure network. Green Infrastructure elements or assets include individual sites or broader features such as urban squares, city parks, nature reserves, brown/green roofs, private gardens, railway corridors and woodland. Most assets can contribute to surface water management. However, whilst Green Infrastructure takes into account flood risk management, it does not, at present, include overland flow paths.

By linking with Green Corridors and Infrastructure, Urban Blue Corridors offer the opportunity to help align with national environmental aspirations. For example, Natural England, in their Position Statement on Urban Areas[58], states that:

- The natural environment in towns and cities is fundamental to sustaining urban life and should be integral to the way in which urban areas are planned and managed;
- The distinctive fabric of the natural environment in towns and cities makes a major contribution to urban landscape and sense of place and should be valued, conserved and enhanced;
- The natural environment in towns and cities should underpin their adaptation to a rapidly changing climate and provide environmental security for communities; and

People should have opportunities to readily access high quality natural environment in urban areas in order to enjoy the broad range of environmental and social benefits it offers.

Where proposed sites contain a main river or ordinary watercourse, conservation and restoration of the river corridor should be incorporated into the site layout, and if necessary a fluvial management strategy developed. Where possible, the post development situation should be better in terms of flood risk compared to the existing situation, by providing space for water to include an allowance for climate change, as well as improve ecology, water quality and amenity. In these instances, it may not be necessary to undertake a Sequential Test for the site, if all development can be shown to be within Flood Zone 1.

7.5.6 Car Parks

Where car parks are specified as areas for the temporary storage of floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary. The Environment Agency recommends that in areas where under croft parking is provided, occupants should also sign up to flood alerts. Due to the nature of flood warnings, it is possible that under croft parking areas may have flooded before a flood warning has been issued.

7.5.7 Structures

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground.

7.5.8 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

[56] Department for Communities and Local Government (2008) Planning Policy Statement 12: Local Spatial Planning. *(Now redacted)*
[57] Natural England (2009) Green Infrastructure Guidance. Available at: http://publications.naturalengland.org.uk/publication/35033
[58] Natural England (24th February 2010) Natural England's Position on Urban Areas, Paper No. NEB PU19 11. Available at: http://www.naturalengland.org.uk/Images/NEBPU1911_tcm6-17024.pdf

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances.

For developments located in areas at flood risk the Environment Agency consider 'safe' access/egress to be in accordance with 'FRA Guidance for new Developments FD 2320'[59]. The requirements for safe access and egress from new developments are as follows in order of preference:

- Safe, dry route for people and vehicles;
- Safe, dry route for people;
- If a dry route for people is not possible, a route for people where the flood hazard, in terms of depth and velocity of flooding, is low and should not cause risk to people; and
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.

Flooding along the safe access/egress route should have a hazard no greater than very low in accordance with the Defra / Environment Agency guidance document FD2320 and entirely on publically accessible land. The route should be located entirely outside the 1% AEP plus climate change flood extent.

7.5.9 Floodplain Compensation Storage

Where proposed development results in an increase in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water and that it does not impact upon floodwater flow conveyance.

Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.

Floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity of the site and linked to the planning application. Floodplain compensation must be considered in the context of the 1 in 100 year (1% annual probability) flood level including an allowance for climate change.

The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, however, this would be subject to detailed investigations and agreement with the Environment Agency and SMDC to demonstrate that the proposals would improve and not worsen the existing flooding situation.

7.5.10 Flood Routing

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Potential overland flow paths should be determined through a detailed review of a sites' topography and that of neighbouring land uses, and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

[59] Defra and Environment Agency (2005) Flood Risk Assessment Guidance for New Development FD 2320

7.5.11 Riverside Development

Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works on, over, under or near a statutory main river (both open channels and culverted sections), flood or sea defence, or to make changes to any structure that helps control floods requires Environment Agency consent. This includes any works (including temporary) that affect flow within the channel of any main river (such as in channel structures or diversion of watercourses) or may impede any drainage work.

In addition, the Environment Agency seek an 8 metre wide undeveloped buffer strip alongside main rivers and behind flood defences, and would also ask developers to explore opportunities for river restoration as part of any development. A buffer zone of 5 metres alongside ordinary watercourses is encouraged by the Environment Agency.

As of 6 April 2012 responsibility for the consenting of works by third parties on ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the FWMA) has transferred from the Environment Agency to SCC as the LLFA. SCC now has responsibility for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. As with main rivers, this includes any permanent or temporary works that affect flow within the channel of any ordinary watercourse. Responsibility for consenting of third party works on main rivers is retained by the Environment Agency.

Consent is refused if the works would result in an increase in flood risk, a prevention of operational access to the watercourse, if they would damage an asset or cause bank instability issues and/ or they pose an unacceptable risk to nature conservation. Consent is required to ensure works do not increase flood risk, damage flood defences or harm the environment, fisheries or wildlife. Where development is proposed near a main river, we recommend that developers contact the Environment Agency as soon as possible to discuss their plans.

7.5.12 Flood Warning and Evacuation Plans

Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible.

For all development proposed in Flood Zones 2 or 3a, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

It may also be necessary to prepare a Flood Warning and Evacuation Plan for development in Flood Zone 1 where the area surrounding the site and/or any potential egress routes away from the site may be at risk of flooding during the 1% annual probability (1 in 100) flood event including an allowance for climate change.

Flood warning and evacuation plans should include:

- How flood warning is to be provided, such as:
  - Availability of existing flood warning systems;
  - Where available, rate of onset of flooding and available flood warning time; and
  - How flood warning is given.
- What will be done to protect the development and contents, such as:
  - How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
  - How services can be switched off (gas, electricity, water supplies);
  - The use of flood protection products (e.g. flood boards, airbrick covers);
  - The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
  - The time taken to respond to a flood warning.

- Ensuring safe occupancy and access to and from the development, such as:
  - Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
  - Safe access route to and from the development;
  - If necessary, the ability to maintain key services during an event;
  - Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
  - Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.); and
  - Whether flooding might occur without a warning e.g. breach or surface water flooding.

The Environment Agency has a tool on their website to create a Personal Flood Plan[60]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details.

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. The LPA is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with the local authority emergency planning staff.

[60] Environment Agency (2015) Tool 'Make a Flood Plan'. Available at: https://www.gov.uk/government/publications/personal-flood-plan

8 Guidance for the Application of SuDS

8.1 Introduction

The PPG, which accompanies the NPPF, indicates that priority should be given to the use of SuDS in new developments. Appropriate deployment of SuDS within a development can offer benefits in terms of reductions in flood risk, improvements to water quality, quicker replenishment of groundwater and improved visual amenity. If SuDS are not going to be used then sufficient evidence should be provided to explain why, and it should be shown that traditional drainage methods can provide benefits above those that can be provided by SuDS.

SuDS are typically softer engineering solutions inspired by natural drainage processes, such as ponds and swales, which manage water as close to its source as possible. Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the preferred system contributing significantly to each objective. Where possible SuDS solutions for a site should seek to:

i. Reduce flood risk (to the site and neighbouring areas),
ii. Reduce pollution, and
iii. Provide landscape and wildlife benefits.

These goals can be achieved by utilising a management plan incorporating a chain of techniques, as outlined in the Interim Code of Practice for Sustainable Drainage Systems[61], 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 systems from a number of sites (e.g. into a detention pond).

The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, 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. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be “traded” between developments.

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.). The SuDS Manual[62] identifies several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge.

- Infiltration: the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed baseflows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination,

[61] National SuDS Working Group (2004) Interim Code of Practice for Sustainable Drainage Systems
[62] CIRIA (errata 2007) SuDS Manual C697. http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

infiltration techniques are not suitable. Additionally shallow groundwater and low infiltration rates will prevent the application of infiltration SuDS.

- Detention/Attenuation: the slowing down of surface flows before their transfer downstream, usually achieved by creating a storage volume and a constrained outlet. In general, though the storage will enable a reduction in the peak rate of runoff, the total volume will remain the same, just occurring over a longer duration.
- Conveyance: the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.
- Water Harvesting: the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

8.2 Type of SuDS

SuDS designs should aim to reduce runoff by integrating storm water controls throughout the site in small, discrete units. Through effective control of runoff at source, the need for large flow attenuation and flow control structures becomes minimised.

As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development. Table 8-1 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS options and details their typical components.

Table 8-1: Typical SuDS Components

*(Y = primary process. * = some opportunities, subject to design)*

TECHNIQUE	DESCRIPTION	CONVEYANCE	DETENTION	INFILTRATION	HARVESTING
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.		Y	Y	*
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.	Y	Y		
Filter Strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and particulates.	*	*	*	
Swales	Shallow vegetated channels that conduct and/or retain water, and can permit infiltration when unlined.	Y	Y	*	
Ponds	Depressions used for storing and treating water.		Y	*	Y
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds. Based on geology these measures can also incorporate some degree of infiltration.	*	Y	*	Y
Detention Basin	Dry depressions designed to store water for a specified retention time.		Y		
Soakaways	Sub-surface structures that store and dispose of water via infiltration.			Y	
Infiltration Trenches	As filter drains, but allowing infiltration through trench base and sides.	*	Y	Y	
Infiltration Basins	Depressions that store and dispose of water via infiltration.		Y	Y	

TECHNIQUE	DESCRIPTION	CONVEYANCE	DETENTION	INFILTRATION	HARVESTING
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation. It is noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof (CIRIA C697).		Y		
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building, e.g. toilet flushing. It is noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvested water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.	*	*	*	Y

When planning drainage requirements for new developments, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

As well as treating water quality before discharge to watercourses and sewers it may be necessary for surface water to pass through a series of treatment stages before infiltration.

For further guidance on SUDS, the following documents and websites are recommended as a starting point:

- Staffordshire LLFA;
- Defra Non-statutory Technical Standards for SuDS (March 2015)[63];
- The NPPF and associated Planning Policy Guidance technical notes;
- The SuDS Manual – CIRIA C697 (2007) provides the best practice guidance on the planning, design, construction, operation and maintenance of SuDS and facilitates their effective implementation within developments.
- CIRIA C644 – Green Roofs (2007)[64] provides guidance on the design, construction and operation of Green Roofs. The guidance also describes how 'quick wins' for biodiversity can be achieved in the built environment by incorporating nesting and roosting boxes for bird, bats and other animals.
- Interim Code of Practice for Sustainable Drainage Systems[65], National SuDS Working Group, 2004.
- www.ciria.org.uk/suds/
- Defra / Environment Agency Preliminary Rainfall Runoff Management Rev E[66] provides guidance on surface water drainage strategy for the Environment Agency, LPAs and developers.

[63] DEFRA (March 2015). Non-statutory technical standards for sustainable drainage systems. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
[64] CIRIA (2007) Building Greener. Guidance on the use of green roofs, green walls and complementary features on buildings (C644)
[65] National SuDS Working Group. (2004). Interim Code of Practice for Sustainable Drainage Systems
[66] Defra / Environment Agency (2013). Rainfall runoff management for developments.

8.3 National SuDS Standards

A set of National non-statutory technical Standards[55] (NS) have been published which set the requirements for the design, construction, maintenance and operation of SuDS. The NS are intended to be used alongside the NPPF and PPG.

The NS that are of chief concern in relation to the consideration of flood risk to and from development relating to runoff destinations, peak flow control and volume control are presented below:

8.3.1 Peak Flow Control

SuDS NS2 – *"For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must not exceed the peak greenfield runoff rate for the same event".*

SuDS NS3 – *"For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event".*

8.3.2 Volume Control

SuDS NS4 – *"Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event".*

SuDS NS5 – *"Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event".*

SuDS NS6 – *"Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk".*

8.3.3 Flood Risk Within the Development

SuDS NS7 – *"The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event".*

SuDS NS8 – *"The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development".*

SuDS NS9 – *"The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property'"*

8.4 Use of SuDS in Staffordshire Moorlands

As part of this SFRA, a high level assessment of the suitability of using SuDS techniques across the District has been undertaken. The Environment Agency Groundwater Vulnerability Map shown on Appendix B Figure 9 is largely based on the BGS Infiltration SuDS Suitability dataset.

Given the greenfield nature of many of the potential sites in Staffordshire Moorlands, there are significant opportunities for the development sites to adopt source control and site measures that are consistent with an overarching regional SuDS policy.

Site geology should be taken into account when deciding on suitable SuDS measures. Some SuDS systems rely on infiltration which in areas of low permeability may be technically unviable. If SuDS using infiltration are to be used, permeability tests should therefore be carried out to establish infiltration rates.

Any surface water management system should be implemented in accordance with relevant policy and guidance such as NPPF, National SuDS Working Group (2004), BRE365, CIRIA C522 for SUDS, CIRIA 523 (SuDS Best Practice Manual) and CIRIA C697 (the SUDS Manual).

Four categories have been identified by the BGS for suitability for Infiltration SuDS:

1. **Highly compatible for Infiltration SuDS:** The subsurface is likely to be suitable for free-draining infiltration SuDS;
2. **Probably compatible for Infiltration SuDS:** The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions;
3. **Opportunities for bespoke infiltration SuDS:** The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions; and
4. **Very significant constraints are indicated:** There is a very significant potential for one or more geo-hazards associated with infiltration.

The review of the BGS Compatibility with Infiltration SuDS map and Environment Agency Aquifer Designation maps suggest that infiltration SuDS techniques are probably compatible in large areas across the District. Very significant constraints are shown along the river corridors of the River Churnet (both the Valley and its headwaters east of Tittesworth Reservoir), Cecilly Brook, Biddulph Brook, River Blithe and the Head of Trent. The BGS 'Depth to Water Table' map indicates that groundwater levels are likely to be shallow (<3 m) in these areas, likely to due to the low topography combined with the presence of superficial deposits, and therefore attenuation SuDS techniques may be more suitable.

The Environment Agency recommends that all new developments should incorporate SuDS, whereby infiltration systems should be the preferred means of surface water disposal, provided ground conditions are appropriate. Above ground attenuation such as balancing ponds should be considered in preference to below ground attenuation due to the water quality and biodiversity benefits they offer.

It should be noted that this is a high level assessment and only forms an approximate guide to infiltration SuDS suitability; an enhanced site investigation is required in all cases to confirm local conditions. The maximum likely groundwater levels should be assessed, to confirm that soakaways will continue to function even during prolonged wet conditions.

In addition any proposed infiltration SuDS should be located away from areas of historic landfill, known contamination or areas which are at risk of contamination. This is to ensure that the drainage does not re-mobilise latent contamination and exacerbate the risk to groundwater quality and down gradient receptors such as abstractors, springs and rivers. In such circumstances, a preliminary groundwater risk assessment may be required with the planning application.

8.5 Outline Planning Application Recommendations

To ensure a satisfactory consultation, SCC recommends the following information to be included in an outline planning application:

a) Site location and layout plans;

b) Topographical survey of the existing site's catchment to include contours at 1m interval and existing surface water flow routes, drains, sewers and watercourses;

c) Site plan showing areas of Main River and surface water flooding;

d) Flood Risk Assessment;

e) Site Drainage Strategy to include:

- SuDS proposals;
- Infiltration test results;
- Outfall locations and levels, including confirmation from relevant authorities that the proposed outfall location will be accepted;
- Rates of discharge including confirmation from relevant authorities that the proposed discharge rate will be accepted;
- On-site storage requirements including storage location indicated within the proposed development plan, confirmation that is it is to be located outside the existing 1% AEP+CC flood extent, and evidence that sufficient space is available; and

f) Maintenance, funding and operation proposals for the SuDS.

8.6 Full Planning Application, Reserved Matters, Discharge of Conditions Recommendations

To ensure a satisfactory consultation, the SCC recommends that the following information to be included in a full planning application, reserved matter and discharge of conditions:

a) Proposed site plan showing exceedance flow routes;

b) Drainage layout plan (to include SuDS, sewer, drains and watercourse);

c) A condition survey of any drainage assets, infrastructure or watercourse to be utilised;

d) Design calculations as necessary to demonstrate the functionality of the SuDS;

e) Detailed design drawings;

f) SuDS flow calculations (*.mdx files compatible with MicroDrainage software if that software has been used);

g) Cross sections including design levels;

h) Specification of materials;

i) Phasing of development including Construction Management Plan;

j) Construction phase Surface Water Management Plan;

k) Construction details;

l) Details of inlets and outlets and flow controls;

m) Whole life cycle costing for the SuDS to include replacement cost;

n) Details of the organisation responsible for the SuDS;

o) Details of funding arrangements for SuDS maintenance;

p) Maintenance and operation manual for the SuDS, to include physical access arrangements for maintenance and establishment of legal rights of access in perpetuity;

q) Health and Safety Risk Assessment for construction, operation and maintenance of the SuDS.

9 Summary and Recommendations

9.1 Site Allocation Process

The mapping outputs from this Level 1 SFRA Update should be used as an evidence base from which to direct new development to areas of low flood risk (Flood Zone 1). Where development cannot be located in Flood Zone 1, SMDC should use the flood maps to apply the Sequential Test to their remaining land use allocations.

Where the need to apply an Exception Test is identified, due to there being an insufficient number of suitable sites for development within zones of lower flood risk, the scope of the SFRA may need to be widened to a Level 2 assessment. The need for a Level 2 SFRA cannot be fully determined until SMDC has applied the Sequential Test. It is recommended that as soon as the need for an Exception Test is established, a Level 2 SFRA is undertaken by a suitably qualified technical expert or engineer so as to provide timely input to the overall plan making process.

9.2 Council Policy

The Local Plan for the District and supporting guidance documents should continue to include policies to:

- Protect the functional floodplain from development;
- Direct vulnerable development away from flood affected areas taking account of all flood sources;
- Ensure all new development is 'safe' for its lifetime. Dry pedestrian access to and from the development must be possible without passing through flood waters where the hazard is greater than "very low" according to Defra / Environment Agency guidance FD2320/TR2, and emergency vehicular access must be possible;
- Ensure that all new developments do not cause flood risk to be increased elsewhere;
- Promote the use of strategic, integrated and maintainable SuDS in all Flood Zones for both brownfield and greenfield sites, with space set-aside for SuDS; and
- Reduce flood risk from all sources where possible, for example through reduction of surface water runoff rates and volumes, increasing floodplain storage, setting development back from watercourses and de-culverting of watercourses.

9.3 Emergency Planning

It is recommended that SCC's MAFP is reviewed and, if necessary, updated in light of the findings of the SFRA to ensure that it is informed by the most up-to-date flood risk information available.

It is further recommended that SMDC works with the Environment Agency to promote the awareness of flood risk and encourage communities at risk to sign-up to the Environment Agency Flood Warning Service.

9.4 Future Updates to the SFRA

This SFRA has been updated building heavily upon existing knowledge with respect to flood risk within the District. The Environment Agency review and update the Flood Map for Planning (Rivers and Sea) on a quarterly basis and a rolling programme of detailed flood risk mapping is underway. Future new modelling of watercourses in the area will improve the current knowledge of flood risk within the District, and may marginally alter predicted flood extents within parts of the District in the future.

New information may influence future development management decisions within these areas. Therefore it is important that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the District. Appendix C provides examples of when an update to the Level 1 SFRA may be required.

9.5 Level 2 SFRA

This Level 1 SFRA will allow SMDC to assess their proposed site allocations using the Sequential Test. This will act as a 'sieving' process, allocating as many sites as possible to Flood Zone 1. Where it is found that some sites can only be placed in Flood Zones 2 and 3, an Exception Test will need to be applied as described in Section 6.4, and SMDC may wish to consider the preparation of a Level 2 SFRA.

A Level 2 SFRA should be viewed as rather more site specific than a Level 1 SFRA, addressing flood risk to potential development sites which have gone through the Sequential Test and have been located in Flood Zones 2 or 3. The data required for a Level 2 SFRA will therefore depend upon which, if any, of the council's final list of preferred sites remain in Flood Zones 2 and 3 following application of the Sequential Test and hence where an Exception Test needs to be applied.

It is important that a Level 2 SFRA considers the variation of flood risk within a Flood Zone due to flood risk management measures i.e. flood defences. This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding). If development is to be located behind defences, or downstream of flood storage reservoirs, it may be necessary to model constructional failure of the defence (breach) and water levels rising to exceed the level of the defence (overtopping). It is not necessary to carry out such scenarios behind all existing defences, if no new development is to be located behind these structures. In some instances improvements to existing flood defences may be required to manage residual flood risks. Here, the SFRA should include an appraisal of the extent of works to provide or raise the flood defence to appropriate standard.

Level 2 SFRA outputs typically include:

- Maps showing the distribution of flood hazard (as a function of flood depth and velocity) within Flood Zones;
- Guidance on appropriate policies for the development of sites which satisfy an Exception Test i.e. are safe for occupants / users over their lifetime, do not increase flood risk and where possible reduce flood risk overall; and
- Guidance on the preparation of FRAs for sites with varying flood risk across the Flood Zone.

Appendix A.
Data Register

The following register details the datasets that were used throughout the preparation of the Level 1 SFRA update.

*(*available to the public on the Environment Agency website)*

	DATASET	SOURCE	FORMAT	DESCRIPTION
Fluvial	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Environment Agency Geostore*	GIS Layer	A quick and easy reference that can be used as an indication of the probability of flooding from Main Rivers. The original Flood Map was broad scale national mapping typically using JFLOW modelling software that is generally thought to have inaccuracies. This is regularly updated with the result of new modelling studies. For those rivers where there is no updated modelling, the Flood Zones from JFLOW modelling may not provide an accurate representation of probability of flooding. 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 that on first inspection, suggest there is no flood risk.
	Detailed River Network (DRN)	Environment Agency Geostore*	GIS Layer	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and SCC have discretionary and regulatory powers.
	Historic Flood Map	Environment Agency Geostore	GIS Layer	A single GIS layer showing the extent of fluvial historic flood events created using best available information at time of publication. However, some of the data is based on circumstantial and subjective evidence. There is not always available metadata, e.g. date of flood event.
	Modelled flood outlines for the Cecilly Brook, River Blithe, Fors Brook and River Churnet.	Environment Agency	GIS Layer	Detailed and calibrated hydraulic model outlines. The Environment Agency applies the outcomes from such detailed modelling studies to update the Flood Map for Planning (Rivers and Sea) on a quarterly basis. Some watercourses have not been modelled (e.g. smaller tributaries). The flood risk from these is based on broad scale JFLOW modelling and therefore the flood risk from these cannot be as accurately assessed.
	Asset Information Management System (AIMS) for the District	Environment Agency	GIS Layer	Shows where there are existing defences, structures, heights, type and design standard. Only one such asset exists within the Staffordshire Moorlands District.
	Fluvial Flood Records	SSC	MS Excel Database	Historic records of fluvial flooding in the District held by SSC.

	DATASET	SOURCE	FORMAT	DESCRIPTION
Surface Water	'Updated Flood Map for Surface Water' dataset	Environment Agency Geostore*	GIS Layer	Provides an indication of the broad areas likely to be at risk of surface water flooding, i.e. areas where surface water would be expected to flow or pond. This dataset does not show the susceptibility of individual properties to surface water flooding.
	Surface Water Flood Records	SCC	MS Excel Database / GIS Layer	Historic records of surface water flooding in the District held by SCCs Flood and Water Management and Highways teams.
Groundwater	Groundwater Flood Records	SCC	MS Excel Database	Unconfirmed records of groundwater flooding in the held by the SCC.
	GIS layers of the geology across the District	SCC	GIS Layer	Illustrates bedrock and superficial geology across the District.
	GIS layer of Source Protection Zones	Environment Agency Geostore*	GIS Layer	Shows the areas where the groundwater is protected by the Environment Agency. The designation may not consider fractures in the strata at a greater radius where pollutants could reach the source protection zone.
	Aquifer Designation Maps for Bedrock and Superficial	Environment Agency website*	Website	Shows aquifer designations for bedrock aquifers. The designations identify the potential of the geological strata to provide water that can be abstracted and have been defined through the assessment of the underlying geology.
	GIS layer 'Areas Susceptible to Groundwater Flooding'	Environment Agency Geostore*	GIS Layer	Strategic-scale mapping indicating areas where groundwater emergence may occur.
Sewer	DG5 Register of sewer flooding incidents	Severn Trent Water Limited	MS Excel Database	Indicates individual properties that may be prone to flooding as have experienced flooding in the last 20 years due to hydraulic incapacity. However, given that ST target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding.
Artificial	GIS layer of canals and other artificial channels	Environment Agency Geostore	GIS Layer	GIS layer showing the centre line of the Caldon Canal and canal feeders within the District.
Other	LiDAR data (DTM, ASCII)	Staffordshire Moorlands District Council	GIS ASCII	Provides a useful basis for understanding local topography and the surface water flood risk in the area. Spatial resolution of 2m, resampled to 5m.
Emergency Planning	Flood Warning Areas	Environment Agency Geostore*	GIS Layer	Indicates which areas are covered by the flood warning system.

	DATASET	SOURCE	FORMAT	DESCRIPTION
Planning	OS Mapping of SMDC administrative area (1:10K, 1:25K, 1:50K and 1:250K)	Staffordshire Moorlands District Council	GIS format	Provides background mapping to other GIS layers.
	GIS layer of SMDC administrative boundary	Ordnance Survey website	GIS format	Defines the administrative area of the District for mapping purposes.

Appendix B.
Level 1 SFRA Flood Risk Mapping Figures

FIGURE NUMBER	FIGURE TITLE
1 (Inset Maps 1a- 1f)	Level 1 SFRA Potential Development Sites
2	Topography
3	Surface Waterbodies
4	Historic Flooding Incidents
5a	Aquifer Designation Map - Bedrock Geology
5b	Aquifer Designation Map - Superficial Geology
6 (Inset Maps 6a – 6f)	Fluvial Flood Zones
7 (Inset Maps 7a – 7f)	Updated Flood Map for Surface Water
8	Areas Susceptible to Groundwater Flooding
9	Groundwater Vulnerability and Source Protection Zones
10	Historical Sewer Flooding Incidents
11	Flood Alert and Flood Warning Areas

Appendix C.
SFRA Update Checklist

1. A significant flood event occurs, following which relevant information should be detailed within an addendum to the Level 1 SFRA. The following information should be included:
   - The mapped extent of the flooding;
   - The date on which the event occurred;
   - The source of the flooding;
   - If known, the return period of the flood event – the likelihood of an event of the same magnitude occurring in any given year;
   - Any amendments to Flood Zone 2 and 3 carried out by the Environment Agency as a result of the flooding.

2. The NPPF or PPG are amended, with subsequent impacts on the approach to flood risk, for example:
   - An amendment is made to the application of the Sequential or Exception Test;
   - An amendment is made to the definition of fluvial Flood Zones;
   - Land use vulnerability definitions, presented in the PPG, are amended;
   - The approach to management of SuDS is amended.

3. The Environment Agency releases updates or amendments to its detailed modelling of the Cecilly Brook, River Blithe, Fors Brook and River Churnet, or amends its standing advice. An update would be required if:
   - Updates to the Cecilly Brook, River Blithe, Fors Brook and River Churnet models alter the 1 in 20/25 year (defended), 1 in 100 year (undefended), 1 in 100 year plus climate change (defended) or 1 in 1000 year (undefended) outline. If this is the case Flood Zone 3b, Flood Zone 3, Flood Zone 3 with climate change and Flood Zone 2 should be re-mapped within the Level 1 SFRA;
   - If any other flood risk data is updated, such that the SFRA does not provide the most relevant and up-to-date information;
   - Environment Agency standing advice is altered so that it is no longer in-line with Flood Risk Management Policy Considerations, or other guidance within this Level 1 SFRA. Should this be the case, it is recommended that the Environment Agency is consulted.

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