South Kesteven District Council Strategic Flood Risk Assessment

South Kesteven District Council

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Revision	Revision date	Details	Authorized	Name	Position
01	March 2017	Updated to reflect EA consultation comments		Jo Somerton	Senior Flood Risk Consultant
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List of Acronyms

Acronym	Definition
ABDs	Areas Benefitting from Defence
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
AOD	Above Ordnance Datum
AStGWF	Areas Susceptible to Groundwater Flooding
CDAs	Critical Draiange Areas
CFMP	Catchment Flood Management Plan
DCLG	Department for Communities and Local Government
FCERM	Flood and Coastal Erosion Risk Management
FRA	Flood Risk Assessment
FWD	Floodline Warnings Direct
FWMA	Flood and Water Management Act
GAAP	Grantham Area Action Plan
IDB	Internal Drainage Board
LCC	Lincolnshire County Council
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LFRMS	Local Flood Risk Management Strategy
LPA	Local Planning Authority
FRMPs	Flood Risk Management Plan's
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
PPS	Planning Policy Statement
RBMPs	River Basin Management Plans
RFCC	Regional Flood and Coastal Committee
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SKDC	South Kesteven District Council
SPZs	Source Protection Zones
SSSI	Sites of Scientific Interest
SuDS	Sustainable Draiange Systems
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive

1. Introduction

1.1 Terms of Reference

AECOM was commissioned by South Kesteven District Council (SKDC) in October 2016 to review and revise their Level 1 and Level 2 Strategic Flood Risk Assessments (SFRAs). This report comprises the updated Level 1 SFRA.

1.2 Project Aims and Objectives

The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance for Flood Risk and Coastal Change (PPG)[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.

In 2004 Bullen Consultants was commissioned by SKDC to undertake a SFRA for the whole district in accordance with national guidance available at that time. This assessment also considered some 33 specific sites which had been identified by Council Officers as possible areas for development in the future. This piece of work was subsequently signed off by the Environment Agency. In 2009 Entec produced an updated SFRA in accordance with PPS25: Development and Flood Risk. In 2010 a Level 2 SFRA was produced to provide an additional, more detailed flood risk evidence base to inform the Site Allocation Development Plan Document and the Grantham Area Action Plan (GAAP). The 2010 SFRA utilised available information provided by the Environment Agency and considered all sources of flooding in the areas where there is a risk of flooding across South Kesteven. Potential allocation sites were plotted to ascertain their relationship to the flood zones.

Since the preparation of the 2009 and 2010 SFRA reports, there have been a number of further changes in legislation and guidance relating to planning and flood risk, including the introduction of the Localism Act in 2011 and the NPPF in 2012, the latter of which was introduced following the revocation of the Planning Policy Statements in 2010. These legislative changes were intended to create a more locally orientated planning system.

The Flood and Water Management Act (FWMA) attained royal assent in 2010, with the intention of enabling the provision of more effective flood management. As such, Lincolnshire County Council (LCC) is designated a Lead Local Flood Authority (LLFA) and has significant duties and powers in relation to flooding from local sources, specifically surface water, groundwater and Ordinary Watercourses. The Environment Agency has a strategic overview role in flood risk management and retains responsibility for leading and coordinating the management of flood risk associated with Main Rivers and the sea.

As well as legislative and planning policy changes, a number of new and revised datasets have been made available since the release of the previous SFRA, including the Environment Agency's updated Flood Map for Surface Water (RoFSW), which can be used by LPAs for the development of SFRAs. SKDC have also commissioned a number of new studies and strategy documents which have been used to inform the SFRA, including their emerging Local Plan and Water Cycle Study Update.

The purpose of the revised Level 1 SFRA is to collate and analyse the most up to date readily available flood risk information for all sources of flooding, to provide an overview of flood risk issues across the District. This will be used by SKDC to inform the application of the Sequential Test for future site allocations. The revised Level 2 SFRA will provide more detailed information regarding the nature of flood risk to enable further assessment of those sites where the Exception Test may be required.

The objectives of the SFRA update are to:

- Provide a Level 1 SFRA in accordance with the requirements of the NPPF and the associated PPG.

[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/

- Particular regard should also be given to changes in river flows and river levels and the effect of climate change. The SFRA should take into account the fact that the Environment Agency is not obliged to maintain flood defences and advice relating to Hazard Mapping Models.
- Provide the Council with sufficient information to allow the Sequential Test to be applied to site selection and to enable SKDC to prepare appropriate policies for the management of flood risk within the Local Plan and inform the Sustainability Appraisal process of policies within the Local Plan.
- The SFRA should provide definitive and up to date flood zones for inclusion on the Local Plan Policies Map.

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), see **Section 8**. When considering the requirements of site specific FRAs, reference should also be given to LCC's SuDS Adoption Guidance[3].

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:

- Section 2: Study Area Overview;
- Section 3: Legislative and Planning Policy Context;
- Section 4: Level 1 SFRA Assessment Methodology;
- Section 5: Flood Risk Sources within SKDC;
- Section 6: Flood Risk Management Measures;
- Section 7: Guidance on the Application of the Sequential and Exception Tests;
- Section 8: Guidance for Preparing Site Specific FRAs;
- Section 9: Flood Risk Management Policy Recommendations;
- Section 10: Summary and Recommendations;
- Appendix A: Data Register;
- Appendix B: Level 1 SFRA Flood Risk Mapping Figures; and
- Appendix C: Site Assessment Database Attributes.

Section 5 provides a strategic assessment of flood risk from all sources within the SKDC administrative area and should be read in conjunction with the suite of flood maps contained within Appendix B. The methodology used to undertake this assessment can be found in Section 4.

The strategic assessment of flood risk presented in Section 5 will inform the Sequential Test carried out by SKDC. SKDC is required to carry out the Sequential Test when allocating future development sites as part of the drafting process of the Local Plan. Section 7 provides detailed guidance on the application of the Sequential Test, including how developers should promote the development of Windfall Sites.

It should be noted that this document is strategic in nature and only provides an overview of flood risk within the SKDC administrative area. The document should be used as a starting point for developers and SKDC Development Management Officers to gain an understanding of flood risk across the County. SKDC should ensure that each planning application is supported by an appropriate site-specific FRA, where required by the NPPF, PPG and this Level 1 SFRA. Section 8 provides guidance for prospective developers and SKDC on the contents of a site-specific FRA.

Section 9 outlines a number of flood risk management objectives and policy considerations which may be adopted by SKDC as formal policies in the Local Plan.

1.4 Partner Organisations

Several organisations are involved in development and flood risk management activities across the District. These organisations and their respective roles are discussed below:

[3] Lincolnshire County Council (2016) *Sustainable Drainage Systems (SUDS).* Available at : https://www.lincolnshire.gov.uk/residents/environment-and-planning/flood-risk-management/sustainable-drainage-systems-(suds)/103051.article

Lincolnshire County Council is the designated LLFA for Lincolnshire under the FWMA[4]. Under the FWMA, LLFAs are responsible for managing flood risk from local sources, specifically surface water, groundwater and Ordinary Watercourses. They are required to prepare and maintain a strategy for local flood risk management in their areas, maintain a register of assets, investigate significant local flooding incidents, act as a statutory consultee of the LPA with regard to SuDS (Sustainable Drainage Systems) and play a lead role in emergency planning and recovery after a flood event. Main River and coastal flooding remain the responsibility of the Environment Agency. LLFAs should encourage local communities to participate in local flood risk management[5].

South Kesteven District Council is the LPA for the District. The District Council is a key partner in planning local flood risk management and can carry out flood risk management works on minor watercourses, working with LLFAs and others, including through taking decisions on development in their area which ensure that risks are effectively managed. As the LPA, the Council is responsible for the development of long term strategic plans as well as the appraisal of planning applications to ensure future development meets the requirements of these locally set strategic policies[4]. Under the Civil Contingencies Act, the District Council has emergency planning functions during flood events as a Category 1 responder.

The **Environment Agency** has a strategic overview role for all sources of flooding and coastal erosion which includes developing strategic plans, providing the necessary evidence base and advice to inform Government policy and providing a framework to support local delivery, under the Water Resources Act.

Within SKDC, the Environment Agency has operational responsibility for managing flood risk associated with Main Rivers and reservoirs and is a statutory consultee for any development proposed within Flood Zone 2 or 3 or works in the bed of or within 20m of the top of a bank of Main River (this is different than the 8m documented in the Environmental Permitting Regulations for Flood Risk Activities[6] (EPR)). The Environment Agency regulate the EPR which is a risk-based framework for controlling works which could increase flood risk.
The Environment Agency is continually improving and updating their Flood Map for Planning (Rivers and Sea)[7] and has permissive powers to carry out flood defence works, maintenance and operational activities for these assets under the Water Resources Act. However, overall responsibility for maintenance lies with the riparian owner.

As part of taking a strategic overview for all sources of flooding the Environment Agency are involved in strategic flood risk mapping projects, such as the national mapping of surface water flood risk. The Environment Agency also has a key role in allocation of funding for Flood and Coastal Erosion Risk Management (FCERM) projects.

Anglian Water has a duty as a statutory undertaker to provide clean and waste water services across the County and is responsible for the management, maintenance and operation of flood control structures associated with their operational sources. Water Companies are defined as a Risk Management Authority (RMA) within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. As part of this role they are required to make sure their systems have the appropriate level of resilience to flooding, maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and provide advice to LLFAs on how water and sewerage company assets impact on local flood risk[4].

Internal Drainage Boards are independent public bodies responsible for managing water levels and reducing the risk from flooding within their districts. Each Internal Drainage Board (IDB) operates within a defined area, known as a Drainage District. They are made up of elected members who represent land occupiers, and others nominated by local authorities who represent the public and other interest groups. Under the Land Drainage Act 1991, each IDB exercises a general power of supervision over all matters relating to water level management within its district. IDBs also have a series of bylaws relating to the management of watercourses and can designate features and structures within their district which relate to managing flood risk.[8]

[4] Local Government Association. 2012. *Managing flood risk: roles and responsibilities*. Available at: https://www.gov.uk/guidance/flood-risk-management-information-for-flood-risk-management-authorities-asset-owners-and-local-authorities

[5] Environment Agency. 2014. *Flood risk management: information for flood risk management authorities, asset owners and local authorities.* Available at: http://www.local.gov.uk/local-flood-risk-management/-/journal_content/56/10180/3572186/ARTICLE

[6] Environment Agency, 2016. *Flood risk activities: environmental permits guidance.* Available at: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

[7] Environment Agency Flood Map for Planning. Available at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=floodmap&layerGroups=default&lang=_e&ep=map&scale=7&x=531500&y=181500#x=527545&y=186560&lg=1,2,10,&scale=5

[8] ADA. 2016. *Internal Drainage Boards*. Available at: http://www.ada.org.uk/about_idbs.html

IDBs are not statutory consultees in the Planning Application process undertaken by the Local Planning Authority. However, IDBs will endeavor to make comment on weekly Planning Applications in relation to Land Drainage Act 1991 Section 23 and Section 66 (byelaws) related consent requirements.

The following IDBs are located within the South Kesteven District - Welland and Deeping IDB, Upper Witham IDB, Black Sluice IDB, Witham First District IDB and Trent Valley IDB.

Highways Authorities have the lead responsibility for providing and managing highway drainage and roadside ditches under the Highways Act 1980. To manage these risks, as set out in the national strategy, highways authorities will need to work effectively with the Environment Agency, LLFAs and district councils to ensure their flood management activities are well coordinated[4].

2. Study Area and Background

The study area, as shown below in Figure 1 is defined by the administrative area of SKDC; it lies to the south west of Lincolnshire. South Kesteven is bordered to the north by Newark and Sherwood and North Kesteven, to the east by Melton and Rutland, to the south by Peterborough and to the west by South Holland.

SKDC covers an area of approximately 969.5km^2, with a population of around 138,000. Grantham is the main town and administrative centre of the District. There are three other market towns located within the district, Stamford, Bourne and The Deepings and over 100 villages and hamlets. In total, approximately 60% of the population lives in the District's market towns with the other 40% residing in the villages and countryside.

South Kesteven is predominantly rural, with large areas of open farmland, and has approximately 2,194 ha of ancient woodland. The District is characterised by flat fenland in the east, gently undulating central limestone Uplands and more regulated field patterns to the north of the neighbouring Trent and Belvoir Vale. The District has 27 nationally important Sites of Scientific Interest (SSSI) and two Natura 2000 sites).

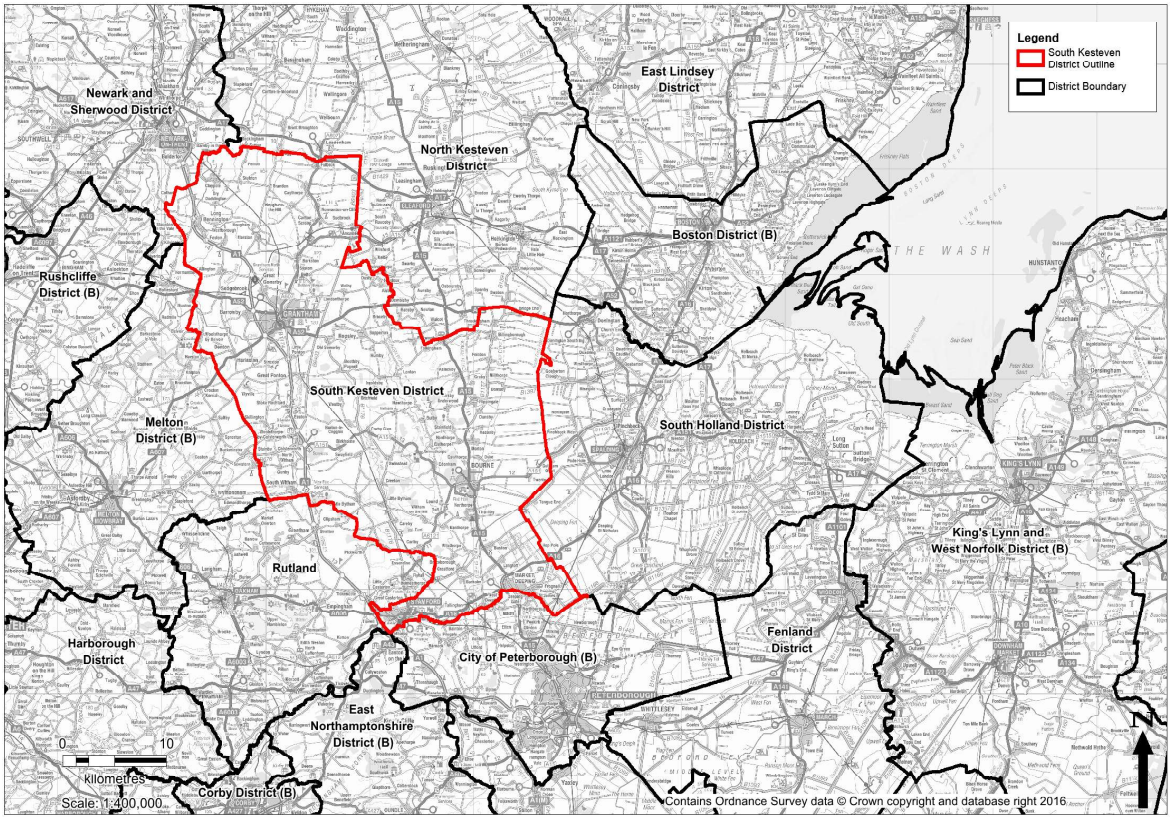


Figure 1.1. SKDC Study Area

2.1 Topography

The topography of the District can be seen in Appendix B, Figure 1. As stated above the east of South Kesteven is characterised by low lying Fenland, with ground levels in the area ranging from 1m Above Ordnance Datum (AOD) to 30m AOD. The central area of the district between the A15 and Grantham is characterised by gently undulating limestone uplands. The ground levels within the central region range from 40m AOD to 150m AOD around Stainby and Great Ponton. To the north west of Grantham ground levels can be seen to gradually decrease from 70m AOD to 10m AOD at the northern boundary, allowing more regulated field patterns to be seen.

2.2 Geology and Hydrogeology

The bedrock geology of the study area is presented in Appendix B Figure 2 and consists of the Kellaways Formation and Oxford Clay Formation (Mudstone, Siltstone and Sandstone) to the east of the East Glen River,

the Great Oolite Group (Sandstone, Limestone and Argillaceous Rocks) between the East Glen River and the West Glen River, the Inferior Oolite Group (Limestone, Sandstone, Siltstone and Mudstone) between Grantham and the West Glen River and Lias (Mudstone, Siltstone, Limestone and Sandstone) to the north west of Grantham.

Appendix B Figure 3 shows the District to be underlain by several aquifers, the aquifer boundaries can be seen to coincide with the changing bedrock geology across the district. The east of the District is underlain by a Secondary A aquifer within the Kellaways and Oxford Clay Formations. The central area of the District is underlain by a Principal Aquifer that coincides with the Great and Inferior Oolite Groups. To the north west of Grantham, the district is underlain by a mix of Secondary A, Secondary B and Secondary Undifferentiated aquifers that coincide with the Lias Group. Secondary A aquifers are capable of supporting water supplied at a local, rather than a strategic scale. Principal Aquifers support water supply at a strategic scale. As such, there are a number of Source Protection Zones (SPZs) within this area.

Appendix B Figure 4 indicates that superficial deposits overlay bedrock across the district. In the east of the district, the Kellaways and Oxford Clay Formations are overlain by superficial deposits of Peat and Undifferentiated River Terrace Deposits. The Great and Inferior Oolite Groups between Grantham and Bourne are overlain by superficial deposits of Till. To the north west of Grantham, the Lias group is primarily overlain by Alluvium. Appendix B, Figure 5 indicates the areas of Alluvium and River Terrace Deposits coincide with Secondary A superficial aquifers and the area of Till coincide with a Secondary Undifferentiated superficial aquifer.

2.3 Watercourses

SKDC falls across three river catchments and contains several Main Rivers and Ordinary Watercourses. Figure 2-2 shows the location of the Main Rivers and their respective catchments in relation to SKDC's administrative boundary. For a more detailed illustration of the Main River and Ordinary Watercourses network, as well as the large surface water bodies, refer to Figure 6 of Appendix B. The majority of the district is covered by the Welland and Witham catchments; the remainder is covered by a tributary of the River Trent.

The River Witham catchment extends across the majority of the County, covering approximately 557.4 km^2 (59%). The River Welland catchment covers an area of 369km^2 (39%). The River Trent catchment is located to the north west of the district and covers an area of 13.08km^2 (2%).

The Main Rivers (as defined by the Environment Agency) include:

- The River Witham, with tributaries of the:
  - Cringle Brook
  - Running Furrows
  - Honington Beck
  - Foston Beck
  - Ease Drain
  - Western Drain
  - Shire Dyke
  - Sutton Dyke
  - River Brant
- The River Welland, with tributaries of the:
  - River Gwash
  - River Glen
    - West Glen River
    - East Glen River
    - Bourne Eau
- The River Devon

A catchment approach to flood risk management should be considered as multiple authorities operate across the catchments.

3. Legislative and Planning Policy Context

3.1 Introduction

This Section provides an overview of the legislative and planning policy context specific to the updated Level 1 SFRA for South Kesteven. The information presented in the SFRA should be used by SKDC to establish robust policies in relation to flood risk as part of their emerging Local Plan and used to guide responses to applications for development within areas of flood risk.

Figure 3-1 provides a summary of the key documents that are reviewed within this section. The figure demonstrates that the main driver for the SFRA is the NPPF[9] and highlights the multi partnership approach to flood risk management across the District.

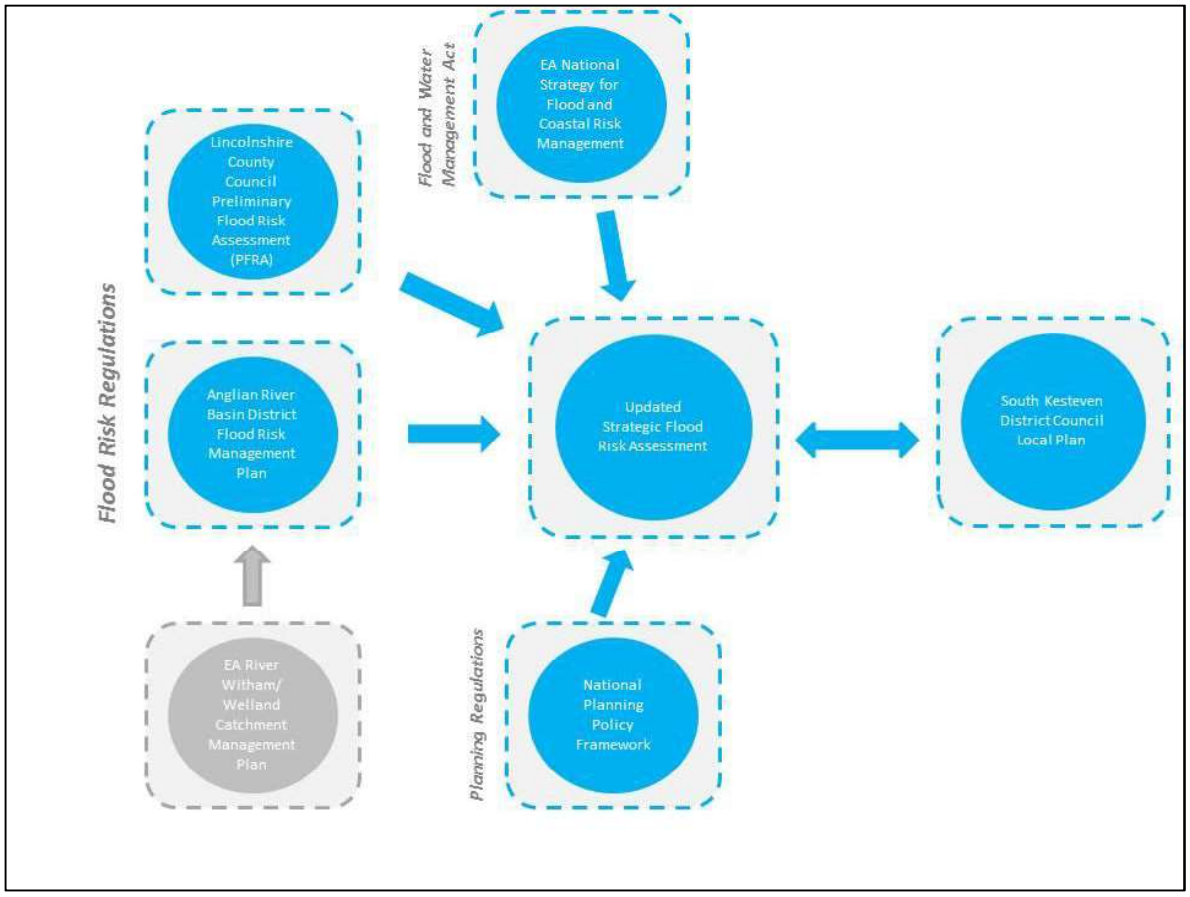


Figure 3-1: Summary of Legislative and Planning Context

3.2 National Policy and Legislation

3.2.1 National Planning Policy Framework

The NPPF was published on 27th March 2012 together with accompanying Technical Guidance[10]. The NPPF superseded most of the previous Planning Policy Statements (PPS) and Planning Policy Guidance. However, the NPPF did not revoke PPS25: Development and Flood Risk Practice Guide[11], although this was later superseded on the 6th March 2014 along with the NPPF Technical Guidance, by the Flood Risk and Coastal Change[12] section of the Planning Practice Guidance.

[9] Department for Communities and Local Government. 2014. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
[10] Department for Communities and Local Government. 2014. *Technical Guidance to the National Planning Policy Framework*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6000/2115548.pdf
[11] Department for Communities and Local Government. 2009. *Planning Policy Statement 25: Development and Flood Risk Practice Guidance*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7772/pps25guideupdate.pdf
[12] Department for Communities and Local Government. 2014. *Flood Risk and Coastal Change Planning Practice Guidance*. Available at: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/

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 Chapter 8 of this report.

3.2.1.1 Planning Practice Guidance (2014)

The NPPF is supported by a series of Planning Practice Documents referred to as the PPG. The PPG: Flood Risk and Coastal change document outlines how LPAs should develop and use SFRAs, (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. 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 and LLFAs.

3.2.1.2 Planning Practice Guidance: Climate Change (2016)

As discussed above, the PPG delivers a framework for the assessment of flood risk across England and provides guidance on the consideration of climate change within the planning system, making available uplift factors for river flows and rainfall estimates to simulate the future effects global climatic change and the impact this will have on river flows and rainfall intensity.

This guidance was updated and replaced in February 2016 by the Environment Agency Flood Risk Assessments: Climate Change Allowances[13] document, which provides catchment / region specific uplift factors for three future scenarios:

- Total potential change anticipated for the '2020s' (2015 to 2039);
- Total potential change anticipated for the '2050s' (2040 to 2069);
- Total potential change anticipated for the '2080s' (2070 to 2115).

[13] Department for Communities and Local Government. 2016. *Flood Risk Assessments: Climate Change Allowances.* Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Within each of the three scenarios, the estimates can be further divided into Central, Higher Central and Upper End; the specific scenario chosen should be reflective of the developments vulnerability and potential to impact flood risk elsewhere.

3.2.1.3 NPPF Guidance SuDS Policy (April 2015)

Sustainable Drainage Systems (SuDS) provide an approach to managing direct rainfall and surface water through replication of the grounds natural drainage parameters. The approach aims to manage flow rates and runoff volumes emitted from a site, providing a downstream flood risk and water quality benefit.

Following a consultation by Defra on the delivery of SuDS[14], in April 2014, the Department for Communities and Local Government (DCLG) issued a Written Ministerial Statement[15] outlining the Government's response regarding the future of SuDS. This was followed by a consultation exercise carried out in December 2014[16] by DCLG on the proposal to make LPAs statutory consultees for planning applications with regards to surface water management. The Government's formal response was published in March 2015[17]. The PPG has subsequently been amended to reflect the new approach to implementation of SuDS in development. The new approach supersedes Schedule 3 of the FWMA, which refers to LLFAs as SuDS Approval Bodies.

From 6th April 2015, LLFAs such as LCC must ensure that SuDS are implemented within all major developments and where appropriate, through the use of planning conditions or planning obligations, clear arrangements are in place for their ongoing maintenance over the lifetime of the development. The legislation also encourages the use of SuDS in minor developments.

As an LPA, SKDC is the statutory consultee for SuDS applications and must be consulted on the drainage elements of planning applications for major development to ensure they conform to necessary national and local SuDS standards.

3.2.2 Flood and Water Management Act 2010

In response to the severe flooding across large parts of England and Wales in summer 2007, the Government commissioned Sir Michael Pitt to undertake a review of current flood risk management practices. The Pitt Review – Learning Lessons from the 2007 Floods[18], and subsequent progress reviews outlined the need for changes in the way the UK is adapting to the increased risk of flooding and the role different organisations have to deliver this function.

The FWMA enacted by Government in response to The Pitt Review in 2010 designated County Councils and Unitary Authorities such as LCC as LLFAs. Under the act LCC has responsibilities to lead and co-ordinate local flood risk management from the following sources: surface water, groundwater, Ordinary Watercourse and land drainage ditches.

The FWMA also formalises the flood risk management roles and responsibilities of other organisations including the Environment Agency, statutory sewerage undertakers and highways authorities establishing them as Risk Management Authorities (RMAs). The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

3.2.3 Flood Risk Regulations 2009

As well as the duties under the FWMA to prepare a Local Flood Risk Management Strategy (LFRMS) and Flood Risk Management Plans, LLFAs have legal obligations under the EU Floods Directive,[19] which was transposed

[14] Department for the Environment Food and Rural Affairs; Department for Communities and Local Government. 2014. *Delivering Sustainable Drainage Systems: Consultation.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/399995/RFI7086_sud_consult_doc_final.pdf

[15] Department for Communities and Local Government. 2014. *House of Commons Written Statement (HCWS161) Sustainable Drainage Systems.* Available at: http://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

[16] Department for Communities and Local Government. 2014. C*hanges to statutory consultee arrangements for the planning application process.* Available at: https://www.gov.uk/government/consultations/planning-application-process-statutory-consultee-arrangements

[17] Department for Communities and Local Government. 2015. *Further changes to statutory consultee arrangements for the planning application process: Government response to consultation.* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389215/Further_changes_to_statutory_consultee_arrangements_for_the_planning_application_process_-_Consultation.pdf

[18] The Cabinet Office. 2008. *The Pitt Review: Learning Lessons 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

[19] Environment Agency. 2009. *Flood Risk Regulations*. Available at: http://webarchive.nationalarchives.gov.uk/20140328084622/http:/www.environment-agency.gov.uk/research/planning/125459

into UK Law through the Flood Risk Regulations 2009[20] ('the Regulations'). In 2011, LLFAs prepared Preliminary Flood Risk Assessments to meet their legislative duties under the Regulations.

3.2.4 Water Framework Directive (2000)

SKDC have a duty to consider the Water Framework Directive (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[21]. The WFD was transposed into UK national law through The Water Environment Regulations 2003[22], and states that SKDC 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 2021.

3.2.5 National Strategy for Flood and Coastal Erosion Risk Management

In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England. Whilst this strategy has been developed by the Environment Agency, it 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. It also aims to encourage more effective risk management by enabling people, communities, business and the public sector to work together to:

- Ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- Set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risks;
- Encourage innovative management of risks taking account of the needs of communities and the environment;
- Ensure that emergency responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and,
- Ensure informed decisions are made on land use planning.

The Environment Agency's 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities'[23] guidance is a supporting note for the National FCERM Strategy which outlies the climate change allowances for fluvial flood flows and extreme rainfall events.

The 2016 version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using the UK Climate Projections (UKCP09) data, to produce more representative climate change allowances for river flood flows and extreme rainfall for each of the river basin districts in England. It is essential that land use planning decisions consider the impact of a changing climate where appropriate both now and into the future.

3.3 Relevant Local Policy and Evidence

3.3.1 Anglian River Basin District Flood Risk Management Plan 2015 – 2021

Under EU Regulations, the Environment Agency is required to prepare Flood Risk Management Plan's (FRMPs) for all of England covering flooding from Main Rivers, the sea and reservoirs. As such, the Anglian FRMP[24] has

[21] European Union. 2000. *Water Framework Directive.* Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT
[22] 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
[23] Environment Agency. 2016. *Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf.

been published by the Environment Agency and sets out the proposed measures to manage flood risk in the River Welland and River Witham Catchments from 2015 to 2021 and beyond. Only 2% of the District falls within the River Trent catchment, which falls under the Humber FRMP.

3.3.2 Anglian (Northern) Regional Flood and Coastal Committee

SKDC falls within the Anglian (Northern) Regional Flood and Coastal Committee (RFCC) area. Although called and RFCC the Anglian (Northern) RFCC only covers Lincolnshire and Northamptonshire. The RFCC is a committee established by the Environment Agency under the FWMA 2010 that brings together members appointed by LLFAs (such as LCC) and independent members with relevant experience for 3 purposes:

- To ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines;
- To encourage efficient, targeted and risk-based investment in flood and coastal erosion risk management that represents value for money and benefits local communities; and,
- To provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to build understanding of flood and coastal erosion risks in its area.

3.3.3 Catchment Flood Management Plans

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. Whilst not entirely superseded by the FRMP, CFMPs complement the later FRMPs and RBMPs prepared for the District and region respectively.

SKDC falls within the Environment Agency's CFMP area for the River Welland[25] and the River Witham[26], where the visions and preferred policy for these areas are:

- Welland Catchment Sub Areas 1 and 2, Policy Option 2: "Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions".
- Welland Catchment Sub Area 6, Policy Option 3: "Areas of low to moderate flood risk where we are generally managing existing flood risk effectively".
- Witham Catchment Sub Area 1, Policy Option 2: "Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions".
- Witham Catchment Sub Area 2, Policy Option 3: "Areas of low to moderate flood risk where we are generally managing existing flood risk effectively".
- Witham Catchment Sub Area 5, Policy Option 1: "Areas of little or no flood risk where we will continue to monitor and advise".
- Witham Catchment Sub Area 7, Policy Option 4: "Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change".

3.3.4 Local Flood Risk Management Strategy 2012

Lincolnshire County Councils' Local Flood Risk Management Strategy[27] is a partnership framework is designed to provide co-ordinated management and delivery of flood risk and drainage functions of all relevant organisations across Lincolnshire. The framework implements the recommendations of the Pitt Review and the provisions of

[24] Environment Agency. 2016. *Anglian River Basin District Flood Risk Management Plan 2015 to 2021.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500463/Anglian_RBD_Part_1_river_basin_management_plan.pdf

[25] Environment Agency. 2009. *River Welland Catchment Flood Management Plan.* Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/288870/River_Welland_Catchment_Flood_Management_Plan.pdf

[26] Environment Agency. 2009. *River Witham Catchment Flood Management Plan*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/288865/River_Witham_Catchment_Flood_Management_Plan.pdf

[27] Lincolnshire County Council, 2016. *Implementing a Strategy to manage flood risk Countywide and Locally.* Available at: https://www.lincolnshire.gov.uk/residents/environment-and-planning/flood-risk-management/implementing-a-strategy-to-manage-flood-risk-countywide-and-locally/103045.article

the FWMA 2010 in a way that is tailored to suit the geographical, social, economic and environmental characteristics of Lincolnshire. Its purpose is to ensure that local communities and infrastructure are better protected from flood risk, and that improved resilience towards flooding is built into all aspects of planning and service provision in the future.

3.3.5 Preliminary Flood Risk Assessment

Under the Flood Risk Regulations (2009)[28], all LLFAs were required to prepare a Preliminary Flood Risk Assessment (PFRA) report in 2011, which will be subsequently due for renewal on a 6-yearly cycle. The PFRA 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.

A PFRA was prepared for LCC in 2011 and sought to provide a high level overview of flood risk from local flood sources, including flooding from surface water, groundwater, Ordinary Watercourses, 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 provides a useful baseline in the preparation of this revised Level 1 SFRA.

3.3.6 South Kesteven Adopted Core Strategy 2010

The South Kesteven Core Strategy Development Plan Document (DPD) was adopted by the Council on the 5th July 2010 and together with the Site Allocation and Policies (DPD) and a few remaining policies and allocations (which affect Grantham only) included in the 1995 Local Plan form the current Local Plan for the District. The Core Strategy.provides the spatial policy framework for development and change in the district of South Kesteven for the period to 2026 and establishes the key principles which should guide the location, use and form of development. The Core Strategy sets out the visions and preferred environmental policy for reducing the risk of flooding:

- Planning permission will not normally be granted, nor sites allocated for development, in areas identified in the South Kesteven SFRA as at risk of flooding from any source. Any proposals in these areas will need to demonstrate that there are not any suitable sites at a lower risk of flooding available[29].
- Exceptionally, where development is necessary in areas at risk of flooding, the developer will be required to demonstrate that all the requirements of PPS25: Development and Flood Risk have been met, including the application of the sequential approach within the site.
- In addition to the requirements of PPS25, a FRA must be submitted with planning applications as required by the SFRA. All FRAs must take into account the SFRAs recommendations.
- All planning applications should be accompanied by a statement of how surface water is to be managed and in particular where it is to be discharged. On-site attenuation and infiltration will be required as part of any new development wherever possible. The long-term maintenance of structures such as balancing ponds must be agreed in principle prior to permission being granted.
- Development which is likely to have a detrimental impact on the natural features of rivers and stream corridors, ponds or wetland habitats will not be permitted.

SKDC are now preparing a new Local Plan which will cover South Kesteven up to 2036. It will set out the strategic direction for sustainable development, covering housing and employment and setting out objectives and vision for the District. This plan will replace the three documents which currently form the development plan.

3.3.7 Lincolnshire County Council Highway and Flood Authority Development Road and Sustainable Drainage Specification and Construction

LCC has the statutory function of the LLFA and Highway Authority. It is therefore a statutory consultee for Highways and local flood risk. The August 2016 Edition of the Lincolnshire County Council Development Road

[28] The Flood Risk Regulations 2009. Available at: http://www.legislation.gov.uk/uksi/2009/3042/pdfs/uksi_20093042_en.pdf
[29] PPS25 and its accompanying Practice Guide provide advice on carrying out the Sequential Test. This advice should be used in considering how to demonstrate whether suitable sites at a lower risk of flooding are available

and Sustainable Drainage Specification and Construction document[30] provides construction requirements that Local Authorities, other bodies or persons developing land, involving the construction of development roads and streets, must comply with when undertaking work.

The document states sustainable drainage principles should be incorporated in all developments as a requirement of both the planning process and the adoption process. The visions and preferred policy are as follows:

- The Highway and Flood Authority will consider adopting surface water drainage infrastructure where it is proved to be an integral part of the highway system, and have been designed and constructed in accordance with this document and all Highway Authority requirements have been met, including payment of all appropriate fees. Attention is drawn to the Lincolnshire Development Roads and Sustainable Drainage Design Guide, Planning and Adoption Milestones and Requirements. This lists the essential technical documents and information required to enable the necessary processes to be progressed. Documents and information specifically required to be provided to the Highway and Flood Authority to enable a Section 38 agreement and subsequent adoption to be considered includes:
  - Estate Location Plan;
  - Level 3 Detailed FRA/Statement; Detailed Geotechnical Interpretive Report;
  - Detailed Whole Site Development Layout Plans, Highways, SuDS & Flood Risk Scheme Design Proposals;
  - Detailed Whole Site SuDS Scheme Operation & Maintenance Manual; Statutory Consents and Other Permissions;
  - Detailed Whole Site Landscape Plan;
  - Whole Site Development Construction Management Plan; Detailed Whole Site SuDS Scheme Health & Safety Plan; Signed Highways & SuDS Sec 38 Adoption Agreement;
  - Detailed Highways, Drainage & Flood Risk Structural Design Calculations; Payment of Highways 7 SuDS Adoption Development Road Fees Construction & Inspection Notifications; and
  - "As Built" drawings (incl. highways & SuDS adoption layout plans).
- For parts of the development where surface water drainage infrastructure is not an integral part of the highway system, the Developer is advised to enter into discussions with the most appropriate potential adopting authority at the earliest stage of the planning process. Attention is drawn to the Lincolnshire Development Roads and Sustainable Drainage Design Guide.

3.4 Summary

The above section presents the legislative requirements and associated documents and plans prepared by SKDC, LCC and the Environment Agency under the requirements of the FWMA and the NPPF. The documents provide a key input to this revised SFRA.

[30] Lincolnshire County Council. 2016. Lincolnshire County Council Development Road and Sustainable Drainage Specification and Construction. Available: https://www.lincolnshire.gov.uk/transport-and-roads/strategy-policy-and-licences/control-of-new-development-affecting-the-highway/development-road-specification-and-construction/87183.article

4. Level 1 SFRA Methodology

This updated Level 1 SFRA comprises a desk-based study based solely on existing information and datasets, enabling SKDC to apply the Sequential Test to those sites identified within their Local Plan as potentially suitable for future development. The SFRA also aims 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 this updated Level 1 SFRA are described below.

4.1 Establishing Key Stakeholders

A project Inception Meeting was held to stimulate engagement and inform collaborative working between stakeholders, which included representatives from SKDC and the Environment Agency. SKDC 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.

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: tidal, fluvial, land (direct rainfall and surface water), groundwater, sewers and artificial sources.

In preparation of this assessment, a number of stakeholder datasets were obtained and collated prior to a quality review and gap analysis. This information was then used to establish the most recent and technically robust datasets. Further details relating to this exercise can be found within Appendix A.

4.3 Strategic Flood Risk Maps

A series of GIS maps have been produced based on the data specifically collected for this assessment. The mapping deliverables are summarised in Table 4-1 below and are presented in Appendix B. These should be referred to when reading Chapter 5 ‘Level 1 Assessment of Flood Risk’ which provides an overview of flood risk across the District.

Table 4-1 Strategic Flood Risk Assessment Maps

Figure 1	Topography
Figure 2	Bedrock Geology
Figure 3	Aquifer Designation - Bedrock
Figure 4	Superficial Geology
Figure 5	Aquifer Designation – Superficial Geology
Figure 6	River Catchments
Figure 7	Historic Flood Incidents
Figures 7A – 7E	*Historical Flood Incidents – Inset Maps*
Figure 8	Flood Zones and Flood Defences
Figure 8A – 8F	*Flood Zones and Flood Defences in North West Grantham*
Figure 9	Risk of Flooding from Surface Water
Figure 10	Areas Susceptible to Groundwater Flooding
Figure 11	Sewer Flooding Incidences
Figure 12	Surface Water Bodies
Figure 13	Flood Risk from Reservoirs
Figure 14	Flood Alert and Flood Warning Areas

4.3.1 Providing Suitable Guidance

Sections of this report provide specific guidance for SKDC on policy considerations, the application of the Sequential Test and guidance on the preparation of site specific FRAs. For guidance relating to the application of SuDS within the District, reference should be made to the Lincolnshire Development Roads and Sustainable Drainage Design Guide as discussed previously in Section 3.4.5.

4.3.2 Need for a Level 2 SFRA

Following the application of the Sequential Test by SKDC, a number of sites have been identified as requiring the application of the Exception Test. Where the need for an Exception Test has been identified, the Level 2 SFRA considers in more detail the nature of risk characteristics within each site including: flood probability, flood depth, flood velocity, rate of onset of flooding and the duration of flooding, where data sources are available.

5. Level 1 Assessment of Flood Risk

5.1 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 has been assessed. This section should be read in conjunction with the figures provided in Appendix B.

5.2 Tidal Flooding

Tidal flooding can occur from several sources such as spring tides, storm conditions, failure of defences or when high tides coinciding with low pressure systems, result in a tidal surge. Whilst primarily affecting coastal areas, high water levels can be conveyed inland along tidally dominated river reaches.

None of the watercourses located within South Kesteven District are tidally influenced therefore the risk of tidal flooding to the study area is low.

The tidal limit of both the River Welland and the River Witham are located approximately 6 km to the east of the District boundary with the tidal limit of the River Welland and Glen located at Spalding and Surfleet respectively. Tidal flood risk along the tidal reaches of these watercourses is summarised within the South Holland SFRA.

With reference to the Environment Agency Climate Change projections[13] the cumulative sea level rise anticipated for the Eastern region of England is 1.21m by 2115. Whilst considering this projection, and given the distance of the study area from the tidal limits of the River Welland and River Witham, the future risk of tidal flooding in South Kesteven is not likely to increase and therefore the risk of flooding from this source will remain low.

5.3 Flooding from Rivers

Fluvial flooding occurs when the channel capacity of a river is exceeded as a result of increased flows. This can be a result of either sustained or intense rainfall.

5.3.1 Sources

The Environment Agency datasets have been used to identify the watercourses within this study area designated as ‘Main River’ or ‘Ordinary Watercourse’. The location of the rivers as well as other surface water bodies is illustrated in Appendix B Figure 6.

Designated Main Rivers in South Kesteven include:

- The River Witham originates to the east of South Witham. At South Witham the watercourse starts flow in a northerly direction adjacent to the A1, through Grantham towards Barkston. At Barkston the Witham flows west towards Long Bennington before returning to its northern pathway into the North Kesteven District. The Witham flows round the North Kesteven and East Lindsey Districts before passing through Boston and discharging into The Wash. Along its route the Witham encounters a number of adjoining tributaries, these include:
  - Cringle Brook - a small tributary originating from two unnamed watercourses that converge at Stoke Rochford Park. The brook flows in a north easterly direction for approximately 2.5km before converging with the River Witham, to the east of Great Ponton.
  - Running Furrows - a small urban watercourse, originating south of the settlement Gonerby Hill Foot. It flows to the north east passing through the town via culverts, under the road and railway infrastructure. Running Furrows converges with the River Witham east of Manthorpe on the outskirts of Grantham.
  - Honington Beck - originates from a small unnamed waterbody south of Frieston, flowing in a south easterly direction. South of Carlton Scoop, Honington Beck converges with a small unnamed watercourse, the beck then flows in a westerly direction adjacent to a dismantled railway for approximately 2km, before turning to flow towards the south west to converge with the River Witham to the north of Barkston.

- Foston Beck - a major tributary of the River Witham within the South Kesteven District. The Beck originates from Denton Reservoir, where it is known as Old Beck, and flows north towards Sedgebrook where it converges with an unnamed watercourse. Old Beck flows in a north easterly direction where it converges with a number of small drains south east of Allington to become Foston Beck. Foston Beck continues north passing under the A1, to converge with the River Witham to the north west of Houghman.
- Ease Drain - originates from two unnamed drains that converge at Sewstern Lane. The drain flows in a northerly direction, passing through a culvert under the A1. The drain flows in a north-easterly direction at the Great North Road and A1 interchange, then around the outskirts of Long Bennington where it converges with the River Witham.
- Shire Dyke - originates in Bennington Fen, and flows along agricultural boundaries to Barnaby in the Willows, where the Dyke then travels in a north easterly direction to converge with the River Witham by Newark Road.
- Sutton Dyke - a small tributary originating at Claypole Fen where two unnamed watercourses converge with a number of small drains to the west of Fenton. The dyke continues in a northerly direction around Sutton converging with the River Witham, south west of Beckingham.
- River Brant - originates in agricultural land south of Gelston. The river flows in a north easterly direction along agricultural boundaries creating a uniform channel. At Brant Broughton Sand Beck converges with the River Brant. The river can be seen to meander north, converging with the River Witham, east of South Hykeham.

- The River Welland originates in Sibbercroft, Northamptonshire, and flows in a westerly direction through the south of the District, before discharging into The Wash at Boston Deeps. Along its route through South Kesteven it converges with two main rivers:
  - The River Gwash - a major tributary of the River Welland the Gwash originates upstream of Rutland Water, to the east of Stamford. The large upstream catchment of the River Gwash includes two major tributaries, Barleythorpe Brook and North Brook, both of which lie outside of the South Kesteven District boundary. The river flows in an easterly direction to Great Casterton and Ryhall. From here the River Gwash heads south meandering towards Stamford, where it converges with the River Welland on the outskirts Stamford.
  - The River Glen - originates to the west of Baston, at the convergence of the West Glen and the East Glen Rivers. The River Glen flows in a north easterly direction, passing through a number of villages and residential areas. The River Glen converges with the River Welland north east of Surfleet Seas End. Along its route the River Glen encounters a number of adjoining tributaries:
    - West Glen River - originates south of the village of Old Somerby. The West Glen generally flowssouth from Old Somerby through the villages of and Little Bytham, and Aunby where its tributes the Tham and Hollywell Brook converge respectively. The watercourse then flows to Greatford, where the Greatford Cut diverts flow into the River Welland at Market Deeping, away from its traditional route through Wilsthrope, where the West Glen River converges with the East Glen to form the River Glen.
    - East Glen River - originates from a small unnamed watercourse in Ropsely Rise Woods, flowing south towards Ropsley. At Sapperton, the river becomes formally known as the East Glen. The river passes through the village of Edenham, before meandering south to converge with the Home Bottom Drain. The East Glen River converges with the West Glen near Wilsthorpe, where it becomes the River Glen.
    - Bourne Eau originates from St Peter's Pool in the centre of Bourne and flows east out of the town through a series of culverts. Car Dyke (South) flows from Kate's Bridge Farm in a northerly direction to Bourne where it converges with the Bourne Eau, to the west of the Eastgate Industrial Estates. Car Dyke (North) flows from Wingate Way along the western boundary of Bourne to converge with the Bourne Eau, to the east of the Eastgate Industrial Estates. The river flows approximately 5km to the south east where it discharges in the River Glen at the Bourne Fens.
- The River Devon originates from Belvoir Lakes, flowing north and through a culvert under the Grantham Canal. From here the river flows east through Muston and Bottesford, where it then turns northwards. At Staunton in the Vale the Winter Beck discharges into the River Devon and the river flows north west to

where the River Smite discharges into the Devon. The river continues to flow north towards Newark-on-Trent where it forms a confluence with the River Trent.

5.3.2 Historic Records of Fluvial Flooding

In the South Kesteven District area there have been numerous accounts of historical flooding associated with the rivers outlined above. Figure 7 in Appendix B illustrates the flood extents as held by the Environment Agency 'Historic Flood Map'. Table 5-1 summarises details of historic flood events gathered through a review of flood studies and the Environment Agency Historic Flood Map. It should be noted that not all flooding events would have been recorded therefore this should not be considered a complete dataset.

Table 5-1: Historic Fluvial Flooding

Date	River	Description of flooding
1922	River Witham	River Witham through Grantham flooded. Historic flood outlines cover sections of the following roads: A52, Agnes Street, Alford Street, Avenue Road, Belton Grove, Belton Lane, Bridge Street, Cambridge Street, College Street, Cottesmore Close, Dudley Road, Eton Street, Granta Cresent, Harrow Street, Harrowby Road, Langford Gardens, Oxford Street, Park Road, Redcross Street, St Catherines Street, Stonebridge Road and Welham Road.
1947	River Welland	River reached channel capacity in March of 1947 causing flooding between the River Welland and Ashold Drain in the south east of the district.
1998	River Welland	Large storm affected a large area of Lincolnshire over Easter 1998 (9^{th} – 11^{th} April). Historic flood outlines show the channel capacity of the River Welland was reached causing flooding through the south of Stamford and the flood plain downstream.
	River East Glen	Historic flood outlines show the agricultural land surrounding the river flooded from the east of Grimsthorpe, through Edenham and south Mansthorpe.
	River West Glen	Historic flood outlines show agricultural land surrounding the river flooded to the west and north of Greatford. In Little Bytham the historic flood outline covers properties on Church Lane and the B1176. The historic flood outline also covers a section of agricultural land and properties on the west of Corby Glen.
	Ouse Mere Lode	River channel reached capacity causing flooding upstream of Ousemere Close in Billingborough. The historic flood outline covers properties on Straton Road and Blasson Way.
Various	River Devon	Numerous flood events, including one in 1950 and 1979 occurring on the River Devon between Woolsthorpe by Belvoir and Muston (to the east of the district boundary). Flood outlines cover Mill Farm, Stenwith Farm and properties on Belvoir Lane.

5.3.3 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 5-2 and presented on the 'Flood Map for Planning (Rivers and Sea)' available on the Environment Agency website[31], or illustrated in Appendix B Figure 8.

[31] Environment Agency. 2016. *Flood Map for Planning (Rivers and Sea).* Available at: http://maps.environment-agency.gov.uk/ [Accessed: 26-11-2016]

Table 5-2: Fluvial Flood Zones (extracted from the NPPF PPG, 2014)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1 (Low Probability)	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 (Medium Probability)	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 (High Probability)	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. For the purposes of this SFRA, land modelled to flood during a 5% AEP (1 in 20 chance of flooding in any one year) has been mapped. Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a.	Very High

5.3.4 Flood Map for Planning (Rivers and Sea)

The 'Flood Map for Planning (Rivers and Sea)' dataset is available on the Environment Agency website 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 3.

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 described in Table 5-3) as well as previous flood events.

5.3.5 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.

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.

For the purposes of this SFRA, the Functional Floodplain has been defined as land where water has to flow or be stored in times of flood. This relates to land falling within the 5% AEP flood envelope 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. Where new development falls within Flood Zone 3, planning applications should be supported by an appropriate site specific FRA inclusive of detailed modelling to demonstrate the separation

between Flood Zone 3a and 3b, refer to Table 5-3 below for details of the Environment Agency's existing hydraulic model coverage across South Kesteven.

Whilst 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, the Sequential and Exception Tests must be applied to ensure the development type is appropriate and the risks posed to and from the development are fully understood and mitigated.

5.3.6 Hydraulic Modelling Studies

As discussed above, Table 5-3 provides a summary of the hydraulic modelling studies that have been undertaken within the South Kesteven District Council area and have been used to inform the current 'Flood Map for Planning (Rivers and Sea)'. The hydraulic modelling is often completed to assess risks to specific communities or to develop flood mitigation options. As such the extent of the modelled areas and the scenarios covered (defended, undefended and return period) can differ between the studies.

Table 5-3: Summary of Hydraulic Modelling Studies completed across the South Kesteven area

Watercourse	Modelling Study	Year
River Witham	Upper Witham Model Improvements Study	2015
River Welland	Welland Catchment Modelling Update	2016

5.3.7 Flood Defences and Flood Storage Areas

South Kesteven has a network of fluvial and tidal flood defences that comprise of flood walls, embankments and raised land. They are outlined by the Environment Agency's Spatial Flood Defences dataset and illustrated in Appendix B Figure 8. From the figure it can be seen the flood defences cover large sections of the River Witham, the River Welland and their associated tributaries, particularly where the rivers pass through larger settlements such as Grantham, Long Bennington, Stamford and the Deepings. The figure shows flood defences covering several of the larger drains in the east of the district including the Bourne Eau and the South Forty Foot Drain.

Appendix B Figure 8 also outlines the Areas Benefitting from the Flood Defences described above. The large reaches of flood defences along the River Witham can be seen to benefit the towns of Grantham, Houghman, Long Bennington, West Borough and large areas of agricultural land to the north of Long Bennington. Along the River Welland, small areas in the south of Stamford can also be seen to benefit from the defences through this reach.

As shown in Appendix B Figure 8, there are no formal Flood Storage Areas within the District.

It is recommended that as part of site specific FRAs the flood risk is determined by developers when seeking to develop adjacent to watercourse (Main Rivers and Ordinary Watercourses). This will help to inform the standard of protection and the residual risk of flooding.

5.3.8 Current Fluvial Flood Risk

The current fluvial flood risk is summarised below and illustrated in Figure 8 of Appendix B. The following summary of fluvial flood risk has been determined from predictive and historic flood information:

- A large section of the District between Grantham and the A15, which covers the upper reaches of the River Witham, East Glen River and West Glen River, has a Flood Zone 3 extent which is very similar to that of Flood Zone 2. This is primarily due to the confined nature of the river channels and floodplains. Any developments within Flood Zone 2 or 3 will need to consider the risk from more frequent events. Where hydraulic modelling has not been completed, this may require additional assessment.
- The largest area of Flood Zone 3 within the district is associated with watercourses located within the low lying Fenland to the east of the A15 and south of the A16. The large number of drains, including the Bourne Eau, River Glen, Car Dyke, Old Beck and the South Forty Foot Drain, combined with the low lying nature of the Fenland, increases the risk of flooding in this area. The likelihood of flooding in the Fenland areas is however considered to be low given the presence of pumped IDB systems and flood defences.

- Within Grantham, Stamford and Market Deeping the extent of Flood Zone 3 is minimal. This is likely associated with the well-defined river valleys within these areas, restricting the passage of flow into the floodplain.
- There is an extensive area of Flood Zone 3 associated with the most downstream section of the River Witham through the District and its tributaries to the south of Long Bennington, where floodplains start to widen as ground levels gradually decrease from 70m AOD to 10m AOD at the northern boundary.

5.3.9 Climate Change

The impact of changing weather patterns on the hydrological cycle is significant, as predicted increases in peak rainfall intensity and river flow could result in more frequent and severe flash flooding and increase soil and river bank erosion.

The Environment Agency issued new climate change guidance in February 2016 based on a regionalised approach whereby climate change allowances (% increases in flows) are provided for each river basin district over three different timeframes (epochs) and for three different emissions scenarios.

It should however be noted that for site specific FRAs, developers will need to demonstrate consideration of climate change as part of any planning application. The February 2016 climate change allowances and guidance for changes to river flood flows relevant to Lincolnshire are provided in Table 5-4 below.

Table 5-4: Peak River Flow Allowances for the Anglian and Humber River Basin Districts (1961 to 1990 baseline)

River Basin District	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Anglian River Basin (River Welland and River Witham Catchments)	Upper End	25%	35%	65%
	Higher Central	15%	20%	35%
	Central	10%	15%	25%
Humber River Basin (River Trent Catchment)	Upper end	20%	30%	50%
	Higher central	15%	20%	30%
	Central	10%	15%	20%

The above climate change figures (Table 5-4) have been used to inform this Level 1 SFRA. When assessing climate change as part of a site specific FRA, current guidance available at the time of writing should always be applied to any planning application.

5.4 Flooding from Surface Water

Surface water flooding, also known as pluvial flooding, occurs when high intensity rainfall generates runoff which flows over the surface of the ground and accumulates in low lying areas. The presence of impermeable surfaces, saturated soils, and insufficient capacity within the drainage network can further exacerbate surface water flooding. Appendix B, Figure 9 shows the spatial distribution of surface water flood risk across South Kesteven.

5.4.1 Historic Records

LCC as the LLFA for the South Kesteven District holds records of flooding investigations across Lincolnshire. LCC have defined areas of their administrative area and Area M[32] and Area N[33] show the flood investigation records across the South Kesteven District. The majority of records relate to surface water flooding and start in 2012. It is, however, important to note that due to the diverse nature of flooding mechanisms, surface water flooding usually occurs from a combination of different sources including sewer flooding, fluvial flooding and/or groundwater flooding.

[32] Lincolnshire County Council. Section 19 Investigations- Network South Area M.
[33] Lincolnshire County Council. Section 19 Investigations- Network South Area N.

Of the records held by LCC, the following pluvial events can be reported:

Date	Location	Description of flooding
1st April 2012	Brandon	Saturated ground led to overland flow effecting property in Brandon.
29th April 2012	Belton	Surface water flooding from public highway (A607) and adjacent private land caused damage to properties in Belton.
28th June 2012	Carlton Scoop	Surface water flooding from a combination of over land flow and highway caused flooding to property in Carlton Scoop.
5th and 6th July 2012	Harlaxton, Allington, Sedgebrook and Barrowby	Low pressure systems caused heavy rain and thundery showers over the 5th to the 7th July[34]. This resulted in flooding in Harlaxton, Allington, Sedgebrook and Barrowby, caused by a combination of highway surface water, surface water runoff from land and insufficient drainage capacity causing flooding to a number of properties.
6th August 2012	Caythorpe	Following an intense period of rainfall, an increase in surface water saw the drainage system capacity insufficient to cope with the influx of waters, surcharging and causing surface water flooding to both highway and property in Caythorpe.
21st November 2012	Corby Glen	Rain caused over land flow from farm land and flooding to adjacent property in Corby Glen.
23rd July 2013	Long Bennington, Stamford, Claypole	A breakdown of thunderstorms and heavy showers caused local flooding across Midland areas[35]. The rainfall events led surface water to flow across highway causing flooding to property in Long Bennington. Elsewhere in Stamford and Claypole, inadequate drainage and blocked gullies saw surface water unable to drain causing surface water flooding to both property and roads.
6th August 2013	Stamford	Standing surface water build up from blocked drainage caused flooding to property in Stamford.
20th October 2013	Grantham	Surface water flooding on carriageway led to surface water flows flooding Kings School, Grantham.
22nd May 2014	Bourne, Deeping St James, Market Deeping	Low pressure caused widespread showers and thunderstorms across Lincolnshire; with up to 20mm recorded in 4 hours[36]. Bourne, Deeping St James and Market Deeping experienced surface water flooding due to the torrential rain that fell in a short period of time. Surface water drains were exceeded and insufficient drainage on highways caused surface water flooding to a number of properties in the District.
9th July 2014	Barkston	Heavy rainfall caused surface water flooding, which failed to drain via gullies, to property in Barkston.
8th August 2014	Uffington	Short intense heavy rainfall caused surface water to flood property in Uffington.
10th August 2014	Stamford	The outfall of Hurricane Bertha brought strong winds and heavy rain to many parts of the UK[37]. The heavy rainfall caused public open space to build up surface water causing flooding to nearby property in Stamford.
4th July 2015	Tallington	Surface water flooding caused damage to property in Tallington.
11th July 2015	Stamford	Following a rainfall event a business property flooded due to gullies backing up. The premises previously flooded approximately 2 years ago during similar circumstances.

[34] Met Office. 2012. *Weather Summaries July 2012.* Available at: http://www.metoffice.gov.uk/climate/uk/summaries/2012/july
[35] Met Office. 2013 *Weather Summaries July 2013.* Available at: http://www.metoffice.gov.uk/climate/uk/summaries/2013/july
[36] Met Office. 2014. *Weather Summaries May 2014*. Available at: http://www.metoffice.gov.uk/climate/uk/summaries/2014/may
[37] Met Office. 2014. *Weather Summaries August 2014*. Available at: http://www.metoffice.gov.uk/climate/uk/summaries/2014/august

Date	Location	Description of flooding
24th August 2015	Westborough, Grantham, Long Bennington and Barkston	Isolated thunder storms with heavy rain[38] caused 'flash floods' across South Kesteven. Properties were flooded in Westborough, Grantham, Long Bennington and Barkston, as surface waters failed to drain due to the increased influx of waters as hydraulic capacities in sewers were exceeded.
9th and 10th March 2016	South Witham	There were notable flooding impacts across South Kesteven from an un-named storm on the 9th March. South Witham (adjacent to the A1 north bound) and Welby were subject to surface water flooding that caused damage to property. Surface water pooling caused by the persistent rainfall and insufficient gullies.

In addition to these events, there are several incidents in the Flood Investigation Logs where there are reports of re-occurring flooding in Claypole and Stamford.

5.4.2 Risk of Flooding from Surface Water

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 magnitude rainfall events:

1. High Probability - 3.3% AEP (1 in 30 chance of flooding in any one year),
2. Medium Probability - 1% AEP (1 in 100 chance of flooding in any one year)' and
3. Low Probability - 0.1% AEP (1 in 1,000 chance of flooding in any one year).

The latest version of the mapping, published in 2013, is the Risk of Flooding from Surface Water (RoFSW) Map (this is the new name for the updated Flood Map for Surface Water (uFMfSW, 2013-2016) but it is the same product). The dataset supersedes information from the Areas Susceptible to Surface Water Flooding (2008) dataset and the Flood Map for Surface Water (2010). The RoFSW is available either as GIS layers or via the Environment Agency's online viewer. Figure 9 presents the RoFSW extents across the South Kesteven.

For the purposes of this SFRA, the mapping allows an improved understanding of areas within the District which may be at risk from surface water flooding. The mapping identifies that a widespread risk is present across the District. Through an assessment of the dataset, it can be seen that surface water flood risk can typically be associated with the following, although this list is by no means exhaustive:

- **Fluvial Corridors**: The risk of surface water flooding tends to coincide with the fluvial floodplains of Main Rivers and Ordinary Watercourses, which, due to their low lying nature, allow flows to be accumulated and passed downstream. In these areas, there is significant interaction between fluvial and surface water flows, especially within the upper extents of river catchments (such as at South Witham). Within areas of urban development, any surface water drainage networks which discharge to watercourses may be restricted by flood locked outfalls.
- **Land Drains**: Within the eastern extent of South Kesteven, there is an extensive network of land drainage systems and Ordinary Watercourses, which act as conveyance routes for surface water. Although these features tend to occur in primarily rural, undeveloped areas, there is the potential that new sites, particularly minerals and waste allocations, may coincide with these features. The risk of flooding as a result of these flow routes, will need to be examined as part of any development, even if the current risk appears to be minimal.
- **Urban Areas**: Surface water flooding frequently occurs in urban areas as a direct result of topographic features, such as buildings and roads, which restrict infiltration, deflect flows into sewer systems with limited capacity and encourage localised ponding. This can be seen within the majority of the urban areas in South Kesteven, but is especially prevalent in the areas surrounding Grantham, Stamford, Bourne and Long Bennington.
- **Railway and Road Embankments**: The presence of raised embankments, such as those usually associated with highway and rail networks, can have a significant impact on surface water flow routes,

[38] Met Office. 2015. *Weather Summaries August 2015.* Available at: http://www.metoffice.gov.uk/climate/uk/summaries/2015/august

which restrict flows leading to localised areas of deep ponding. This is evident across the District and increases flood risk to those communities which align with this infrastructure.

- **Roads**: Roads, highways and railway lines can act as conveyance routes for surface water whilst flooding can also affect the operational potential of this infrastructure. The risk to these receptors should be considered as part of any future development application, ensuring safe access and egress to sites during times of flood. Of notable accent, includes the A15, A1 north of Grantham, the B1177, the A607 and the railway line north of Grantham, which all show surface water accumulation on the highway. SKDC should also consider the risk of the receptors in terms of emergency planning.
- **Underpasses**: Where underpasses are present, the lower elevation allows for the increased risk of surface water flooding. In these areas, although the extent may be minimal, the depth of flooding experienced may be significant.

However, this assessment has been based on the RoFSW which is a high level, national scale dataset and is subject to a number of limitations:

- The model used to generate the mapping assumes 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 RoFSW is affected by a lack of, or inaccuracies, in available data.

5.4.3 Climate Change

The risk of surface water flooding is likely to increase in the future as a result of higher intensity / prolonged rainfall events associated with the effects of climate change. When considering the flood risk from surface water as part of a site specific FRA, the impact of climate change on surface water flooding must be considered

The RoFSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding; although a range of return periods are provided (3.3%, 1% and 0.1% AEP). For development purposes and where site specific modelling is not available, it is advised that the 0.1% AEP flood extent is used to represent the climate change scenario. SKDC should however, note the conservative nature of this approach.

Where the developer proposes to carry out surface water modelling, the revised Environment Agency climate change allowances, presented in Table 5-5 below, should be utilised.

Table 5-5: Peak Rainfall Intensity Allowances in Small Urban Catchments (1961-1990 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%
Central	5%	10%	20%

5.5 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.

LCC's Flood incident reports (Areas M and N) show historic two incidents of groundwater flooding in South Kesteven. In July 2012, an incident was recorded of a property in Long Bennington damaged through groundwater flooding of its cellar; the owner was advised to tank the cellar to reduce the risk of groundwater flooding in the future. In the summer of 2014 an incident was recorded of a property in Stamford damaged after a period of heavy rainfall, which caused groundwater to encroach over the threshold and enter the property.

Appendix B Figure 10 illustrates the Environment Agency's Areas Susceptible to Groundwater Flooding (AStGWF) map for South Kesteven. The mapping shows the susceptibility to coincide with the distribution and thickness of Glacial Till (typically Boulder Clay) within the superficial geology (Appendix B Figure 4). As such, the greatest susceptibility to groundwater occurs to the north east and south west of the District and along the river corridors where Till cover is typically thin or absent.

5.6 Flooding from Sewers

5.6.1 Sources

Sewer flooding can occur through several mechanisms:

- **The rainfall event exceeds the capacity of the sewer / drainage network**

  The majority of modern 'adoptable surface water' sewer systems are designed to accommodate rainfall events with a 3.3% probability of occurrence rainfall event. Therefore, rainfall events with an annual probability less than 3.3% would be expected to result in surcharging of some of the sewer system. It should be noted that older sewer systems and combined sewers may have a lower capacity. As a result, these sewer systems may be expected to become overloaded and for flooding to occur more frequently.

- **The system becomes blocked by debris or sediment**

  Depending on their location, gullies and drains can accumulate debris e.g. leaves, rubbish or silt. This can reduce the capacity or block the drain potentially leading to flooding from the highway drainage system.

- **The system becomes blocked by domestic waste products**

  Sewer blockages may be caused by fats, oils, grease and un-flushable or sanitary items which are largely derived from domestic waste streams.

- **The system surcharges due to high water levels in receiving watercourses**

  Within the study area there is potential for surface water outlets 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, water will begin to overflow. 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 dilute untreated sewage.

5.6.2 Current Records

Appendix B Figure 11 illustrates the location of properties at risk of hydraulic flooding within the South Kesteven District. The map illustrates the Anglian Water DG5 Sewer Flooding 'Risk' Register.

It should be noted that the DG5 register indicates areas that are at risk of flooding as a result of insufficient hydraulic capacity in the sewer network. The majority of records date back over the last 5 years, with some dates unknown.

As illustrated in Appendix B Figure 11, the majority of these DG5 records are located within the larger urban areas of Grantham, Stamford and the Deepings. There are fewer isolated incidents of sewer flooding at village level across the District.

5.6.3 Climate Change

The flood risk from sewers across the South Kesteven District may increase as a result of climate change. As outlined in Section 5.4.3, climate change is predicted to result in increased rainfall intensities. Therefore sewer systems may more frequently become overwhelmed by intense rainfall.

5.7 Flooding from Reservoirs

A reservoir can be defined as a natural or artificial waterbody where water is collected and stored until needed. Under the FWMA (2010), the Environment Agency is responsible for managing flood risk from large raised reservoirs. Large raised reservoirs are defined in the FWMA (2010) as:

- A large, raised structure designed or used for collecting and storing water;
- A large, raised lake or other area capable of storing water which was created or enlarged by artificial means;

A structure or area is "raised" if it is capable of holding water above the natural level of any part of the surrounding land;

A raised structure or area is "large" if it is capable of holding 10,000$m^3$of water or more, above the natural level of any part of the surrounding land. A review into reducing the capacity to which a reservoir will be regulated from 25,000 m^3 to 10,000 $m^3$are expected to be phased in to improve the safety legislation and regulation of reservoirs[39]. These changes to the safety legislations of reservoirs have yet to come into effect under the Environment Agency.

There are a number of reservoirs located within the South Kesteven area. These are illustrated in Appendix B Figure 12. Those that are above 10,000 m^3 are listed below:

- Denton Reservoir is located to the south-west of Grantham. It is used to supply water to the Grantham Canal, immediately to the North of the reservoir;
- Specimen Lake is a fishing lake that forms part of the Woodland Waters estate located to the west of Ancaster;
- Harlaxton Manor Lake is located in the Manor's grounds to the east of Harlaxton;
- The Lake at Grimsthorpe is located in land surround Grimsthorpe Castle to the west of Grimsthorpe;
- Holywell Lake is a large lake located in the village of Holywell, to the south west of Little Blytham; and
- The Lake at Lakeside Farm located to the south of Caythorpe.

The Risk of Flooding from Reservoirs is mapped within Appendix B Figure 13. This shows the potential flood risk if reservoirs were breached. The model outputs are for emergency planning purposes and are not intended to reflect the most detailed flood extents. As such, these data show the absolute maximum flood where there is likely to be an impact.

Appendix B Figure 13 shows that two of the reservoirs mentioned above have a potential flood risk if they were breached. If Denton Reservoir were to breach the potential flooding follows Old Beck and Foston Beck's floodplains to the north. Flooding from the reservoir has the potential to affect the A52, Gonerby Lane, Fallow Lane, Bennington Lane and properties in Sedgebrook, Westborough and Long Bennington.

If The Lake at Grimsthorpe were to be breached, the potential flooding of the Hollows downstream, could affect the A6121 and properties in Mansthorpe. It also has the potential to cause the East Glen River to flood downstream of Mansthorpe.

From Appendix B Figure 12 there are several additional reservoirs and structures that, if breached, have the potential to affect property and infrastructure in the District. These include the following:

- Rutland Water is a large water supply reservoir to the west of Stamford. If a breach were to occur, the River Gwash and River Welland would likely flood. Flooding from this breach could potentially affect the A15, the A16 and properties in Stamford, Market Deepings and Spalding. The A151 is shown to be the northern limit of potential flooding;
- Boathouse Pond is located to the east of Belton and slightly downstream of The Lake at Boathouse Plantation located to the east of Syston. If these reservoirs were to be breached the upper River Witham would likely flood, affecting the A607 and properties in Barkston, Syston and Marston;
- Knipton Reservoir is located to the west of the South Kesteven District boundary, upstream of the Belvoir Lakes. If a breach were to occur flooding could potentially affect properties in the towns of Woolsthorpe by Belvoir and Stenwith, located close to the western District boundary, as the River Devon is seen to flood.

Any site specific FRA should identify any reservoir, including those with a smaller area, and determine the risk of flooding from these.

[39] Flood and Water Management Act (2010). *Chapter 29 Schedule 4- Reservoirs*. Available at: http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf

6. Flood Risk in Grantham

6.1 Introduction

Appendix B, Figure 8A has highlighted that some of the potential allocation sites in Grantham lie within or overlap Flood Zones 2 or 3. The Sequential Test should therefore be undertaken to steer development away from those areas of risk. In addition the Sequential Test should consider reliable information regarding locations of risk of other sources of flooding. Section 5 indicates that several potential sources of flooding may occur in Grantham; these will be discussed in this section.

6.2 Flooding from Rivers

6.2.1 River Witham

The River Witham flows through Somerby Hill in the south east of Grantham, to the town centre where it converges with Mow Beck and Barrowby Stream next to the Government Offices on Castlegate. The River Witham continues to flow in a northerly direction to converge with the Witham Brook and Running Furrows to the south of Grantham.

There are records of historic flooding of the River Witham through Grantham, which are detailed in Appendix B, Figure 7 and Table 5.1 above. Appendix B, Figure 8, shows the modelled fluvial flood risk from the River Witham, through Grantham. From both figures, it can be seen numerous properties and roads along the watercourse through Grantham are in areas of flood risk. Appendix B, Figure 8 also shows several flood defences are located along the watercourse, providing a benefit to the roads and properties located behind them.

From Appendix B, Figure 8, it can be seen the large potential allocation site located in Somerby Hill, to the south of Grantham is affected to the western border with the River Witham by Flood Zones 2 and 3. As this is such a large area it is unlikely all of it would be developed or redeveloped. Therefore the Sequential Test could be used to steer development within the allocated area away from areas of fluvial flood risk.

6.2.2 Mow Beck

Mow Beck flows from Harlaxton to the south west of Grantham, in a north easterly direction under the A1 and A607 junction to flow through the Canalside area, beneath a culvert through the town centre, where it discharges to the River Witham.

Appendix B, Figure 8, shows the modelled Flood Zones 2 and 3 to affect properties and roads along large reaches of the watercourse. From Figure 8 it can be seen part of the potential allocation site located on Harlaxton Road is located with Flood Zone 2 and 3. The application of the Sequential Test to this allocation site will determine whether development can be undertaken at the site, and which vulnerability of land uses is appropriate. If development at these locations is unavoidable the sequential approach should be applied within the site to steer access and built areas away from Flood Zones 2 and 3.

6.2.3 Barrowby Stream

Barrowby Stream flows west from Barrowby, under the A1 and through west Grantham. It is culverted beneath the town centre, and emerges from the Mow Beck culvert to enter the River Witham.

Appendix B, Figure 8, shows Flood Zones 2 and 3 to affect most of the roads and properties located close to the watercourse. Figure 8indicates part of the potential allocation site located on Beeden Park is located with Flood Zones 2 and 3 and part of the potential allocation site located at the industrial estate on Dysart Road is located in Flood Zone 2. Application of the Sequential Test to these allocation sites will determine whether development can be undertaken at each site, and which vulnerability of land uses is appropriate. If development at these locations is unavoidable the sequential approach should be applied within the sites to steer access and built areas away from Flood Zones 2 and 3.

6.2.4 Witham Brook

Witham Brook is a small watercourse that originates to the south of the Alma Park area of Grantham; it flows in a northerly direction through Alma Park to Londonthorpe Road where it turns to flow in a westerly direction to follow the road to its confluence with the River Witham downstream of the Harrowby Estate.

Appendix B, Figure 8, shows Flood Zones 2 and 3 to affect the industrial estate and properties where the watercourse changes direction near Londonthorpe Road. From this figure it can be seen none of the potential allocation sites are located with Flood Zone 2 or 3.

6.2.5 Running Furrows

Running Furrows is a small watercourse that originates to the south of Gonerby Hill Foot in the north west of Grantham. It flows in a north easterly direction through Manthorpe where it converges with the River Witham.

From Appendix B, Figure 8A, it can be seen Running Furrows is one of the River Witham's tributaries that has not been included in the current model, therefore there are no flood zones associated with the watercourse. A precautionary 100m buffer strip has been defined around Running Furrows as seen in figure 8A. Any developments within this buffer strip that are put forward for planning prior to modelling being undertaken on the watercourse should be treated on a precautionary basis. Developments should be required to carry out their own site specific FRA, including hydraulic modelling, where required.

6.3 Flooding from Surface Water and Sewers

The RoFSW map and the historic incidences of sewer flooding in Grantham can be seen in Appendix B Figure 9 and Figure 11 respectively. From Figure 9 it can be seen that large areas of Grantham are at risk from surface water flooding, with only four of the 22 potential allocation sites identified by SKDC around Grantham, to be unaffected by surface water flood risk. The areas at greatest risk are shown to be those located close to a watercourse, on a major thoroughfare such as the A607and A52, or the train line that runs diagonally through Grantham.

Appendix B Figure 11 shows that Grantham has a history of sewer flooding; the areas with the largest number of historic flood events are Somerby Hill, Manthorpe and Earlesfield Depot. From Figure 11 it can be seen three of the potential allocation sites are in areas with four or more historic instances of sewer flooding.

As in the previous SFRAs for the District, concern remains from the Environment Agency and other responsible authorities over the strain on drainage capacity in Grantham.

In order to regulate effective proposals for surface water management on new developments , site specific FRAs should be undertaken for sites greater than 0.5ha, particularly where the site has a known history of drainage and surface water problems.

The NPPF Guidance SuDS Policy states "*LPAs must ensure that SuDS are implemented within all major developments and where appropriate, through the use of planning conditions or planning obligations, clear arrangements are in place for their ongoing maintenance over the lifetime of the development*". The legislation also encourages the use of SuDS in minor developments. The use of SuDS must be recognised early in the planning stage to ensure that drainage and storage can be integrated into the design. Further advice on SuDS design and adoption is provided in Anglian Waters' "SuDS for Adoption" manual[40], LCC's SuDS guidance[3] and LCC's Highway and Flood Authority Development Road and Sustainable Drainage Specification and Construction[27].

6.4 Flooding from Groundwater

Appendix B, Figure 10 shows the areas susceptible to groundwater flooding in Grantham. From the figure it can be seen there are four of the potential allocation sites in areas where groundwater flooding could be a risk. Basements should not be allowed in these areas, and site specific FRAs would be required at these locations to consider the groundwater flood risk.

[40]Anglian Water. SuDS for Adoption Manual. Available at: http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf

7. Flood Risk Management Measures

7.1 Overview

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.

7.2 Flood Defences

Within the Flood Map for Planning (Rivers and Sea) there is a GIS layer which identifies 'Areas Benefitting from Flood Defences'. This information has been provided from the Environment Agency Asset Information Management System (AIMS) which contains details of flood defence assets associated with Main Rivers across the South Kesteven District.

7.2.1 Residual Risk

In producing flood zone maps the Environment Agency takes the presence of defences into account by showing Areas Benefitting from Defences (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 flood management design standard(s) and results in, for example, overtopping.

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.

Residual flood risk associated with each of the identified allocated sites is identified and assessed in further detail as part of the Level 2 SFRA. Residual flood risk should be studied in further detail as part of any site specific flood risk assessment undertaken in support of a planning application.

7.3 Flood Warning Areas

The Environment Agency provides a free flood warning service for many areas at risk of flooding from rivers and the sea. 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.

Flood Alert and Flood Warning Areas can be viewed on the Environment Agency website[41]. These are also presented in Appendix B Figure 14. 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.

Further information on Flood Warnings in force, and Flood Warning and Alert Areas can be found from the Environment Agency website[42].

7.4 Emergency Plan

LCC has produced an Emergency Plan, which includes the Multi Agency Flood Response & Flooding Resources Plans. These outline the procedures for responding to Environment Agency flood warning notices and co-ordinates the emergency response of agencies to flooding within the County. The plan details matters such as

[41] Environment Agency (2015) Flood Warning and Alert Areas. Available at: http://maps.environment-agency.gov.uk
[42] Environment Agency (2016) Flood Warning Areas. Available at http://maps.environment-agency.gov.uk

health and safety considerations, resource prioritisation, vulnerable community identification and appropriate evacuation procedures.

8. Guidance for Applying the Sequential and Exception Tests

8.1 Sequential Approach

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.

8.2 Applying the Sequential Test for Local Plan Preparation

As the LPA, SKDC must demonstrate that, throughout the site allocation process and related Sustainability Appraisal process, a range of possible sites have been considered in conjunction with the flood risk and vulnerability information set out in the SFRA, and that the Sequential Test, and where necessary the Exception Test, has been applied.

Figure 8-1 illustrates the approach for applying the Sequential Test that SKDC should adopt in the preparation of the Local Plan. The Sequential Test should be undertaken by SKDC and accurately documented to ensure decision processes are consistent and transparent.

The Sequential Test requires an understanding of the flood zones in the District and the vulnerability classification of proposed forms of development. The definitions of the flood zones were previously given in Table 5-2. The flood zones are mapped in Appendix B Figure 8 (the Flood Map for Planning (Rivers and Sea)) and also illustrated on the Environment Agency's website. A summary of the vulnerability classifications, as defined in the NPPF PPG, is presented in Table 8-1.

Figure 8-1: Application of the Sequential Test for Local Plan Preparation

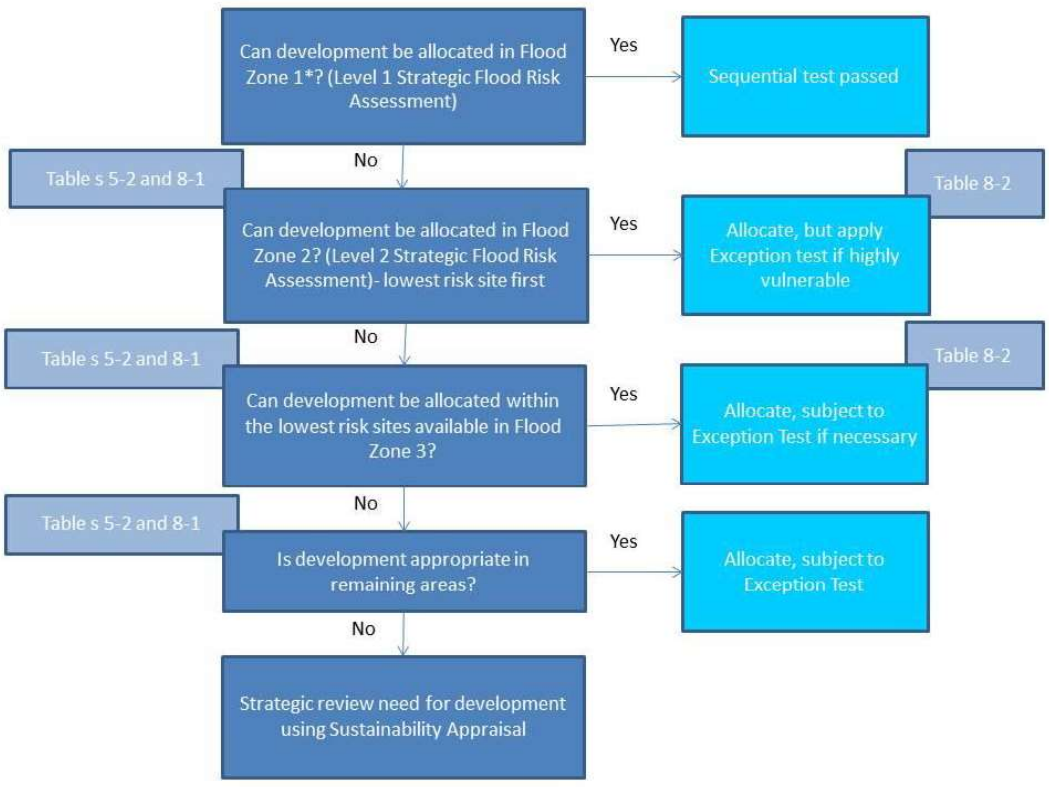


Table 8-1: Flood Risk Vulnerability Classification (PPG, 2014)

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 8-2 demonstrates which types of development are appropriate within each Flood Zone and where the Exception Test is required, further details of how to apply the Exception Test can be seen in Section 8.4.

Table 8-2: Flood Risk Vulnerability and Flood Zone Compatibility (PPG, 2014)

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

Notes to Table 8-2:

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 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 SKDC and the Environment Agency in these circumstances is recommended.

8.2.1 Stages for LPA application of the Sequential Test in Plan-Making

It is recommended that SKDC use the 'Site Assessment Database' developed alongside this SFRA to assist in the decision making process. This database should also be used to record the decisions made at each stage.

Assign the developments with the suitable vulnerability classification (Table 8-1). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.

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.

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.

Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.

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.

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).

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.

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 waterbodies.

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;and
- 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 ‘Site Assessment Database’, accompanying GIS layers and maps presented in Appendix B.

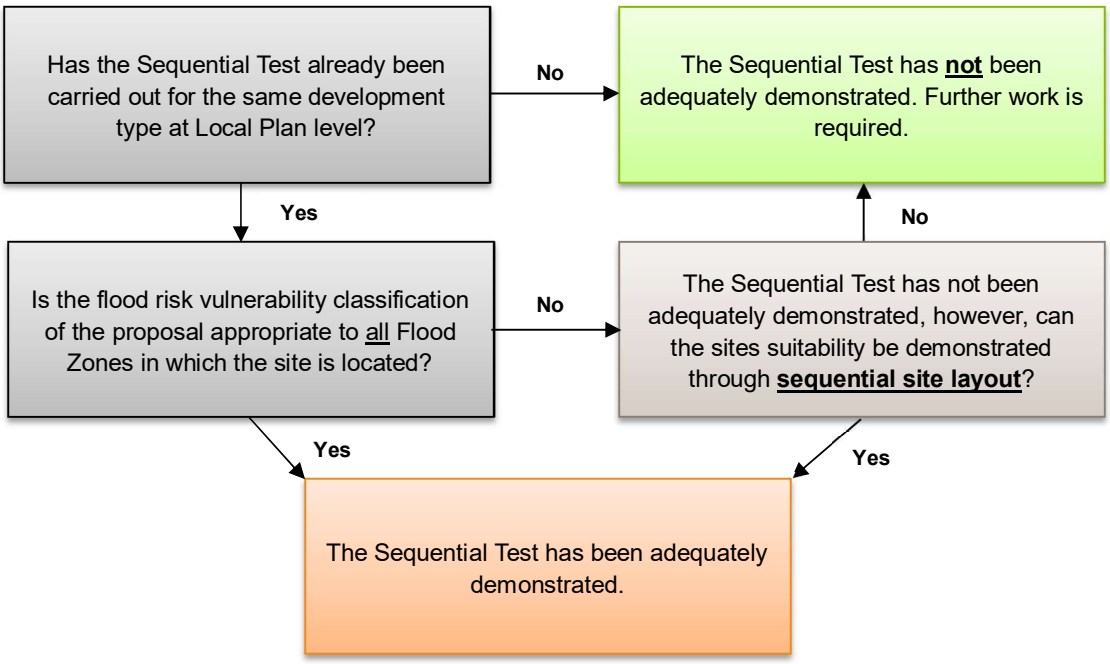
8.2.2 Windfall Sites

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.

8.3 Applying the Sequential Test – Individual Applications

As illustrated in Figure 8-2 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 8-2.

Figure 8-2: 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 8.3.2.

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

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

- 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 8-2, apply an Exception Test;
- Apply the sequential approach to locating development within the site, as described in Section 8.1.

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 SKDC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

8.3.1 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; and
  - 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.

8.3.2 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, such that the risk of flooding to surrounding areas is not increased, and where opportunity exists reduction is sought.

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 9) 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 the provision of SuDS (as outlined in the Development, Road and Sustainable Drainage Specification and Construction guidance) will assist in mitigating any increase in risk from surface water to surrounding areas.

8.4 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. Figure 8-1 illustrates the approach for applying the Exception Test that SKDC should adopt in the preparation of the Local Plan.

The purpose of an Exception Test is to ensure that certain new development (Table 8-1) 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 of the PPG states that for 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 FRA, 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, SKDC 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, 9 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 flooding;

- 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.

Further guidance regarding site-specific FRAs and potential mitigation measures to make developments safe, for example setting of finished floor levels, whether there are restrictions on ground floor use etc. can be seen in Section 9 of this document.

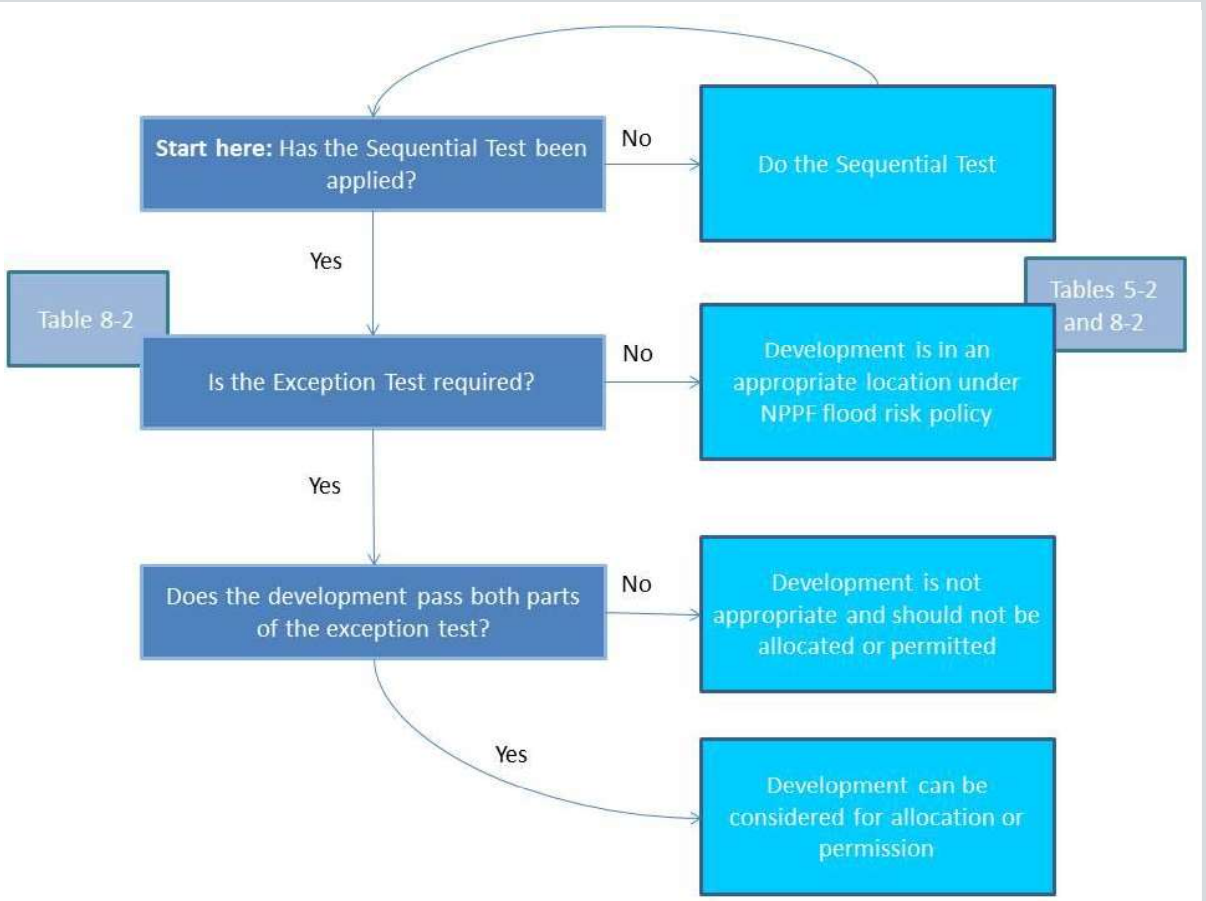


Figure 8-3. Application of the Exception Test to Local Plan preparation.

8.4.1 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) however site-specific FRAs are still required, as detailed in Section 9.

9. Guidance for Preparing Site-Specific FRAs

9.1 Overview

This Level 1 SFRA update provides a high level assessment of the flood risk posed to the South Kesteven District. 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.

9.2 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[44] 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[45] for FRAs in Flood Zone 1 should be consulted for advice on the approach and content of a site-specific FRA.

9.3 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 LPA 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[46] 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 9-1.

[44] 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.

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

[46] CIRIA. 2000. *Development and flood risk – guidance for the construction industry C624.*

Table 9-1: 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 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 9-2 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 9-2: Site-Specific Flood Risk Assessment Checklist (NPPF PPG)

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 8
1c. Is the proposed development consistent with the Local Plan for the area? The South Kesteven District Local Plan to 2036 provides the strategic planning policy framework and sets out strategic site allocations for the District to 2036. The Plan can be accessed via: http://www.southkesteven.gov.uk/index.aspx?articleid=8159
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 SKDC 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.
2.0 Definition of the Flood Hazard
2a. What sources of flooding could affect the site? Refer to Section 5.
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 5.

2c. What are the existing surface water drainage arrangements for the site?
Undertake a site survey to determine specific details and seek advice from Anglian Water.

3. Probability

3a. Which Flood Zone is the site within?
Refer to Section 5.3.4

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. 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 RfSW mapping on the Environment Agency's website http://maps.environment-agency.gov.uk.

3d. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?

4. Consideration of Climate Change

How is flood risk at the site likely to be affected by climate change?
Refer to Section 5.3.9, Table 5-4 and Table 4-6 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 7.1 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 9.4 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 Risk

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?

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 6.3 for details regarding flood warning and flood evacuation plans.

9.3.1 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 RoFSW dataset (Appendix B Figure 9) 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 10 should be used to provide an indication of areas where there may be a risk of groundwater flooding. 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.

9.3.2 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.

9.3.3 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.
- 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 are 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;

- Sustainable drainage principles should be incorporated in all developments as a requirement of both the planning process and the adoption process[30];
- 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 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.
- 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.

9.3.4 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 7-1 from the NPPF (Section 8 of this report), details the type of developments classified as 'Water Compatible' or 'Essential Infrastructure.'

9.4 Guidance on Flood Risk Management Measures

9.4.1 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.

9.4.2 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 300 mm above the 1% AEP (1 in 100 chance of flooding in any one year) plus climate change peak flood level. The peak flood level derived should be specific to 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 floor levels are set at 300 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.

9.4.3 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.

9.4.4 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'[47] , 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 9-1 provides a summary of different design strategies depending on the depth of floodwater that could be experienced.

[47] Communities and Local Government (2007) *Improving the flood performance of new buildings.* Available (05/12/2016) at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

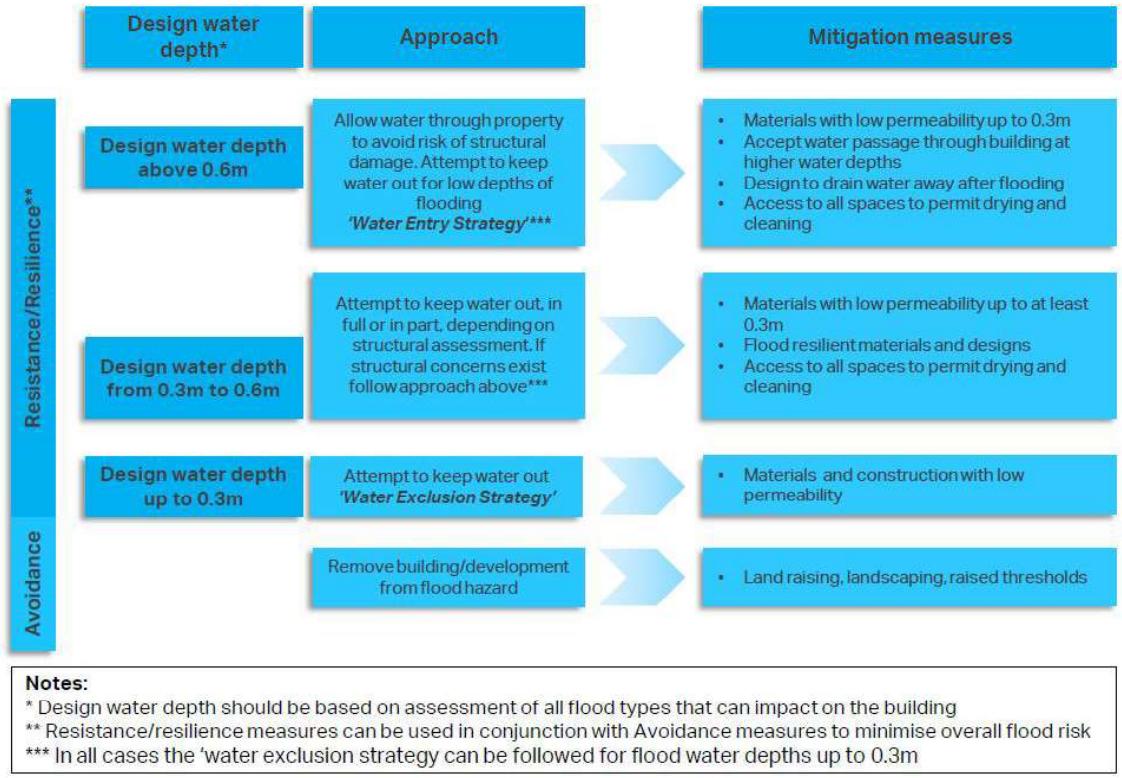


Figure 9-1: Rationale for Flood Resilient Design Strategies, Improving Flood Performance, (Figure 4.1 from CLG 2007)

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 300mm 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.

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.

9.4.5 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.”

Definitions for Green Infrastructure vary in the degree to which they refer to ‘Blue’ infrastructure elements. The Natural England Green Infrastructure Guidance[48] 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, 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.

9.4.6 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.

9.4.7 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.

9.4.8 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.

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.

[48] Natural England. 2009.Natural England’s Green Infrastructure Guidance (NE176). Available at: http://publications.naturalengland.org.uk/publication/35033

For developments located in areas at flood risk the Environment Agency considers 'safe' access/egress should be in accordance with 'FRA Guidance for new Developments FD 2320'[49]. 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.

9.4.9 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 SKDC to demonstrate that the proposals would improve and not worsen the existing flooding situation.

9.4.10 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.

[49] Environment Agency. 2005.Flood Risk Assessment Guidance for New Development. Avalible at: http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2320_3364_TRP_pdf.sflb.ashx

10. Flood Risk Management Policy Recommendations

10.1 Overview

To ensure developments promoted under the NPPF achieve the aims of the PPG for Flood Risk and Coastal Change, a number of recommendations have been made in light of the information generated within this Level 1 SFRA. The aim of these recommendations is to support SKDC in the development of their Local Plan and provide advice over the type and nature of policies contained within.

10.2 Policy Considerations

Through the review of national and local policy, combined with the newly attained insight into local flood risk issues, the following catchment wide and specific area policy recommendations have been developed. The policies aim to address flood risk across the South Kesteven District by ensuring that the Sequential Test requirements are considered and provide guidance on which planning applications should be accompanied by Site-Specific FRAs.

10.2.1 Flood Risk Reduction through Spatial Planning and Site Design

The primary aim of the PPG is to "steer new development to areas with the lowest probability of flooding". To achieve this aim the following policies are recommended:

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to areas within Flood Zone 1;
- Use the Sequential Test 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 at high hazard areas in the event of failure;
- Where a site is located within Flood Zones 2 or 3, a site-specific FRA should be undertaken to identify the actual risk from Flood Zone 3, including likely flow routes and floodplain storage volumes;
- As the variation in flood extents can be negligible between the return periods, consideration should be given to how the proposed site would be affected by this and developers should be confident in their assessment of flood levels. Especially taking into account the range of climate change allowances;
- 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;
- 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);
- 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. Dry pedestrian access/egress should be possible for the 1 in 100 year return period event including an allowance for climate change associated with fluvial flooding;
- Ensure developers engage with local regulators such as the Environment Agency, Anglian Water, LCC, the local IDBs and SKDC Highways, throughout the development/planning process to develop and instigate initiatives for the reduction of flood risk; and
- Avoid culverting watercourses 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 the local IDB (for Ordinary Watercourses), which act as agents for LCC in each of their extended catchments under the terms of the Land Drainage/Water Resources Act 1991 and Flood and Water Management Act 2010. These regulatory bodies

seek to avoid culverting, and their consent for such works will not normally be granted except as a means of access.

10.2.2 Reducing Surface Water Runoff from New Developments

The risk of surface water flooding is less predictable than fluvial flooding and whilst there are clear trends for surface water to accumulate within the river corridors and specific topographic and urban features (embankment etc.), the risk of surface water can be much more localised and harder to predict. Where possible, SKDC should ensure that all sites located in areas of surface water flood risk (based on the mapping and historic incidences) are supported by a site-specific FRA. The FRA should also consider the impacts of climate change on future surface water flood risk.

All sites require the following:

- Use of SuDS (where possible use of strategic SuDS should be made);
- Discharge rates should be restricted to Greenfield runoff rates;
- For brownfield sites, runoff rates should be restricted to the calculated Greenfield rate, in accordance with the LCC Development Road and Sustainable Drainage Specification and Construction Guidance;
- Attenuation of surface water for up to and including the 1 in 100 year storm event, including an allowance for climate change;
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites;
- Surface water drainage proposals should follow the SuDS train as outlined in the LCC Development Road and Sustainable Drainage Specification and Construction Guidance and have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission in line with national planning policy.; and
- Large potential development areas with a number of new allocation sites should look to develop a strategy for providing a joint SuDS scheme. This should be on an integrated and strategic scale and where necessary would require the collaboration of all developers involved in implementing a specific expansion area or site.

10.2.3 Improving Flood Awareness and Emergency Planning

- Seek to improve the emergency planning process 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 Flood Warning Direct Service operated by the Environment Agency; and.
- Ensure robust emergency (evacuation) plans are implemented for new developments.

11. Summary and Recommendations

11.1 The Sequential Test

Using the strategic flood risk information presented within this Level 1 SFRA, SKDC should undertake the Sequential Test to document the process whereby future development is steered towards areas of lowest flood risk.

11.2 Council Policy

The SKDC Core Strategy and Local Plan and supporting guidance documents should 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[3,27]; 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.

11.3 Emergency Planning

As both the LCC and SKDC are Category 1 responders it is recommended that they review their Emergency Plans and, if necessary, update it 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 recommended that SKDC 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 Warnings Direct Service.

11.4 Level 2 SFRA

Once SKDC have undertaken the Sequential Test, a Level 2 SFRA will be produced to assess the level of risk to those areas identified as being at risk of flooding. The Level 2 SFRA will provide information to support the application of the Exception Test for future development sites and will consider the detailed nature of the flood characteristics within a flood zone including:

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

11.5 Future Updates to the SFRA

This SFRA has been updated building heavily upon existing knowledge with respect to flood risk across SKDC's administrative area. The Environment Agency review and publish updates to the Flood Map for Planning (Rivers and Sea) on a quarterly basis and update catchment strategic models on a five yearly basis. Future new modelling of watercourses in the area will improve the current knowledge of flood risk within the District.

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 across the District.

SKDC could look to improve their understanding of flood risk to include detailed mapping of their ordinary watercourses and working closely with Anglian Water to understand local sewer capacity issues.

Appendix A Data Register

Appendix A Data Register

Dataset	Source	Format	Description
South Kesteven District Council Assessment Sites	SKDC	MAPINFO .tab file	Site boundaries and outlines for potential: - Employment Sites - Residential Sites
Land-Form PANORAMA	OS OpenSource	ASCII	Topographic Data
Watercourse Catchments	FEH CD ROM	TIFF Image	Catchment outlines for the Welland, Witham and Devon.
Flood Zone 3	Data.Gov	MAPINFO .tab file	Flood Zone 3 extent
Flood Zone 2	Data.Gov	MAPINFO .tab file	Flood Zone 2 extent
Flood Storage Areas	Data.Gov	MAPINFO .tab file	Areas classified as Flood Storage Area (FSA)
Areas Benefiting from Flood Defences	Data.Gov	MAPINFO .tab file	Areas classified as benefiting from flood defences
Spatial Flood Defences	Data.Gov	MAPINFO .tab file	Details of flood defences including attributes
Flood Warning Areas	Data.Gov	MAPINFO .tab file	Areas that receive flood warnings of fluvial or tidal flooding from the EA
Flood Alert Areas	Data.Gov	MAPINFO .tab file	Areas that receive flood alerts of fluvial or tidal flooding from the EA
Historic Flood Outlines	Data.Gov	MAPINFO .tab file	Reported historic flood outlines
Detailed River Network	EA Geostore (via SKDC)	MAPINFO .tab file	Main river and ordinary watercourse lines
Main Rivers	EA Geostore (via SKDC)	MAPINFO .tab file	Statutory Main Rivers
Risk of Flooding from Surface Water (RoFSW)	EA Geostore (via SKDC)	MAPINFO .tab file	The low, medium and high risk of flooding from surface water extents
Aquifer Designation- Bedrock Geology	EA Geostore (via SKDC)	MAPINFO .tab file	Designated Aquifers within bedrock geology
Aquifer Designation- Superficial Geology	EA Geostore (via SKDC)	MAPINFO .tab file	Designated Aquifers within bedrock geology
Source Protection Zones	EA Geostore (via SKDC)	MAPINFO .tab file	Areas classified as groundwater protection zones
Areas Susceptible to Groundwater Flooding (AStGWF)	EA Geostore (via SKDC)	MAPINFO .tab file	Database outlining the susceptibility to groundwater flooding

BGS 600k Bedrock Geology	British Geological Survey	MAPINFO .tab file	Bedrock Geology of the UK
BGS 600K Superficial Geology	British Geological Survey	MAPINFO .tab file	Superficial Geology of the UK
AW DG5- Sewer Flooding AW Locations	Anglian Water Limited	Excel Spreadsheet	Details of internal and external flooding recorded within each drainage area.
AIMs Database	Environment Agency	Microsoft Access Database	Information the flood defences in SKDC area, including type of defence, design event and current condition.
Risk of Flood from Reservoirs	Environment Agency	MAPINFO .tab file	Flood risk from Reservoirs extent
EA Flood Model extents	Environment Agency	Various formats	Details of hydraulic modelling studies completed across SKDC area including model extents, results and accompanying reports. For the purposes of this Level 1 SFRA, this data has been used to derive Flood Zone 3b where applicable.