2019s0332 – Strategic Flood Risk Assessment for Hinckley and Bosworth Borough Council

Final Report

July 2019

www.jbaconsulting.com

Hinckley and Bosworth Borough Council

Hinckley & Bosworth Borough Council

Joanne Chillingworth
The Library
St Philips Courtyard
Church Hill
Coleshill
Warwickshire
B46 3AD

Revision history

Revision Ref/Date	Amendments	Issued to
Draft Report v1.0 / 9th May 2019		Chris Colbourn and Rob Foers, Hinckley & Bosworth Borough Council
Final Report v1.0 / 05th July 2019		Chris Colbourn and Rob Foers, Hinckley & Bosworth Borough Council

Contract

This report describes work commissioned by Chris Colbourn, on behalf of Hinckley and Bosworth Borough Council, by an email dated 5th March 2019. Joanne Chillingworth, Hannah Coogan, Lucy Finch and Adam Church of JBA Consulting carried out this work.

Prepared by	Lucy Finch BSc
	Analyst
.....	Adam Church BSc
	Assistant Analyst
Reviewed by	Joanne Chillingworth BSc MSc MCIWEM C.WEM
.....	Principal Analyst
.....	Hannah Coogan BSc MCIWEM C.WEM
	Technical Director

Purpose

This document has been prepared as a Draft Report for Hinckley and Bosworth Borough Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Hinckley and Bosworth Borough Council.

Acknowledgements

We would like to acknowledge the assistance of:

- Hinckley and Bosworth Borough Council;
- Environment Agency;
- Severn Trent Water;
- Leicestershire Fire and Rescue Service;
- The Canal and Rivers Trust; and,
- Planners at the neighbouring authorities

Carbon footprint

JBA is aiming to reduce its per capita carbon emissions.

Executive summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the production of the Local Plan to 2036. This is a Level 1 Strategic Flood Risk Assessment (SFRA) and it will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

Introduction

This Strategic Flood Risk Assessment (SFRA) document provides an update to the Joint 2014 SFRA for Hinckley and Bosworth, Blaby and Oadby and Wigston Borough Councils, as well as an update to the Leicestershire and Leicester City 2017 SFRA. Both of these existing SFRAs contained relevant data to Hinckley and Bosworth but included a much larger area and additional Local Authorities. This study provides a comprehensive and robust evidence base to support the new Hinckley and Bosworth Borough Council Local Plan. The key objectives are:

- To update the Council's Joint 2014 SFRA and the 2017 SFRA, taking into account the most recent policy and legislation in the National Planning Policy Framework (2019).
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated.
- To inform decisions in the emerging Local Plan, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support the Council's preparation of the Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- To provide advice for applicants carrying out site-specific flood risk assessments and outline specific measures or objectives that are required to manage flood risk.

Summary of flood risk in Hinckley and Bosworth Borough

- Past flooding information available for this study is limited. The data that does exist shows that the main risk is from surface water and culverted watercourses. The most affected areas for historic flooding correspond with the main urban areas in the borough, including Hinckley, Barwell, Earl Shilton, Desford, Ratby and Groby, although there are some records of historical flooding in rural areas.
- The main rivers associated with fluvial flooding are the River Anker and River Sence, which pose a flood risk to settlements including Sheepy Magna, Shackerstone, Witherley and the outskirts of Atherstone. Additionally, there is fluvial flood risk posed to the borough by a number of smaller watercourses. Within Hinckley and Burbage, the Battle Brook, Harrow Brook and Sketchley brook pose a fluvial flooding risk. In the east of the borough, the Rothley Brook poses a fluvial flood risk to the urban areas of Groby and Ratby.

- The Areas Susceptible to Groundwater Flooding map shows that, in general, the majority of Hinckley and Bosworth borough is within the <25% susceptible classification, therefore it is at lower risk of groundwater flooding. Parts of the borough around Stoke Golding, Newbold Verdon and Desford, and the west of the borough along the River Sence channel fall within higher susceptibility classifications and are therefore at higher risk from groundwater flooding.
- There is one canal located within Hinckley and Bosworth borough, the Ashby Canal. These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been five recorded incidents of canal breach from 1981 to 1990, and three recorded incidents of canal overtopping from 2012 to 2016. The canal breach incidents occurred in primarily rural locations on the stretch of the canal between Congerstone and Shenton. The canal overtopping incidents occurred in Stoke Golding and Hinckley.
- There is a potential risk of flooding from reservoirs both within the borough and those outside. There are four reservoirs within Hinckley and Bosworth borough. There are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

How to use this report

Planners

The SFRA provides recommendations regarding all sources of flood risk in Hinckley and Bosworth borough, which can be used to inform policy on flood risk within the Local Plan. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test and provides guidance on how to apply the Exception Test. The Borough Council will use this information to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed.

The SFRA provides guidance for developers, which can be used by Development Management staff to assess whether site specific Flood Risk Assessments meet the required quality standard.

Developers

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the Sequential Test. For all sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage.

When assessing sites not identified in the Local Plan (windfall sites), developers should use evidence provided in this SFRA to apply the Sequential Test as well as providing evidence to show that they have adequately considered other reasonably available sites.

This SFRA provides guidance for the application of the Sequential and Exception Tests at a site level and for detailed site-specific Flood Risk Assessments.

This is a strategic assessment and does not replace the need for site-specific Flood Risk Assessments where a development is either within Flood Zones 2 or 3 or greater than a hectare in Flood Zone 1. In addition, a surface water drainage strategy will be needed for all major developments in any Flood Zone to satisfy Leicestershire County Council (the Lead Local Flood Authority (LLFA) for the area).

Developers can use the information in this SFRA, alongside site specific research to help to scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this they should refer to the Chapter 5 Sources of flooding in Hinckley and Bosworth and the flood maps in the appendices.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, due to be updated by the Environment Agency in 2019), inform master planning and prove, if required, whether the Exception Test can be passed. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

Developers need to ensure that new development does not increase surface water runoff from a site. Chapter 9 provides information on the surface water drainage requirements of Leicestershire County Council as LLFA. Sustainable Drainage Systems should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Flood Risk Assessments will need to identify how flood risk will be mitigated to ensure the development is safe from flooding. In high risk areas the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Any developments located within an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', where the future maintenance is uncertain and where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Neighbourhood plans

The SFRA provides information on the sources of flooding and the variation in the risk across the borough, which organisations are involved in flood risk management and their latest strategic plans, current plans for major flood defences, the requirements for detailed Flood Risk Assessments and to inform the site selection process

Neighbourhood planners can use this information to assess the risk of flooding to sites within their community, using the Chapter 5, the sources of flooding in Hinckley and Bosworth and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

These maps highlight on a broad scale where flood risk from fluvial, surface water, groundwater and the effects of climate change are most likely. These maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or model small scale changes in flood risk.

Local knowledge of flood mechanisms will need to be included to complement this broadscale mapping. Similarly, all known recorded historical flood events for the borough are listed in Section 5.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by Hinckley and Bosworth Borough Council are outlined in Section 6.4 and Section 8.4 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

A cumulative impact assessment has been carried out which has identified which parishes in Hinckley and Bosworth borough are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should mitigate against existing flooding problems and any potential future flooding.

Contents

List of Figures

List of Tables

Abbreviation

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
AStGWf	Areas Susceptible to Groundwater flooding

Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	The cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second; also m^3/s.
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
Design flood	This is a flood event of a given annual flood probability, which is generally taken as: fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or; tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
Exception Test	Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.
FCERM	Flood and Coastal Erosion Risk Management
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.

FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
IDB	Internal Drainage Board
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
Jflow	2D generalised hydrodynamic modelling software.
LFRMS	Local Food Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.
PPS25	Planning Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG

RBMP	River Basin Management Plan
RFCC's	Regional Flood and Coastal Committee
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	Operating authorities who's remit and responsibilities concern flood and / or coastal risk management.
RoFfSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

JBA Consulting were commissioned by Hinckley and Bosworth Borough Council to prepare a Level 1 Strategic Flood Risk Assessment (SFRA). This study provides a comprehensive and robust evidence base to support the production of the Local Plan to 2036. This document provides an update to the Joint 2014 SFRA for Hinckley and Bosworth, Blaby and Oadby and Wigston Borough Councils, as well as an update to the Leicestershire and Leicester City 2017 SFRA.

The 2019 SFRA will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

1.2 Local Plan

The Hinckley and Bosworth Local Plan, which is currently in the 'New Directions for Growth Consultation' phase of the Review, is scheduled for adoption in 2021 and will look ahead to the year 2036. The current Local Plan comprises a number of documents, the last of which was adopted in 2016. The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

1.3 Levels of SFRA

The Planning Practice Guidance identifies the following two levels of SFRA:

- Level 1: where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.
- Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all necessary development, creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This Level 1 SFRA is intended to aid Hinckley and Bosworth Borough Council in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 SFRA.

1.4 SFRA outputs

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including Main River, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Assessment of the potential increase in flood risk due to climate change.
- Flood Risk Assessment guidance for developers.

- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

1.5 SFRA Study Area

Hinckley and Bosworth Borough Council's administrative area covers an area of approximately 297km^2 and has a population of approximately 105,078 (2011 census).

Hinckley and Bosworth borough is bound by North West Leicestershire Borough Council, North Warwickshire Borough Council, Nuneaton and Bedworth Borough Council, Rugby Borough Council, Blaby District Council and Charnwood Borough Council. Hinckley and Bosworth borough is predominantly rural, with the primary urban centres of Hinckley, Burbage, Barwell and Earl Shilton located to the south of the borough. The M1 passes through the north east of the borough, and the M69 passes through the south. Figure 1-1 and Figure 1-2 show the study area and the neighbouring Local Authorities.

Figure 1-1: Hinckley and Bosworth Borough Council study area

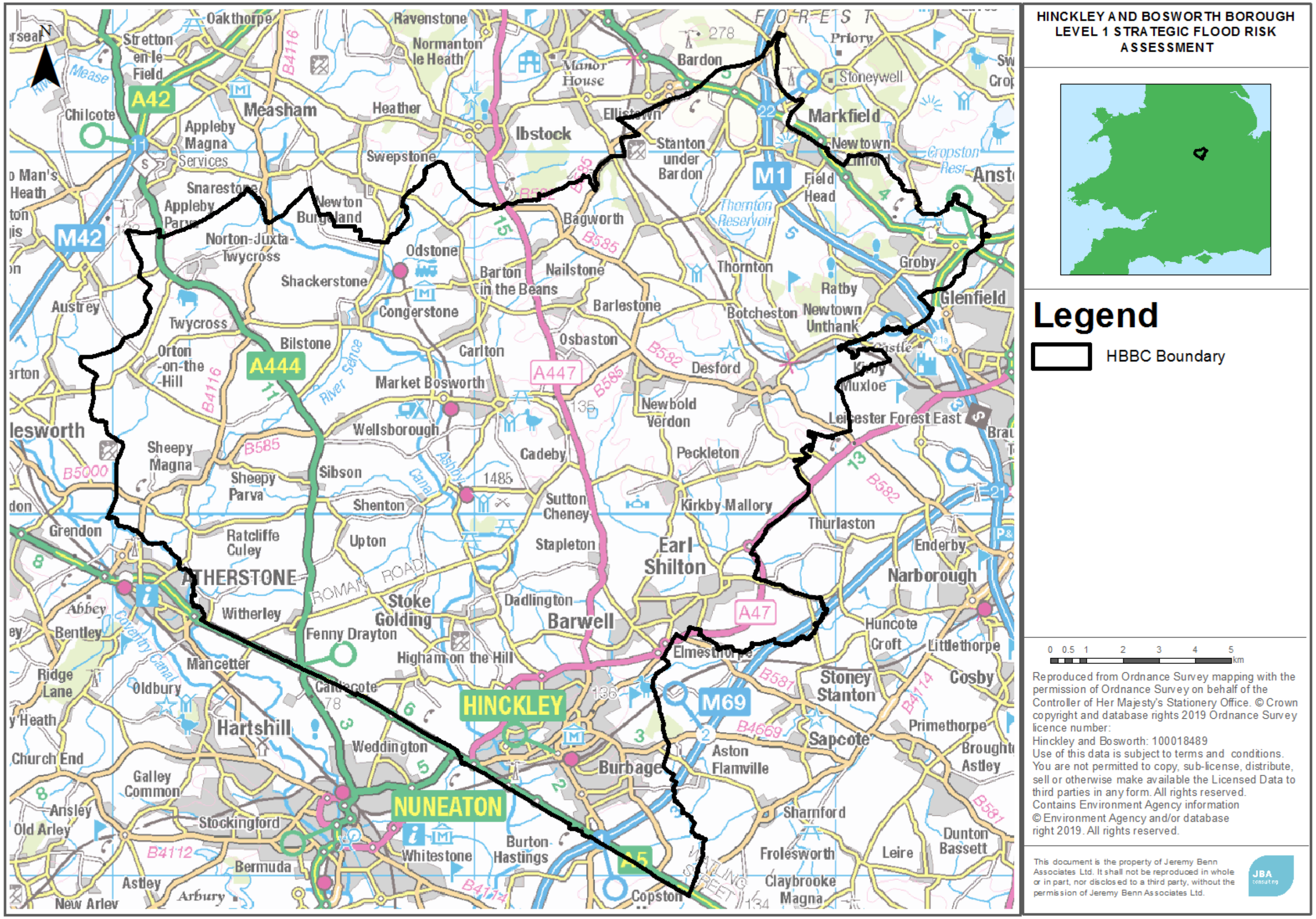
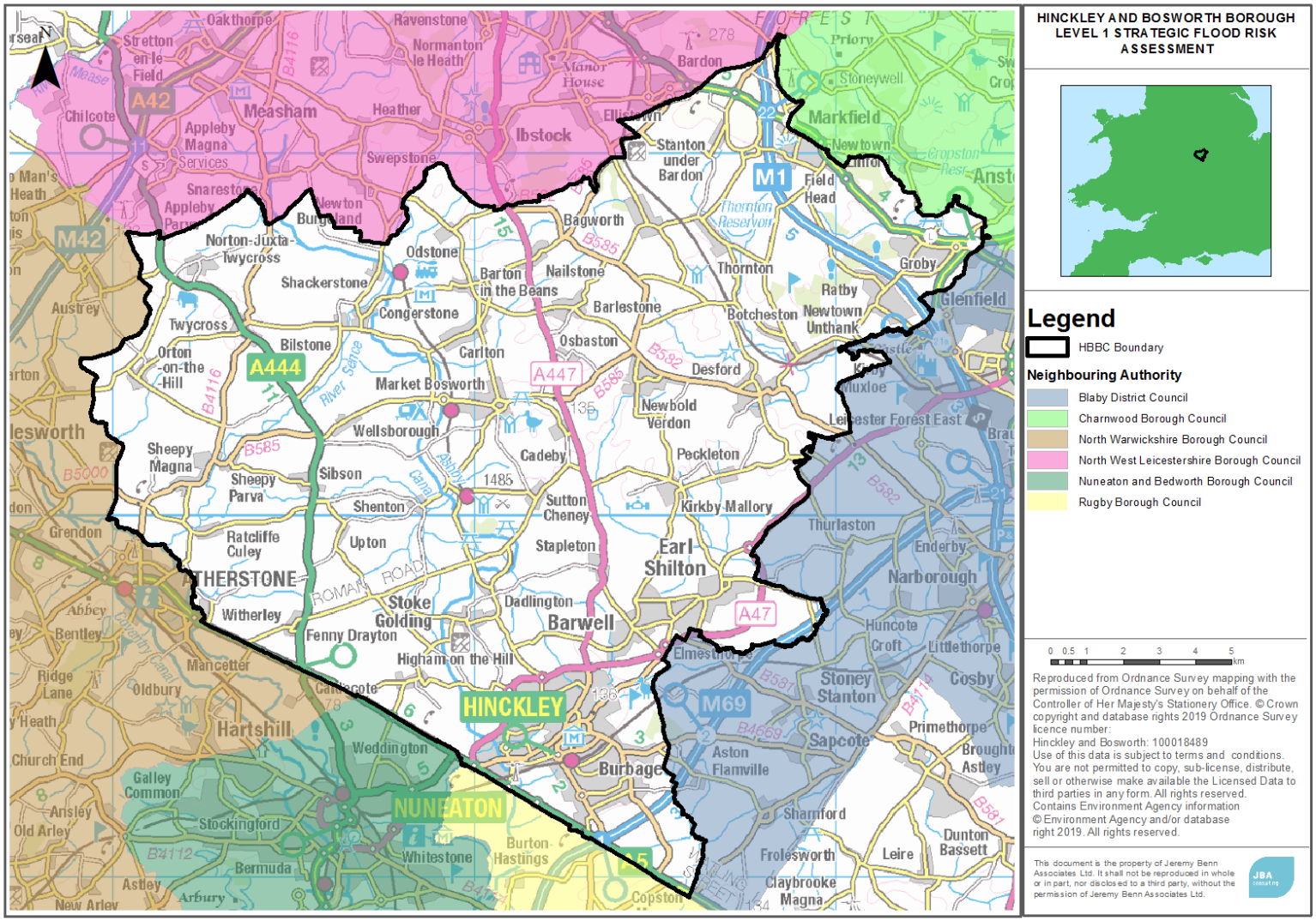


Figure 1-2: Neighbouring Local Authorities



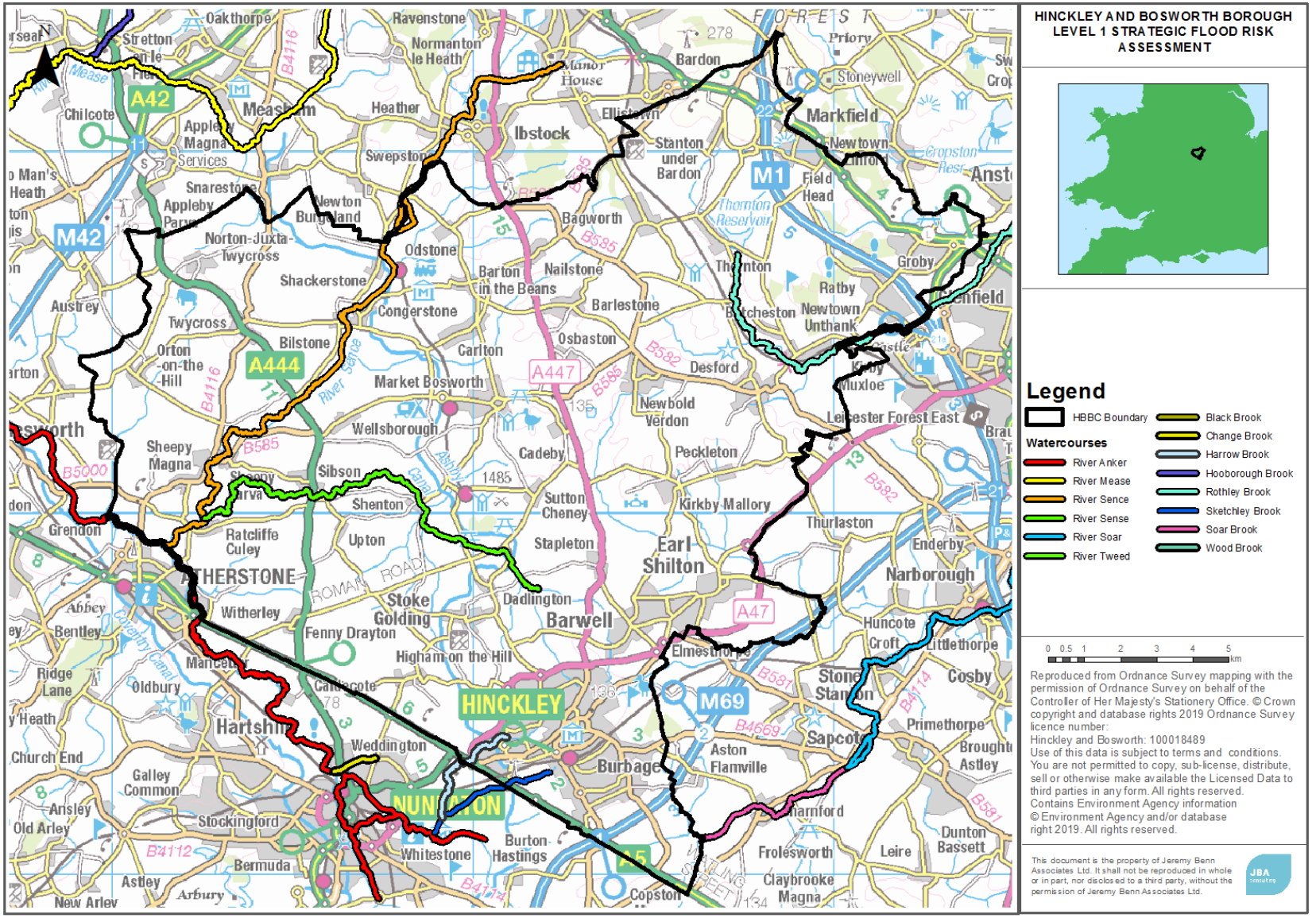
The main rivers that fall within Hinckley and Bosworth borough are:

- River Anker
- River Sence
- River Tweed

The River Anker forms the boundary between Hinckley and Bosworth borough and North Warwickshire borough and flows in a north-westerly direction past the north of Atherstone towards Tamworth, where it joins the River Tame. The River Sence, a tributary of the River Anker, enters the borough to the north of Odstone. The river flows in a south-westerly direction before joining the River Anker north of Atherstone. The River Tweed rises to the north of Barwell and flows in a generally north-western direction before joining the River Sence to the north east of Atherstone. The Ashby de la Zouch Canal (Ashby) also flows through the borough. It enters the borough to north, adjacent to Snarestone, and flows in a southerly direction before exiting the borough to the west of Hinckley and Sketchley.

There are several notable minor rivers and brooks within Hinckley and Bosworth Borough, including the Sketchley Brook, Rothley Brook and Harrow Brook. Outside of the borough, the River Mease is situated to the north, and the River Soar to the east. Figure 1-3 shows a map of the main watercourses within Hinckley and Bosworth borough.

Figure 1-3: Map of the principal rivers and other watercourse within and around Hinckley and Bosworth Borough



1.6 Consultation

The following parties (external to Hinckley and Bosworth Borough Council) were consulted to inform the SFRA:

- Environment Agency
- Leicestershire County Council
- Canal & River Trust
- Severn Trent Water
- Neighbouring authorities including:
  - North West Leicestershire District Council
  - North Warwickshire Borough Council
  - Nuneaton and Bedworth Borough Council
  - Blaby District Council
  - Rugby Borough Council
  - Charnwood Borough Council

1.7 Use of SFRA data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the Local Plan and any future flood risk policies.

Developers will still be required to undertake site-specific Flood Risk Assessments to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Hyperlinks to external guidance documents/ websites are provided in Green throughout the SFRA.

Advice to users has been highlighted in **amber boxes** throughout the document.

On the date of publication, the SFRA contains the latest flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), flood event information, new defence schemes and updates to policy and legislation. Developers should check the online Flood Map for Planning in the first instance to identify any major changes to the Flood Zones.

1.8 Structure of this report

Section	Contents
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA Provides a short introduction to how flood risk is assessed and the importance of considering all sources Includes this table of the contents of the SFRA
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the Council and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.
4. The impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments
5. Understanding flood risk in the study area	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.
7. Cumulative impact of development and cross boundary issues	This section provides a summary of the catchments with the highest flood risk and development pressures, considers opportunities for strategic flood risk solutions and makes recommendations for local planning policy based on these.
8. Guidance for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources
9. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage Systems (SDS) from the Lead Local Flood Authority.
10. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations

Appendices:

- Appendix A: Interactive flood risk maps
- Appendix B: Data sources used in the SFRA
- Appendix C: Groundwater Source Protection Zones
- Appendix D: Detailed information on Flood Alert and Flood Warning Areas
- Appendix E: Summary of flood risk across the borough
- Appendix F: Cumulative Impact Assessment methodology

1.9 Understanding flood risk

This section provides useful background information on how flooding arises and how flood risk is determined.

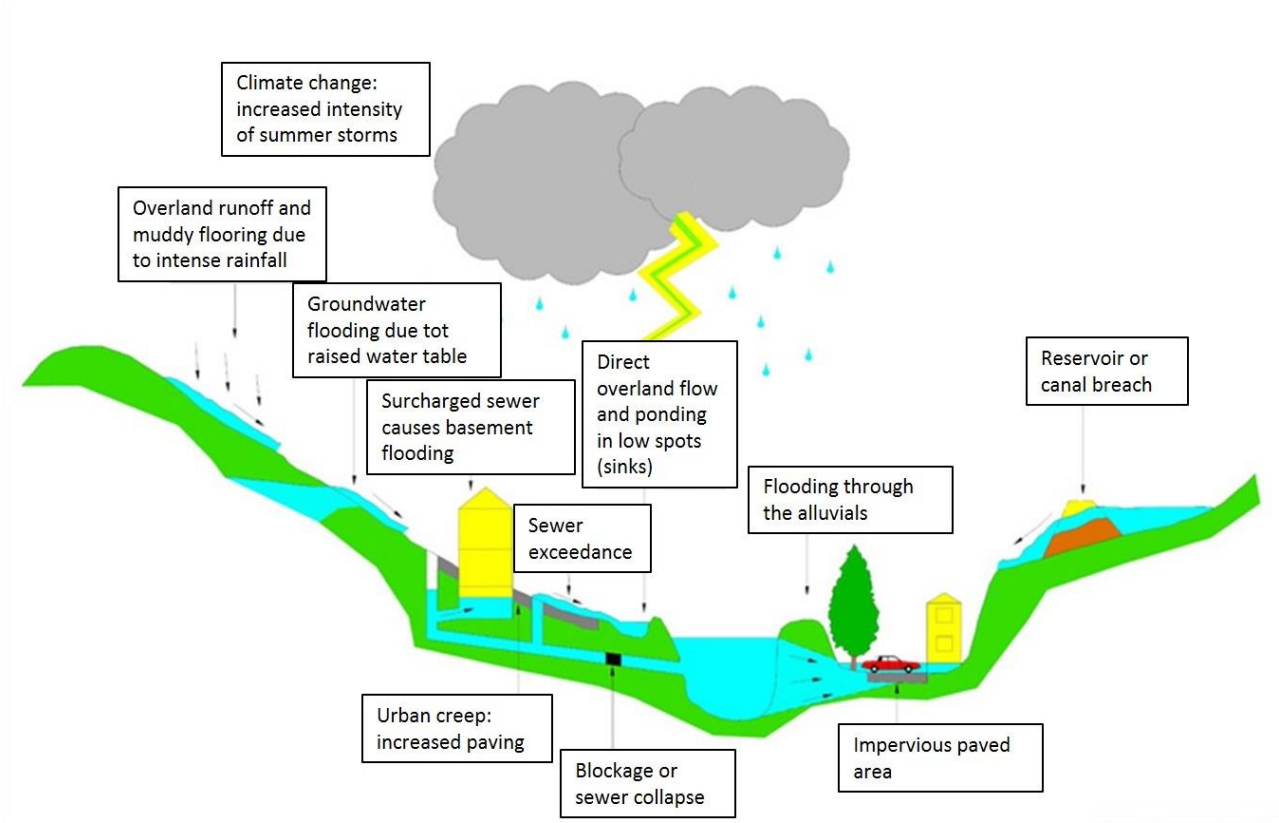
1.9.1 Sources of Flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways, as illustrated in Figure 1-4. Major sources of flooding include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.)
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

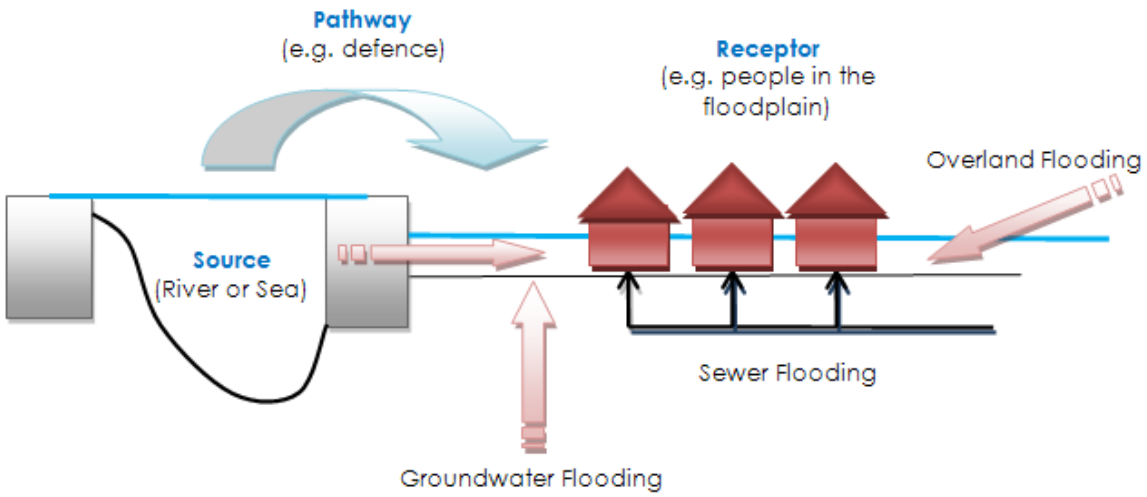
Figure 1-4: Flooding from all sources



1.10 Likelihood and Consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 1-5 below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

Figure 1-5: Source-Pathway-Receptor Model



The principal sources are rainfall; the most common pathways are rivers, drains, sewers, overland flow and river floodplains; their defence assets; and the receptors can include people, their property and the environment. All these elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding, but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

1.11 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

1.12 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

2 Flood risk policy and strategy

This section sets out the FRM roles and responsibilities for different organisations and relevant legislation, policy and strategy

2.1 Roles and responsibilities for Flood Risk Management in Hinckley and Bosworth borough

There are different organisations that cover Hinckley and Bosworth borough that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown on Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species and allowing the flow of water to pass without obstruction. More information can be found in the Environment Agency publication 'Owning a Watercourse' (2018).

Table 2-1: Risk Management Authorities

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	• Strategic overview for all sources of flooding • National Strategy • Reporting and general supervision	• Main rivers (e.g. river Idle, River Trent, River Poulter, River Ryton) • Reservoirs	• Statutory consultee for development in Flood Zones 2 and 3
Leicestershire County Council (LCC) as Lead Local Flood Authority (LLFA)	• Preliminary Flood Risk Assessment • Local Flood Risk Management Strategy	• Surface Water • Groundwater • Ordinary Watercourses (consenting and enforcement) • Ordinary watercourses (works)	• Statutory consultee for major developments
Hinckley and Bosworth as Local Planning Authority	• Local Plans as Local Planning Authorities	• Determination of Planning Applications as Local Planning Authorities • Managing open spaces under Borough Council ownership	• As left
Severn Trent Water	• Asset Management	• Public sewers	• Non-statutory consultee

	Plans, supported by Periodic Reviews (business cases) • Develop Drainage and Wastewater management plans		
Highways Authorities • *Highways Agency (motorways and trunk roads)* • *SCC (other adopted roads)*	• Highway drainage policy and planning	• Highway drainage	• Internal planning consultee regarding highways design standards and adoptions

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in Hinckley and Bosworth:

- **Flood Risk Regulations (2009)** - these transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed flood maps and a Flood Risk Management Plan is produced; this is done in a six-year cycle.
- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991)** Environment Act (2005), **Flood and Water Management Act (2010)** – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- The **Land Drainage Act (1991, as amended)** and **Environmental Permitting Regulations (2018)** also set out where developers will need to apply for additional permission (as well as Planning Permission) to undertake works to an Ordinary Watercourse or Main River.
- The **Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aims to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good status'.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

2.3 Relevant flood risk policy and strategy documents

Table 2-1 Summarises relevant national, regional and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform Flood Risk Assessments within the local area.

- Set the strategic policy and direction for Flood Risk Management (FRM) and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in the Borough.
- Provide guidance and/ or standards that informs how a developer should assess flood risk and/ or design flood mitigation and SuDS.

Table 2-2: National, regional and local flood risk policy and strategy documents

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	Flood and Coastal Management Strategy (Environment Agency) 2011	No	Yes	No	2019
	National Planning Policy Framework and Guidance (MHCLG) 2018/2015)	No	No	Yes	2019 updates to NPPG
	Building Regulations Part H (MHCLG) 2010	No	No	Yes	-
Regional	River Trent Catchment Flood Management Plan (Environment Agency) 2009	Yes	Yes	No	-
	Humber River Basin Management Plan (Environment Agency) 2018	No	Yes	No	2021
	Climate Change guidance for development and flood risk (Environment Agency) 2019	No	No	Yes	2019
Local	SuDS guidance Leicestershire County Council (LCC) (2018)	No	No	Yes	-
	Leicestershire County Council Standing Advice to Local Planning Authority (LCC) 2015	Yes	Yes	No	-
	Local Flood Risk Management Strategy (LCC) 2015	Yes	No	No	-
	Drainage and Wastewater Management Plan (Severn Trent Water) due 2023	Yes	Yes	Yes	2023
	Leicester City and Leicestershire Strategic Water Cycle Study (JBA) 2017	Yes	Yes	Yes	-

2.4 Key legislation for flood and water management

2.4.1 Flood Risk Regulations (2009)

The Flood Risk Regulations 2009 translate the EU Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk (known as a Preliminary Flood Risk Assessment (PFRA)) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans.

The Flood Risk Regulations direct the Environment Agency to do this work for river, sea and reservoir flooding. LLFAs must do this work for surface water, Ordinary Watercourse and Groundwater flooding. This is a six-year cycle of work and the second cycle started in 2017.

The Leicestershire PFRA (2011) provides information on significant past and future flood risk from localised flooding in Leicestershire. This was updated in 2017, and no nationally significant Flood Risk Areas for localised flooding have been identified in Leicestershire.

2.4.2 Flood and Water Management Act (FWMA) 2010

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way we manage our water resources.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

2.4.3 Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP), which were last published in 2015 and are currently being updated.

Hinckley and Bosworth borough lies within the Humber River Basin District.

2.5 Key national, regional and local policy documents and strategies

2.5.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2011)

The National Flood and Coastal Erosion Risk Management Strategy for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. It was prepared by the Environment Agency with input from Defra.

The Strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. It describes how risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment.

The strategy encourages more effective risk management by enabling people, communities, business, infrastructure operators 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 risk;
- manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment;
- ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood forecasts, warnings and advice;
- help communities to recover more quickly and effectively after incidents.

The Strategy is currently being updated and will be published in 2019.

2.5.2 River Basin Management Plans

The Humber River Basin District River Basin Management Plan (RBMP), managed by the EA, has been updated since the first cycle in 2009. The latest version was published in December 2015. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Humber RBMP includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality. The plans include an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use and progress since the first plan in 2009. The Plans are currently being reviewed.

2.5.3 Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) are part of the six-year cycle of assessment, mapping and planning required under the Flood Risk Regulations. The Environment Agency led the development of the Humber FRMPs, which were published in 2015. The FRMPs summarise the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.5.4 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

Hinckley and Bosworth Borough sits within the River Trent Catchment Management Plan and is part of sub areas 8 (Rural Leicestershire) and 9 (Upper Soar and Upper Anker).

Within sub area 8, surface water runoff in rural areas creates a rapid response to rainfall events, where several environmental sites are liable to be affected by flooding. The preferred policy is Policy Option 6, which uses sustainable flood storage and mitigation schemes should be used to store water and manage surface runoff in locations that provide overall flood risk reduction as well as environmental benefits.

Within sub area 9, there are several urban locations in the Soar valley and floodplains, chiefly Leicester, Nuneaton and Loughborough. These areas are at risk of flooding as a result of lack of capacity in river channels and floodplain inundation. There is a medium risk of flooding in this area. The preferred policy is Policy Option 4, which recognises that flood risk is already being managed effectively but there will need to be future improvements to management strategy to keep pace with the increased flood risk as a result of climate change.

2.5.5 Leicestershire Local Flood Risk Management Strategy

The Leicestershire Local Flood Risk Management Strategy was published in 2015. The Strategy sets out how Leicestershire County Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk in the County. The Local FRM Strategy sets out policies on:

- When the LLFA will investigate flooding incidents
- How the LLFA will collate data on flood risk assets
- Where the LLFA will designate third party assets affecting flood risk
- How the LLFA will respond to planning applications
- How the LLFA will work with others to develop flood risk schemes
- How the LLFA will preserve watercourses in their natural state
- When the LLFA will take land drainage enforcement action
- How the LLFA will seek to improve the environment

The Strategy notes that the Council will seek to deliver sustainable drainage systems (SuDS) as part of new development in its roles as statutory consultee for major planning applications and non-statutory consultee for non-major planning applications.

The Strategy has seven objectives, which are to:

1. Develop a strategic understanding of flood risk from all sources
2. Promote effective management of drainage and flood defence systems
3. Support communities to understand flood risk and become more resilient to flooding

4. Manage local flood risk and new development in a sustainable manner
5. Achieve results through partnership and collaboration
6. Be better prepared for flood events
7. Secure and manage funding for flood risk management in a challenging financial climate

The Strategy has the specific objective to "Manage local flood risk and new development in a sustainable manner" and the keys actions are to:

- Seek the inclusion of Sustainable Drainage Systems wherever possible within new developments and prepare a Local Sustainable Drainage System (SuDS) Handbook (now published)
- Regarding Sustainable Drainage Systems, respond to planning applications within 21 days as Statutory / Non-Statutory Consultee
- Regarding river flood risk, respond to planning applications within 21 days as Statutory Consultee (Environment Agency to lead)
- Assist with the development of planning policies, site allocations, neighbourhood plans and identification of future infrastructure needs
- Work with developers and Local Planning Authorities to secure appropriate connections to sewers / IDB assets (water companies and IDBs to lead)

2.5.6 Water Cycle Studies

Water Cycle Studies (WCS) – scoping, outline and detailed – assist Councils to select and develop sustainable development allocations in locations where there is minimal impact on the environment, water quality, water resources, infrastructure, and flood risk. WCSs provide the required evidence, and an agreed strategy, to ensure that planned growth occurs within environmental constraints (and where possible contributes to environmental improvements), with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable. This is undertaken by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts.

The latest WCS that covers Hinckley and Bosworth borough was Leicester City and Leicestershire Strategic Water Cycle Study, last published in November 2017. This will assist the Council in selecting and developing sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk.

2.5.7 Surface Water Management Plans

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from risk from surface runoff, groundwater, and ordinary watercourses. SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the County Council, Local Authority, Sewerage Undertaker and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree.

At the time of publication of this SFRA document, no SWMP has been published that covers Hinckley and Bosworth borough. Leicestershire County Council was

contacted to provide a timescale for the publication of the next SWMP covering Hinckley and Bosworth borough. However, it was confirmed that a SWMP has not yet been commissioned.

3 Planning policy for flood risk management

This section summaries national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised National Planning Policy Framework (NPPF) was published in July 2019, replacing the 2012 version. The NPPF sets out Government's planning policies for England. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements. The NPPF states that:

"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards"

Planning Practice Guidance on flood risk was published in March 2014 and sets out how the policy should be implemented. Diagram 1 in the NPPG sets out how flood risk should be considered in the preparation of Local Plans.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas.

3.2.1 The Flood Zones

The definition of the Flood Zones is provided below. The Flood Zones do not take into account defences. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change. Hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

The Flood Zones are:

- Flood Zone 1: Low probability: less than a 0.1% chance of river and sea flooding in any given year
- Flood Zone 2: Medium probability: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year
- Flood Zone 3a: High probability: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes.

The Flood Zones in the Appendix A Geo-PDFs are the same as those shown on the Environment Agency's 'Flood Map for Planning' (which incorporates latest modelled data), where available, and 2D generalised modelling from the 2014 SFRA for additional coverage.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses with areas <3km^2. As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from smaller watercourse not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is land which would flood with an annual probability of 1 in 20 years; where detailed modelling exists, the 1 in 20-year flood extent has been used to represent Flood Zone 3b (provided by the Environment Agency or 2014 2D generalised modelling). For areas outside of the detailed model coverage, this is represented by Flood Zone 3a (indicative Flood Zone 3b) as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists.

3.2.2 The Sequential Test

Firstly, land at the lowest risk of flooding and from all sources should be considered for development. A test is applied called the 'Sequential Test' to do this. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sides in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. Table 2 of the NPPG defines the vulnerability of different development types to flooding. Table 3 of the NPPG shows whether, having applied the Sequential Test first, that vulnerability of development is suitable for that Flood Zone and where further work is needed.

Figure 3-1 The Sequential Test

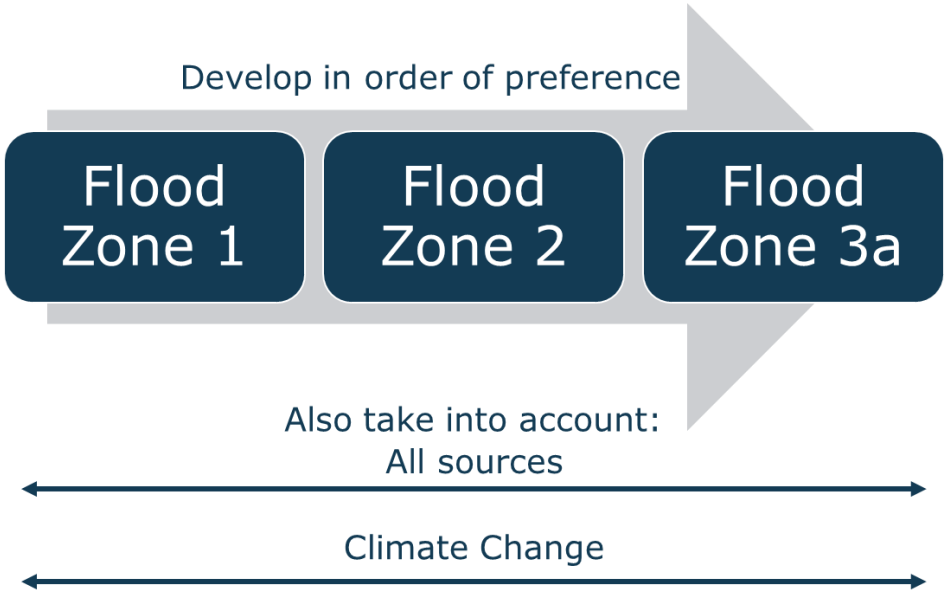
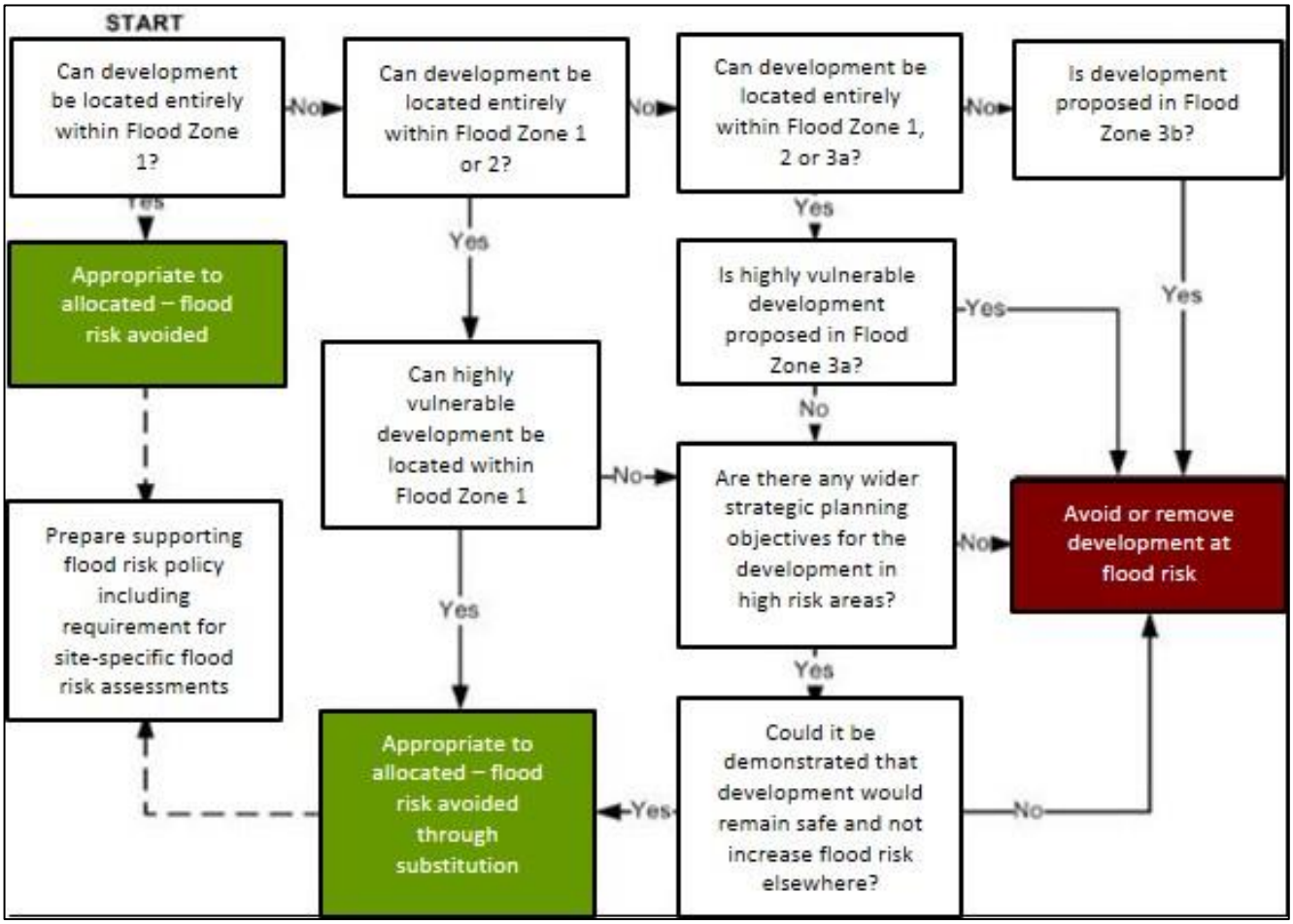


Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded.

In addition, the risk of flooding from outer sources and the impact of climate change must be considered when considering which sites are suitable to allocate.

Figure 3-2: Local Plan sequential approach to site allocation



3.2.3 The Exception Test

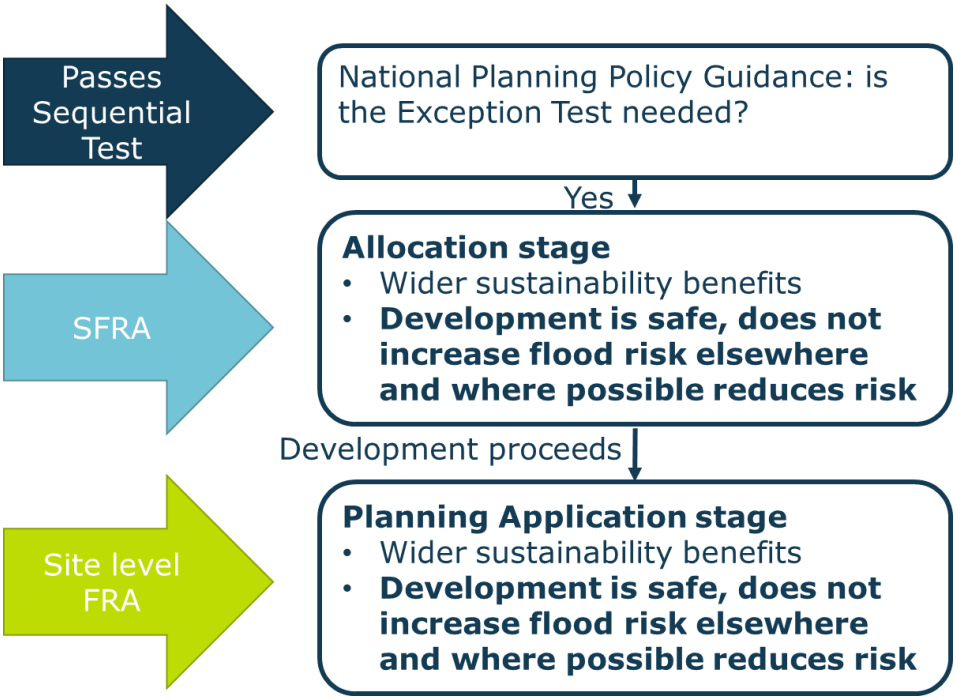
It will not always be possible for all new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances:

- More vulnerable in Flood Zone 3a
- Essential infrastructure in Flood Zone 3a or 3b
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)

Figure 3-3 summarises the Exception Test. An LPA should apply the Exception Test to strategic allocations. For all developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test. This is because when a site-specific Flood Risk Assessment is done, more information on the exact measures that can manage the risk is available.

Figure 3-3 The Exception Test



There are two parts to demonstrating a development passes the Exception Test:

1. *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk*

   Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

2. *Demonstrating 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.*

   A Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations. At Planning Application stage, a site-specific Flood Risk assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.3 Applying the Sequential Test and Exception Test to individual planning applications

3.3.1 Sequential Test

Hinckley and Bosworth Borough Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers are required to apply the Sequential Test to all development sites, unless the site is:

- A strategic allocation and the test has already been carried out by the LPA, or
- A change of use (except to a more vulnerable use), or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2), or
- A development in flood zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

The SFRA contains information on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Site with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood.

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required (as set out in Table 3 of the NPPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception test:

- *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk*

  Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

  Applicants should detail the suitability issues the development will address and how doing out will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- *Demonstrating 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.*

  The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:

  - The design of any flood defence infrastructure;
  - Access and egress;
  - Operation and maintenance;
  - Design of the development to manage and reduce flood risk wherever possible;
  - Resident awareness;
  - Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
  - Any funding arrangements required for implementing measures.

4 Impact of Climate Change

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

> The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be considered.

4.1 Revised Climate Change Guidance

The Environment Agency published updated climate change guidance in 2016 on how allowances for climate change should be included in both strategic and site specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency are currently using these to update their climate change guidance for new developments. Developers should check on the government website for the latest guidance before undertaking a detailed Flood Risk Assessment. At the time of writing this report, this was reported to be due in Spring 2019, but is not yet released.

The UKCP18 will contain high resolution mapping with peak river flow allowances at 1km grid scale. The regional peak river flow allowances in the 2016 guidance may not change but planners and developers may need to consider the finer resolution data where it shows a significant difference to the regional averages.

The UKCP18 high resolution (daily and sub daily) rainfall projections are due to be published in late 2019. Following this, the Environment Agency may update the recommended peak rainfall allowances in their guidance for planners and developers.

4.2 Applying the climate change guidance

To apply the climate change guidance, the following information needs to be known:

- The vulnerability of the development – see the NPPG
- The likely lifetime of the development – in general 60 years is used for commercial development and 100 for residential, but this needs to be confirmed in a FRA
- The River Basin that the site is in – Hinckley and Bosworth borough is situated in the Humber River Basin District.
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- The vulnerability of the development to flooding – see the NPPG
- 'built in' resilience measures used, for example, raised floor levels
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach

4.3 Relevant allowances for Hinckley and Bosworth borough

Table 4-1 shows the peak river flow allowances that apply in Hinckley and Bosworth borough:

Table 4-1 Peak river flow allowances for the Humber 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)
Upper end	20%	30%	50%
Higher central	15%	20%	30%
Central	10%	15%	20%

Table 4-2 shows the peak rainfall intensity allowances that apply in Hinckley and Bosworth borough. Both the central and upper end allowances should be considered to understand the range of impact.

Table 4-2 Peak rainfall intensity allowances for small and urban catchments

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)
Upper end	10%	20%	40%
Central	5%	10%	20%

4.4 Climate change modelling for the 2019 SFRA

Climate change modelling for the watercourses in the study area was undertaken based on the new climate change guidance.

Existing Environment Agency hydraulic models were run for the 2080s period for all three allowance categories (relevant to the river basin district) as part of the 2017 North West Leicestershire SFRA. This includes the River Anker, River Sence, Harrow Brook and Sketchley Brook

As part of the 2014 SFRA, a large proportion of the borough was modelled using 2D generalised techniques. Climate change here was run for the 100-year +20% scenario, so this has been updated as part of this 2019 SFRA to also account for the latest 2080s allowances.

Mapping of the climate change modelling outputs are provided in Appendix A.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase compared to the 100-year current day event.

When undertaking a site-specific Flood Risk Assessment, developers should:

- Confirm which national guidance on climate change and new development applies by visiting GOV.uk

- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed lifetime of the development. If the site is just outside the indicative climate change extents in this SFRA, the impact of climate change should still be considered because these may get affected should the more extreme climate change scenarios materialise.
- Chapter 8 provides further details on climate change for developers, as part of the FRA Guidance.

4.4.1 Adapting to climate change

The NPPG sections on climate change contain information and guidance for how to identify suitable mitigation and adaptation measure in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime;
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development;
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality;
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses; and
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.

5 Understanding flood risk in Hinckley and Bosworth borough

This chapter explores the key sources of flooding in the borough and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses, surface water, sewers and culvert blockages.

This is a strategic summary of the risk in Hinckley and Bosworth borough. Developers should use this Chapter to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

Appendix B contains a list of the sources of data used in the SFRA.

5.1 Historical flooding

Leicestershire County Council's Historic Flooding Incidents and Assets Register includes recorded historical flood events within Hinckley and Bosworth borough. There is a history of documented flood events, with the main sources being fluvial and surface water. Table 5-1 highlights the most significant historic flood events.

Table 5-1: Historical flooding incidents within Hinckley and Bosworth

Location	Date	Record Source	Additional Information
North of Atherstone	December 1992	Recorded Flood Outlines	Fluvial Flooding from the River Sence
North of Atherstone	December 1992	Recorded Flood Outlines	Fluvial Flooding from the River Anker
Shenton Village	25/11/2012	Flood Report, Leicestershire County Council	Heavy rainfall caused the Sence Brook to burst its banks
Borough-wide	27/07/2013	LLFA Historic Flooding Incidents	Surface water flooding to properties and lagoon breach
Borough-wide	14-15/01/2014	LLFA Historic Flooding Incidents	Flooding to Highways from surface water, fluvial and blocked culverts
Borough-wide	09/03/2016	LLFA Historic Flooding Incidents	Flooding to Highways and properties from a combination fluvial and surface water sources
Borough-wide	15-16/06/2016	LLFA Historic Flooding Incidents	Flooding to Highways from surface water
Borough-wide	22-23/01/2018	LLFA Historic Flooding Incidents	Property and Highway flooding from surface water and public sewers

The historic flooding records relating to flooding incidents since 2012, provided by Leicestershire County Council are shown in Figure 5-2. The records do not specify the source of flooding, only the affected property or infrastructure. There are notable clusters of flooding history in the main urban regions of the borough, namely Hinckley and Earl Shilton. There are also notable dates which have a high

frequency of recorded incidents: 27th July 2013 (2 incidents), mid-January 2014 (2 incidents), 9th March 2016 (15 incidents), mid-June 2016 (3 incidents) and late January 2018 (2 incidents). In addition to the Historic Flooding Incidents and Assets Register, Leicestershire Fire and Rescue Service provided their Incident Recording System data, which contains the responses of the Fire and Rescue Service to incidents involving flooding or rescue from water within Hinckley and Bosworth borough. The majority of incidents (16) occurred on Watery Gate Lane in Thurlaston and Earl Shilton, with the remaining two incidents occurring on Mythe Lane in Witheley and Congerstone Road in Carlton. Figure 5-1 and Figure 5-2 shows the location of each of the incidents.

Figure 5-1: Map of Leicestershire Fire and Rescue Service's flooding incident data for Hinckley and Bosworth borough

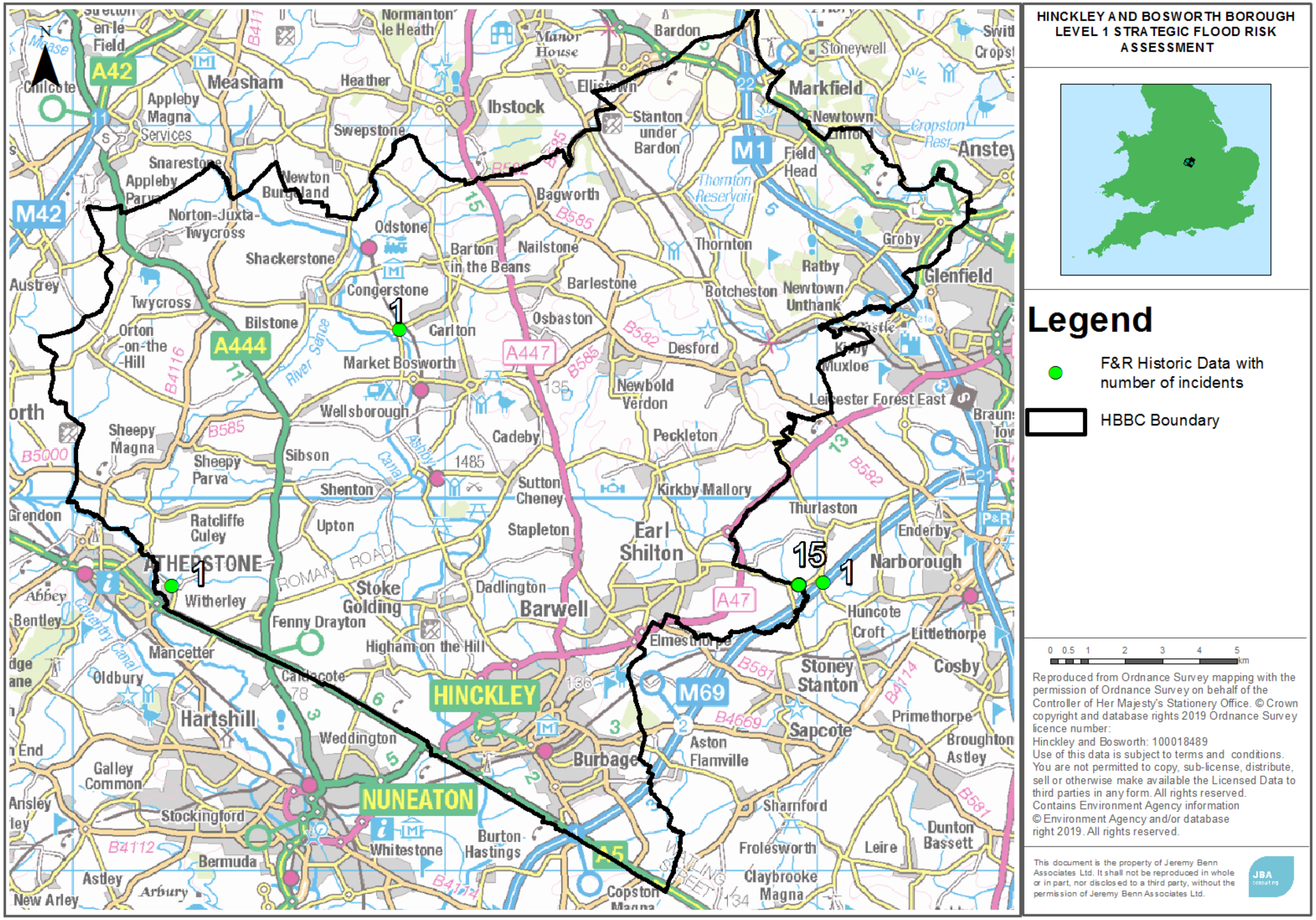
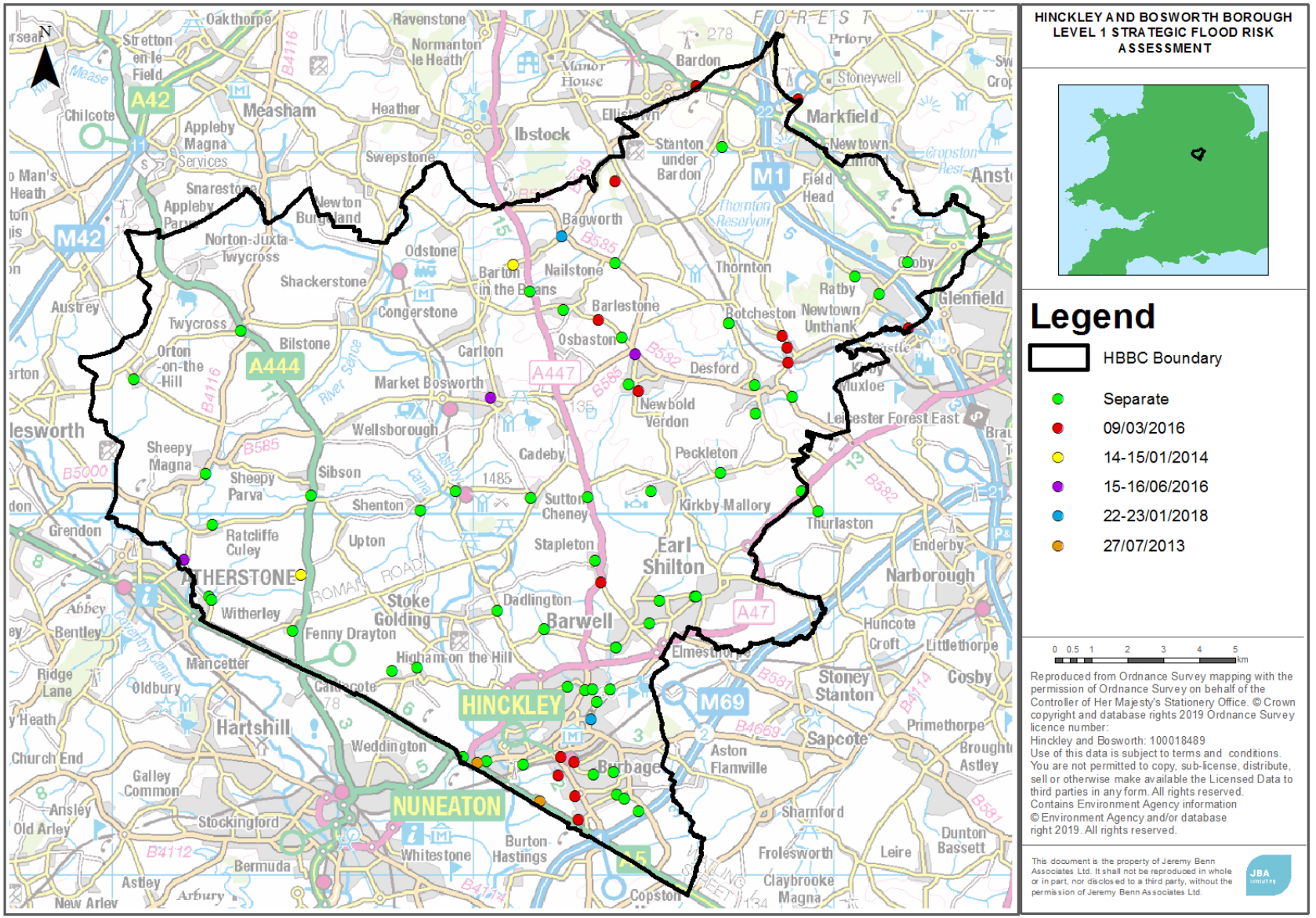


Figure 5-2: Map of historical flood incidents within Hinckley and Bosworth borough grouped by the time period of significant flood events



5.2 Topography, geology, soils and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

Topography

The topography of Hinckley and Bosworth borough is characterised by the low-lying land of the River Sence and Sence Brook floodplain in the west of the borough, and the raised area of Charnwood Forest that starts in the northeast of the borough and extends down to Hinckley. Elevations range from 27m AOD in the River Sence floodplain in the west to 274m AOD in Charnwood Forest Figure 5-3 shows the variation in elevation across the borough.

Geology

The underlying geology in the Hinckley and Bosworth borough is almost exclusively sandstone, siltstone and mudstone from the Triassic period. Bedrock geology groups identified across the borough include the Mercia Mudstone Group, Edwalton Member Mudstone and Siltstone, and Gunthorpe Member mudstone. In the Charnwood Forest region, there are also Diorites and volcanic siltstones present. The bedrock geology is shown in Figure 5-4.

The superficial geology in the area is predominately till (diamicton), glacial sand and gravel and clay, silt and sand alluvium. The superficial geology is shown Figure 5-5.

Soils

There are a mix of slowly permeable, freely draining, impeded drainage and naturally high groundwater soils within the borough. These are a mix of slightly acidic and slightly acidic but base-rich loamy, clayey and sandy soils.

Figure 5-3: topography of the borough

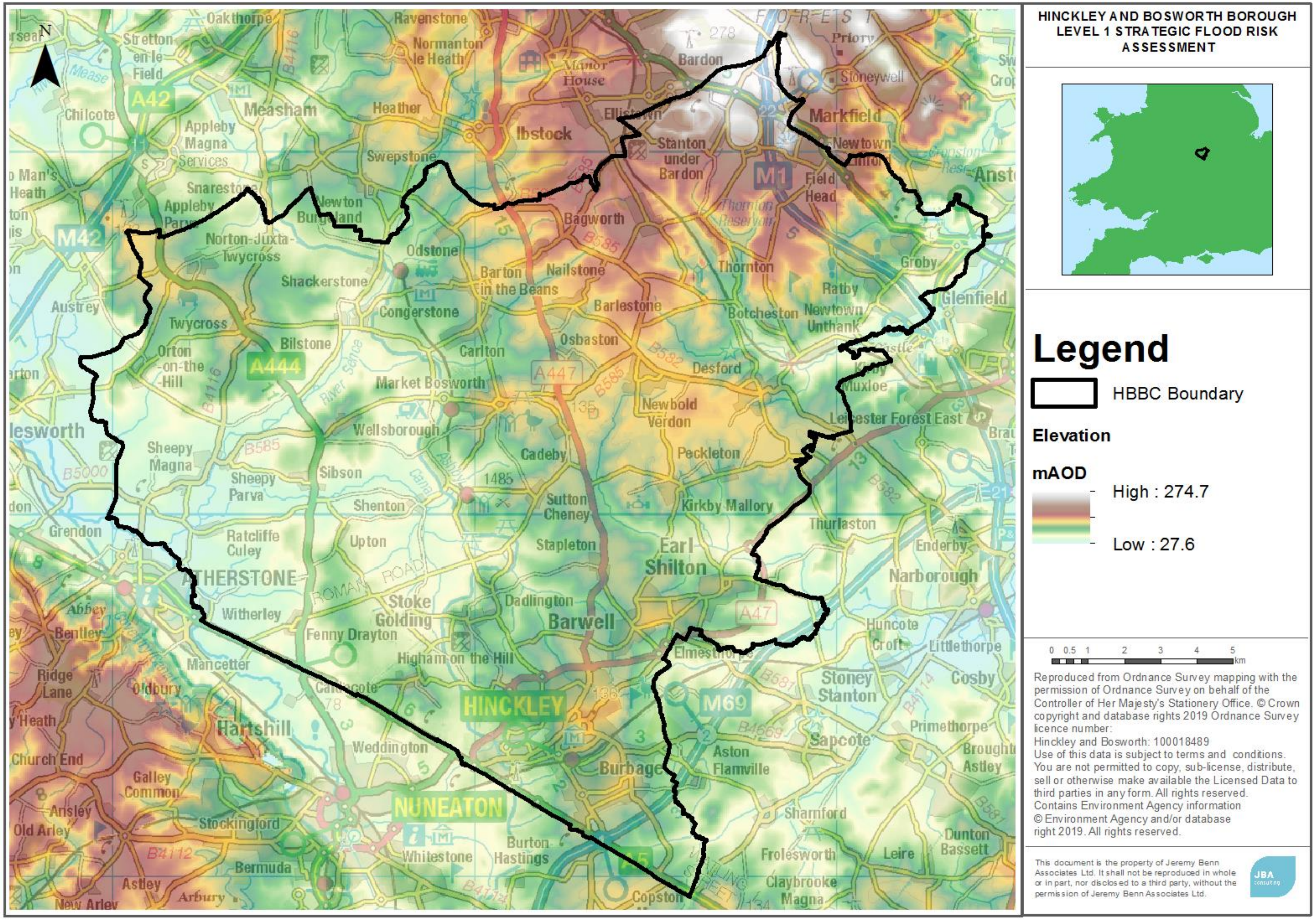


Figure 5-4: Bedrock Geology of the borough

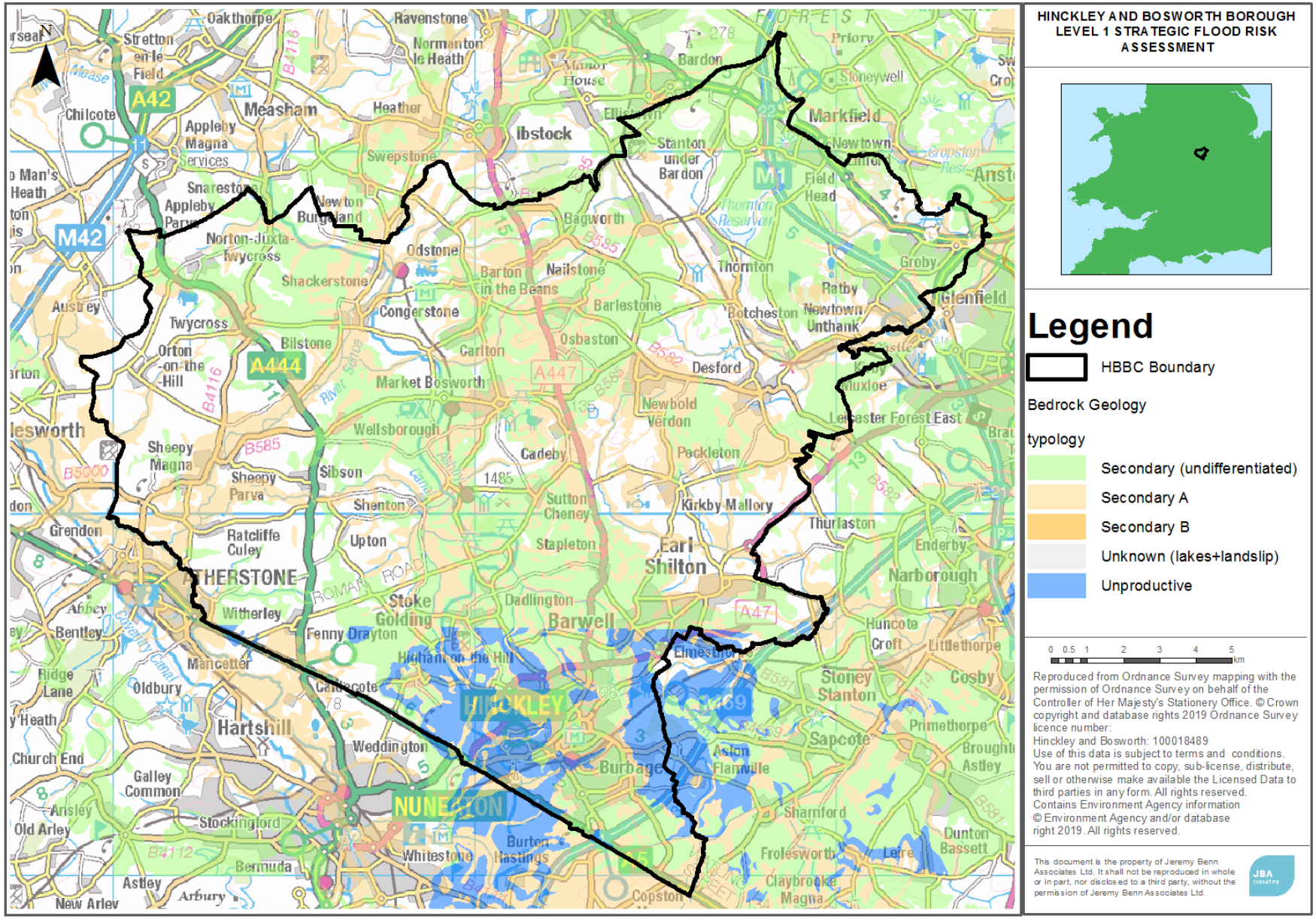
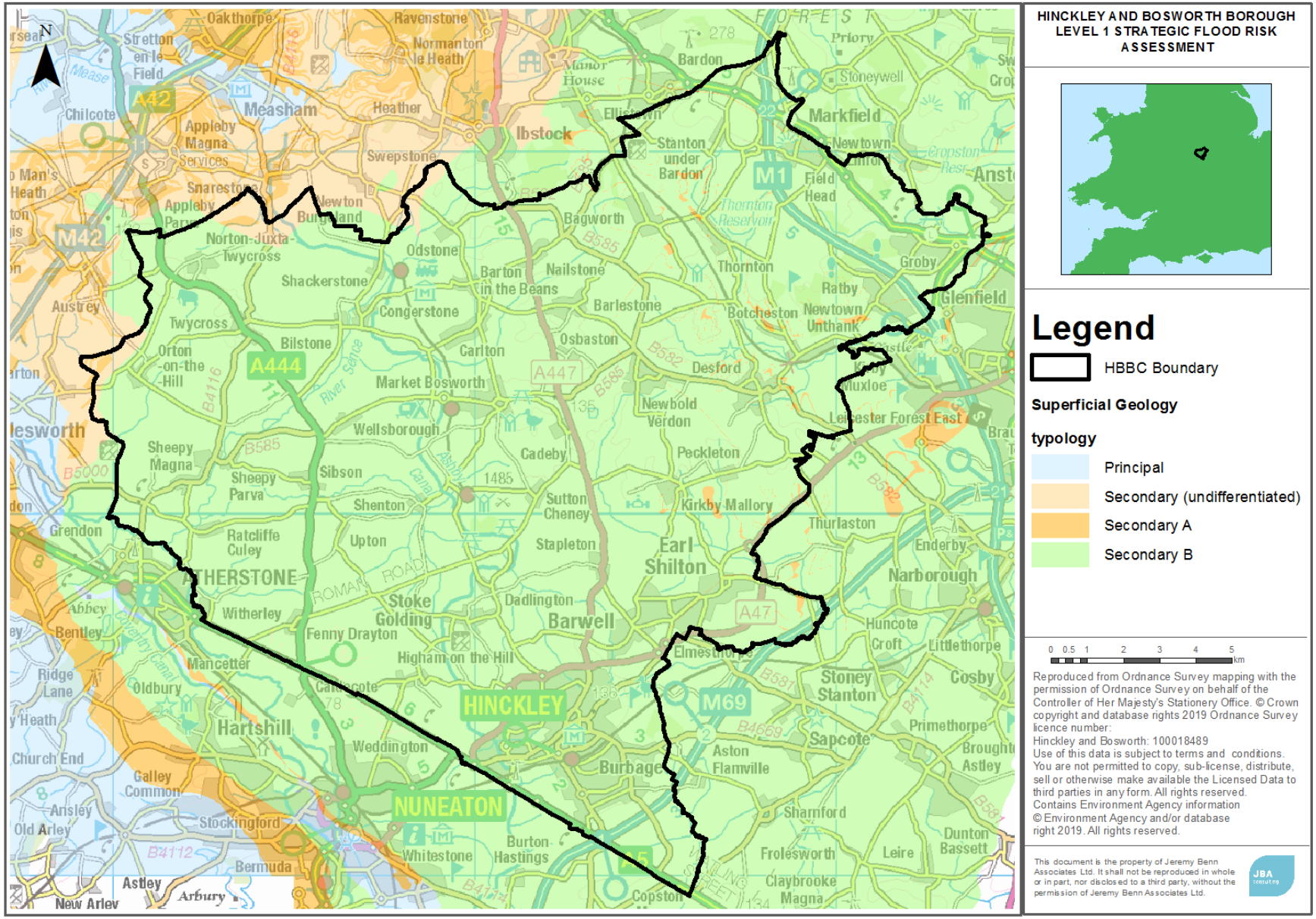


Figure 5-5: Superficial Geology of the borough



5.3 Hydrology

The principal watercourses flowing through the SFRA area are:

- River Sence
- River Mease
- River Anker
- River Tweed
- Meece Brook

There are a number of smaller watercourses and tributaries, including Sketchley Brook, Battling Brook, Harrow Brook and Rothley Brook, that flow through the area. There are also a number of ponds and lakes within the study area. There is a map of the key watercourses in Appendix A.

5.4 Fluvial flood risk

The primary fluvial flood risk in Hinckley and Bosworth borough is along the River Sence, a tributary of the River Anker. This presents a fluvial flood risk primarily to the village of Sheepy Magna. The River Sence presents a less significant fluvial flood risk to several smaller villages adjacent to the channel, including Congerstone and Bilstone.

The River Tweed, a tributary of the River Sence, presents a fluvial flood risk to the village of Shenton to the North of Hinckley.

The Sketchley and Harrow Brooks, which tributaries of the River Anker, both enter Hinckley to the south west. Both of these watercourses present fluvial flood risks to a number of properties within the town.

The Rothley Brook, a tributary of the River Soar, poses a fluvial flood risk to a number of properties within the village of Ratby and the hamlet of Newtown Unthank.

An unnamed watercourse which is a tributary of the River Anker, located to the east of Atherstone on Mythe Lane, poses a fluvial flood risk to a number of properties in Witherly.

There are many smaller tributaries and brooks throughout the borough that raise a smaller flood risk, the majority of which remain unnamed watercourses. The areas that these smaller watercourses affect are predominantly rural.

5.5 Surface water flooding

Surface water runoff (or 'pluvial' flooding) is most likely to be caused by intense downpours e.g. thunderstorms. At times the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with very extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/ or high-water levels in watercourses that cause local drainage networks to back up.

The Environment Agency Risk of Flooding from Surface Water mapping (RoFSW) provided by the Environment Agency shows that a number of communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, e.g. properties situated at the foot of surrounding hills. The RoFSW mapping for Hinckley and Bosworth borough can be found on the Geo-PDF mapping in Appendix A.

5.6 Sewer flooding

Sewer flooding occurs when intense rainfall/ river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels. Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that sewers will be overwhelmed in larger rainfall and flood events. Existing sewers can also become overloaded as new development adds to the surface water discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Information on flooding from sewers has been requested from Severn Trent Water (STW) but was not received at the time of the study. Severn Trent Water are carrying out a fully integrated model for Hinckley, in a partnership scheme between LCC and Severn Trent Water, which is due to be finished in late 2019/2020. These outputs will be able to indicate areas that may be affected from surface water and sewer flooding, should sewers exceed their capacity and discharge (particularly if this happens due to intense rainfall overwhelming the system). It will also help to identify flooding hotspots, where there is limited capacity, and help inform future schemes and mitigation.

5.7 Groundwater flooding

In general, less is known about groundwater flooding than other sources. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes
- Where there are long culverts that prevent water easily getting into watercourses

Groundwater flooding is different to other types of flooding. It can last for days, weeks or even months and is much harder to predict and warn for. Monitoring does occur in certain areas, from example where there are major aquifers or when mining stops. The Coal Authority do monitor groundwater levels in parts of the Borough and the records show that groundwater levels have been rising over time since mining has stopped.

Groundwater susceptibility mapping for Hinckley and Bosworth borough has been provided in the Geo-PDFs in Appendix A.

The British Geological Survey provides further information on groundwater flooding on their website.

5.8 Flooding from canals

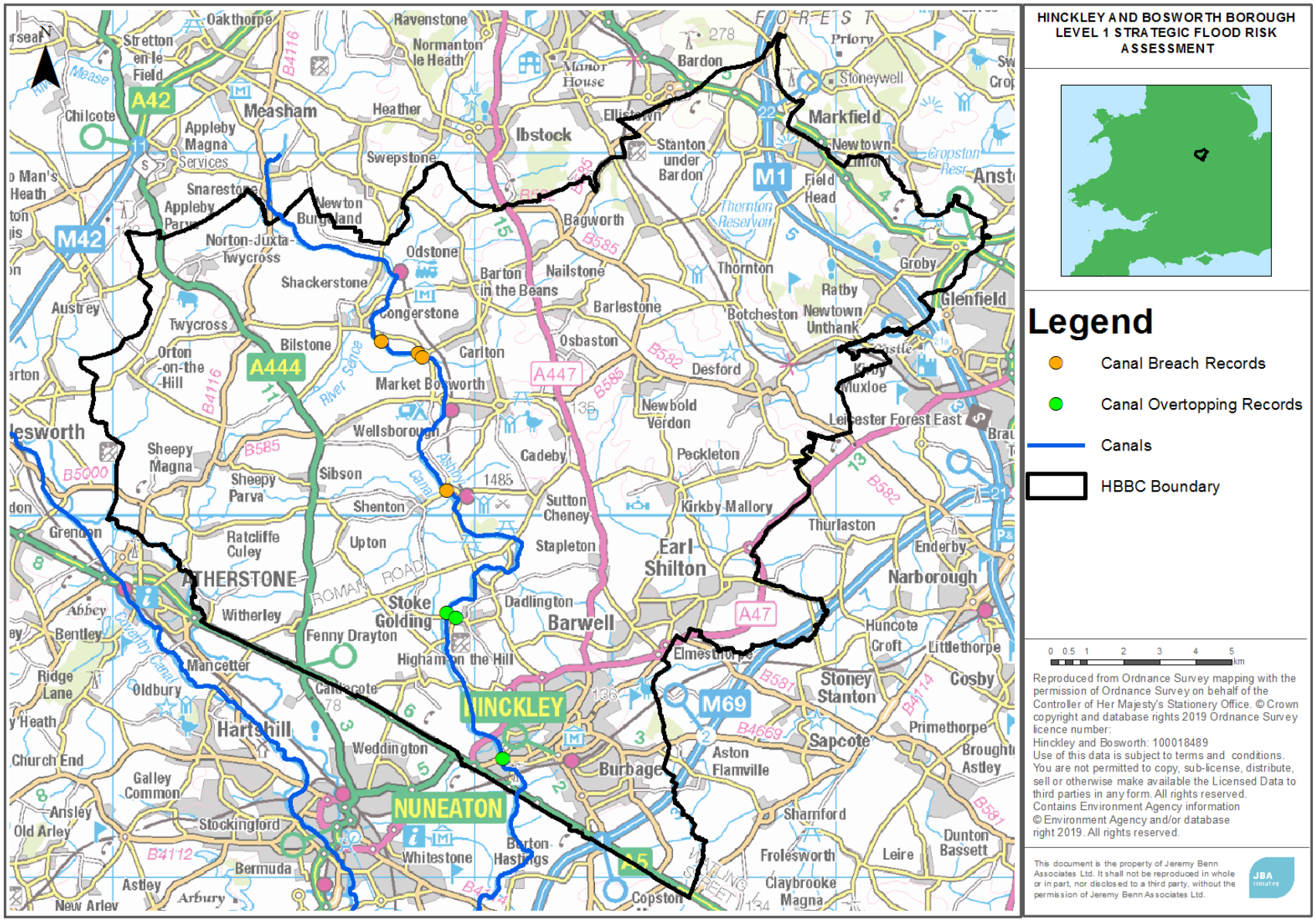
Canals are regulated waterbodies and are unlikely to flood, unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g. collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

The only canal located in Hinckley and Bosworth borough is the Ashby Canal, which enters the borough to the north west and flows in a southern direction and exits the borough to the west of Hinckley. There are five recorded incidents of canal breaches along the Ashby Canal within the study area, located in a rural area between Congerstone and Market Bosworth, and one incident to the east of Shenton. There are three recorded incidents of canal overtopping along the Ashby Canal, located within the village of Stoke Golding and Hinckley. Figure 5-6 shows the location of all recorded canal breaches and canal overtopping, as well as the course of the Ashby Canal in the study area.

Figure 5-6: Location of all recorded incidents of canal breaches and overtopping in the study area.



5.9 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975 and are on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Act means that the risk of flooding from reservoirs is very low.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The Environment Agency hold mapping showing what might happen if reservoirs fail. They are currently updating the mapping and new data should be available in late 2019. Developers and Planners should check the Long-Term Risk of Flooding website before using the reservoir mapping shown in this SFRA to make sure they are using the most up to date mapping.

The current mapping shows that there are four reservoirs within Hinckley and Bosworth that could cause flooding.

Table 5-2: Reservoirs with potential risk to Hinckley and Bosworth borough

Reservoir	Grid reference	Reservoir owner	Local Authority Area	Is the reservoir within the study area?
Thornton Reservoir	447269, 307524	Severn Trent Water Authority	Leicestershire	Yes
Mallory Park Large Lake Reservoir	444888, 299824	Mallory Park Motor Sport Ltd	Leicestershire	Yes
Groby Pool Reservoir	452393, 307911	Hanson Plc	Leicestershire	Yes
Market Bosworth Water Trust	438422, 303011	Market Bosworth Water Trust	Leicestershire	Yes

5.10 Flood Alert and Flood Warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3.

There are currently four Flood Alert Areas (FAA) and two Flood Warning Areas (FWAs) covering Hinckley and Bosworth borough. A list of the Flood Alert and Flood Warning Areas is available in Appendix D. A map of the Flood Alert Areas and Flood Warning Areas is available in Appendix A.

5.11 Summary of flood risk in Hinckley and Bosworth borough

A table of the summaries of the key flood risks in Hinckley and Bosworth borough can be found in Appendix E.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in the Hinckley and Bosworth borough. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

Risk Management Authorities hold databases of flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the Flood and Water Management Act (2010)
- Highways Authorities hold databases of highways drainage assets, such as gulleys and connecting pipes
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific Flood Risk Assessment.

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 100-year SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and as a consequence, the standard of protection offered by flood defences in the area, may differ from those discussed in this report.

Developers should consider the standard of protection provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and Local Authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and

improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highways Authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water Companies have a duty to effectually drainage their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highways or sewer flooding.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at culverts or bridges.

Developers should not assume that any defence, asset or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and ensure future users of the development are aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 6-1.

Table 6-1: Grading system used by the Environment Agency to assess flood defence condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – Environment Agency 2006

6.4 Major flood risk management assets in the borough

The Flood Map for Planning contains information on 'Areas Benefiting from Defences' (ABD). This shows areas that benefit from the defences that provide a SoP of at least a 100-year river flood event. It does not show areas that benefit from protection for more frequent events. There are no 'Areas benefiting from defences' in Hinckley and Bosworth borough.

There are however some minor flood defences in the borough, shown in Table 6-2.

Table 6-2: Flood defences in Hinckley and Bosworth borough

Watercourse	Location	NGR	Type	Design SOP	Condition Rating
Battle Brook	Flood bank in storage area, adjacent to Brodick Road	SP 40706 93782	Embankment	100	3(fair)
Unnamed Tributary of the River Anker	Channel side and high ground adjacent to Mythe Lane, north of Witherley	SP 32602 97727	Embankment	100	3(fair)

6.5 Coventry Road, Hinckley Flood Alleviation Scheme

The Coventry Road, Hinckley, Flood Alleviation Scheme was a £1.8m project undertaken by Severn Trent Water to address internal flooding to a number of residential properties and solve surface water flooding issues. The works were completed in November 2012.

The scheme involved the installation of approximately 1,600m of new sewer pipework as well as on line storage pipework.

6.6 Island Close, Hinckley Flood Alleviation Scheme

The Island Close Flood Alleviation Scheme, in Hinckley, was a £1.5m project undertaken by Severn Trent Water to increase sewer capacity to mitigate surface water flooding to properties in Hinckley during high intensity rainfall events. The works were completed in September 2017.

6.7 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

6.7.1 Actual flood risk

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development. Note that it is not likely to be acceptable to allocate developments in existing undefended areas on the basis that they will be protected by developer works, unless there is a wider community benefit that can be demonstrated.

The assessment of the actual risk should take into account that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is

needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe guarded that is required for affordable future flood risk management measures.

- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.7.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been taken into account. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.
- Parts of Atherstone, located in North Warwickshire, rely on formal flood defences for protection against fluvial flooding which lie within Hinckley and Bosworth. Consequently, there are areas vulnerable to rapid inundation in the event of a breach / failure. The assessment of the residual risk should take into account:
  - The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
  - The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage on parts of the site and considering the design of the development to keep people safe e.g. sleeping accommodation above the flood level
  - A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site an emergency service.

7 Cumulative impact of development and strategic solutions

This section provides a summary of the catchments with the highest flood risk and development pressures and then makes recommendations for local planning policy based on these.

7.1 Introduction

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para. 156), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory they should not increase flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities. Historic flood incidents, the current and predicted increase in surface water flood risk to properties and cross boundary issues in each catchment were assessed to identify the catchments at greatest risk.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

7.2 Strategic solutions

Hinckley and Bosworth Borough Council have a vision for the future management of flood risk and drainage in the borough. This concerns flood risk management, alongside wider environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ FRM schemes, new defences and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems.

Chapter 2 sets out the strategic plans that exist for the borough. The list below summarises the key outcomes these are seeking to achieve. This vision needs to be delivered by new development alongside retrofitting and enhancing green infrastructure and flood defence schemes in the existing developed area.

The strategic policy vision from the CFMP and RBMP focuses on re-naturalising watercourses, safeguarding the floodplains and the encouraging collaboration and creating new partnerships to reduce the risk of flooding and to enhance the natural environment. Within Hinckley and Bosworth borough, strategic solutions encourage development to:

- Use sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits;
- In areas where flood risk is being managed effectively, there will be a need in the future to keep pace with increasing flood risk as a result of climate change;
- Promote partnership working with all relevant stakeholders in the Tame, Anker and Mease Humber RMP management catchment. This includes working with land managers and farmers to reduce soil erosion from intensively farmed land;
- Assess long-term opportunities to move development away from the floodplain and create green river corridors through Leicestershire;
- Identify opportunities to use areas of the floodplain to store water during high flows, to reduce long term dependence on engineered flood defences located both within the borough (at Witherley) and outside the borough (for instance, in Rothley, Charnwood).
- Safeguard the natural floodplain from inappropriate development;
- Where possible, land management change should be used to reduce run-off rates from the development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Land management and uses that reduce runoff rates in upland areas should be supported;
- Development should maintain conveyance of watercourses through hamlets and villages (e.g. Sheepy Magna), to help reduce the impact of the more frequently experienced floods and to improve the natural environment;
- Use SFRAs to inform future development and minimise flood risk from all sources;
- Implement upstream catchment management e.g. slow the flow and flood storage schemes could be implemented in upper catchments to reduce flooding downstream and across neighbouring authority boundaries; and
- Promote and consider SUDS at the earliest stage of the development of a site.

The River Trent Catchment Flood Management Plan gives an overview of the flood risk in the River Trent catchment, and sets out plans for sustainable flood risk management across 10 sub areas. Hinckley and Bosworth borough occupies two of these sub areas; 8 and 9.

Within sub area 8, surface water runoff in rural areas creates a rapid response to rainfall events, where several environmental sites are liable to be affected by flooding. The preferred policy is Policy Option 6, which uses sustainable flood storage and mitigation schemes should be used to store water and manage surface runoff in locations that provide overall flood risk reduction as well as environmental benefits.

Within sub area 9, there are several urban locations in the Soar valley and floodplains, chiefly Leicester, Nuneaton and Loughborough. These areas are at risk of flooding as a result of lack of capacity in river channels and floodplain inundation. There is a medium risk of flooding in this area. The preferred policy is Policy Option 4, which recognises that flood risk is already being managed effectively but there will need to be future improvements to management strategy to keep pace with the increased flood risk as a result of climate change.

7.3 Assessment of cross-boundary issues

Figure 7-3 shows the catchments in Hinckley and Bosworth mapped against the topography and the direction that they drain. The largest catchments that dominate the study area (Rothley Brook, Thurlaston Brook and Stoke Golding Brook) were split up into sub-catchments to produce more locally specific results. This shows that the catchments to the north drain into the borough, whilst the catchments located to the south drain out of the borough. This means that development in Hinckley and Bosworth is more likely to have the potential to increase flood risk to southern neighbouring authorities, whereas development in northern neighbouring local authorities is more likely to impact Hinckley and Bosworth borough.

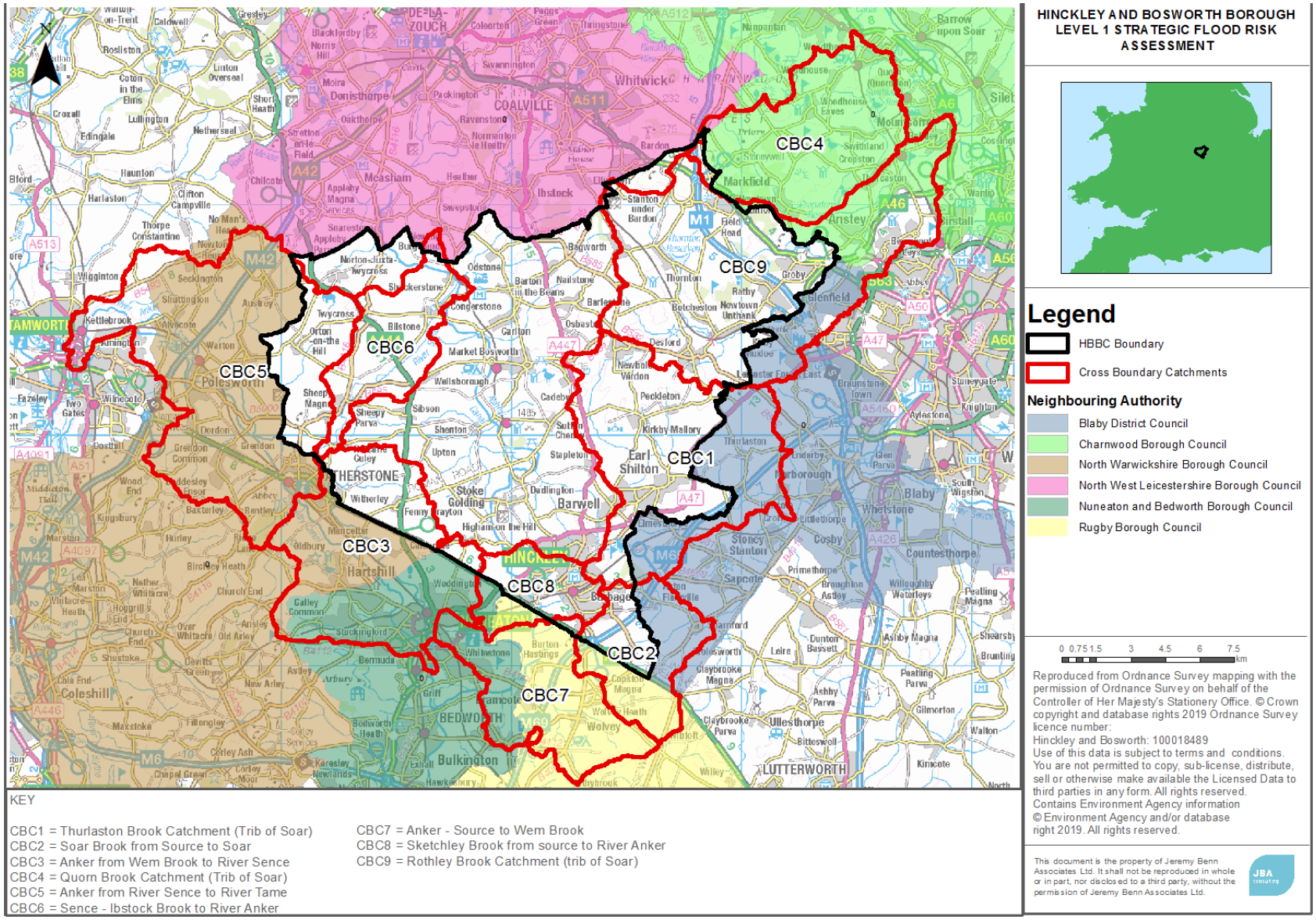
The neighbouring Local Authority that contains catchments which drain into Hinckley and Bosworth borough is North West Leicestershire.

Growth in neighbouring authorities was considered in the cumulative impact assessment outlined below. There were 18 development sites found within North West Leicestershire that are located within the Sence catchment that drains into the north of Hinckley and Bosworth borough. The total area of the planned development sites occupies 13% of the catchment. This included eight housing allocations and ten employment allocations. In the remaining neighbouring authorities, there are no significant development sites on catchments draining into Hinckley and Bosworth borough. In the vast majority of cases, if appropriate drainage and SuDS are adopted, development in North West Leicestershire borough is unlikely to affect flood risk in Hinckley and Bosworth borough.

The neighbouring Local Authorities that catchments located within Hinckley and Bosworth borough drain into, shown in Figure 7-1, include:

- Charnwood Borough Council
- Blaby District Council
- Nuneaton and Bedworth Borough Council
- North Warwickshire Borough Council
- North West Leicestershire Borough Council
- Rugby Borough Council

Figure 7-1: Cross boundary catchments that drain out of the borough into neighbouring Local Authorities.



Consequently, there are a number of catchments and sub-catchments that exist within Hinckley and Bosworth borough where future development may impact flood risk in the neighbouring Local Authorities outlined above, particularly where there are existing flood risk issues. Table 7-1 summarises which catchments drain out of Hinckley and Bosworth borough, and any downstream existing flood risk issues that have the potential to be exacerbated. The sources of data used to inform the existing flood risk issues to properties in neighbouring Local Authorities can be found in Appendix B.

Apart from North West Leicestershire and Charnwood Borough Councils, the Local Plans for the remaining neighbouring Local Authorities are being updated alongside the evidence base (i.e. SFRAs, Sustainability Appraisals etc.) and therefore, their flood risk and drainage policies are not yet formalised. However, it is very likely that to ensure compliance with the NPPF, appropriate sustainable drainage and flood risk policies will be proposed. Below summarises the relevant drainage and flood risk policies relating to the Local Plans for North West Leicestershire and Charnwood Borough Councils.

7.3.1 North West Leicestershire Borough Council's Local Plan 2011-2031

North West Leicestershire's Local Plan was adopted on the 21st of November 2017, and the following policies are relevant to the borough's flood risk and drainage strategy:

- Policy S3 – Countryside
- Policy IF1 – Development and Infrastructure
- Policy En1 – Nature Conservation
- Policy Cc3 – Sustainable Drainage Systems

7.3.2 Charnwood Borough Council's Local Plan 2011-2028

Charnwood Local Plan 2011 to 2028 Core Strategy document was adopted on November 9th, 2015 and forms part of the adopted Local Plan for Charnwood. The following policies are relevant to the borough's flood risk and drainage strategy:

- Policy CS 16 – Sustainable Construction and Energy
- Policy CS 19 – North East of Leicester Sustainable Urban Extension
- Policy CS 20 – North of Birstall Direction of Growth
- Policy CS 21 – Watermead Regeneration Corridor – Direction of Growth
- Policy CS 22 – West of Loughborough Sustainable Urban Extension
- Policy CS 23 – Loughborough University and Science & Enterprise Park

It is recommended that Hinckley and Bosworth Borough Council consults neighbouring authorities to identify and review potential cross-boundary issues.

Table 7-1: Summary of catchments and sub catchments that drain into the neighbouring Local Authorities from Hinckley and Bosworth borough.

Catchment	Neighbouring Local Authority downstream	Details	Existing Flood Risk Issues
Rothley Brook Catchment	Charnwood Borough Council, Blaby District Council	The Rothley Brook drains from this sub-catchment into Charnwood An unnamed drain to the south of Groby drains into Blaby An unnamed drain to the south of Ratby drains into the Blaby	A number of properties in Anstey and Rothley have experienced historic flooding (9th March 2016) and are situated within Flood Zone 3. Moreover, several properties are at risk of sewer flooding. There are surface water and fluvial flood risk issues in Anstey and Rothley, associated with the Rothley Brook. Development in the catchment has the potential to exacerbate the flood risk to existing properties in Anstey and Rothley.
Quorn Brook Catchment	Charnwood Borough Council	A small upper section of this catchment exists within Hinckley and Bosworth	The majority of the north west side of the village of Quorn is situated within Flood Zone 3. Despite several flood defences around the village there have still been multiple historic flood events in 1997 and 2011 on the Quorn Brook. Development in the catchment has the potential to exacerbate the flood risk to existing properties in Quorn.
Thurlaston Brook Catchment	Blaby District Council	The Thurlaston Brook drains from this catchment into Blaby.	The majority of the floodplain of the Thurlaston Brook occupies rural land in Blaby. Development within this catchment in Hinckley and Bosworth Borough is not likely to significantly impact flood risk to properties in this catchment.
Anker – source to Wem Bk	Rugby Borough Council	Tributary of the River Anker drains into Rugby	A small portion of this catchment exists within Hinckley and Bosworth borough, and the majority of the floodplain occupies rural land in adjacent Rugby borough. Development in Hinckley and Bosworth borough is not likely to significantly impact flood risk to properties in this catchment.
Sketchley Brook from source to River Anker	Rugby Borough Council and Nuneaton and Bedworth Borough Council	The Sketchley Brook and Harrow Brook both drain into Rugby and Nuneaton and	Multiple properties in Attleborough, Nuneaton were inundated during a historic flood event in December 1992. A number of properties in Nuneaton and Attleborough are located within Flood Zone 2. Development within this catchment

		Bedworth from Hinckley Town	in Hinckley and Bosworth borough has the potential to impact flood risk to existing properties in Nuneaton and Bedworth borough.
Soar Brook from Source to Soar	Blaby District Council	The Soar Brook drain into and Blaby district	There are records of flooding in Sharnford in November 2012. Flood Warning and Flood Alert areas have been assigned to Sharnford. The south and west of Sharnford is located within Flood Zone 3. Development in the catchment has the potential to exacerbate the flood risk to existing properties in Sharnford.
Anker from Wem Brook to River Sence	North Warwickshire Borough Council	Two unnamed tributaries of the River Anker drain from this catchment into North Warwickshire	A number of properties in Atherstone and Mancetter are within Flood Zones 2 and 3, and are at risk from fluvial flooding from the River Anker. However, the majority of the floodplain in this catchment occupies rural areas, and minor flood defences in Witherley help to alleviate the worst flooding. Development within this catchment in Hinckley and Bosworth borough has the potential to impact flood risk to existing properties in North Warwickshire borough.
Sence – Ibstock Bk to R Anker	North Warwickshire Borough Council	The River Sence joins the River Anker in North Warwickshire	A small portion of this catchment is located within North Warwickshire Borough, therefore development within this catchment in Hinckley and Bosworth Borough is unlikely to have significant impact to flood risk for existing properties.
Anker from River Sence to River Tame	North Warwickshire Borough Council	A number of tributaries and unnamed watercourses drain into the River Anker in North Warwickshire	There are historical records of flooding in Polesworth during the Summer of 2007 and November 2012. A number of properties in the settlements of Polesworth and Grendon are located within Flood Zone 3. However, only a small portion of this catchment exists within Hinckley and Bosworth borough. Development within this catchment in Hinckley and Bosworth borough has the potential to impact flood risk to existing properties in North Warwickshire borough.

Policy recommendations with regards to managing the cumulative impact of development have been made in this Chapter 10. This will help to ensure there is no incremental increase in flood risk both within and downstream of Hinckley and Bosworth Borough Council. The catchments, sub catchments and topography within Hinckley and Bosworth is shown in Figure 7-2. The direction of catchment drainage in or out of Hinckley and Bosworth borough for catchments that straddle neighbouring Local Authority boundaries is shown in Figure 7-3.

Figure 7-2: River Catchments and sub catchments in Hinckley and Bosworth borough

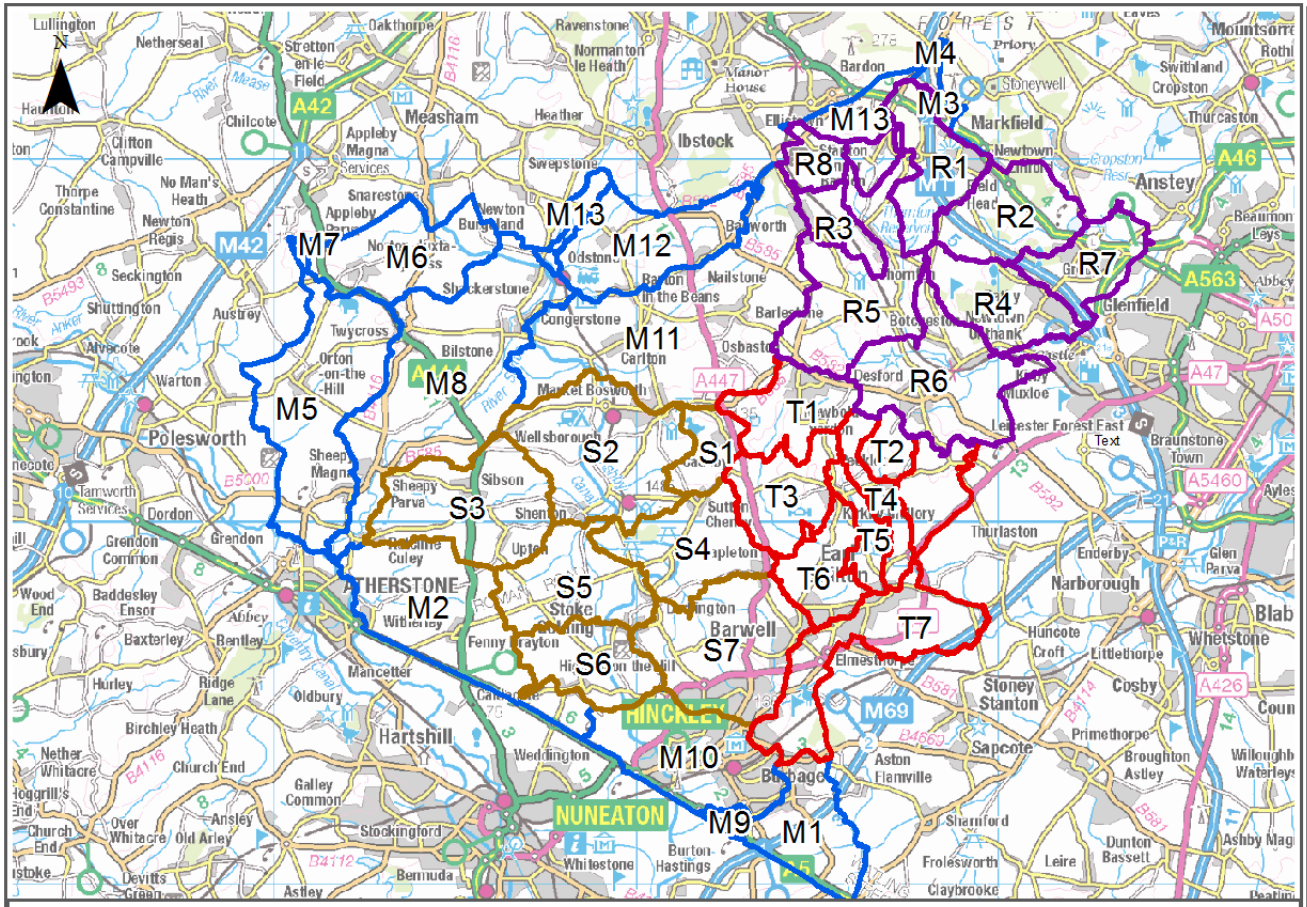
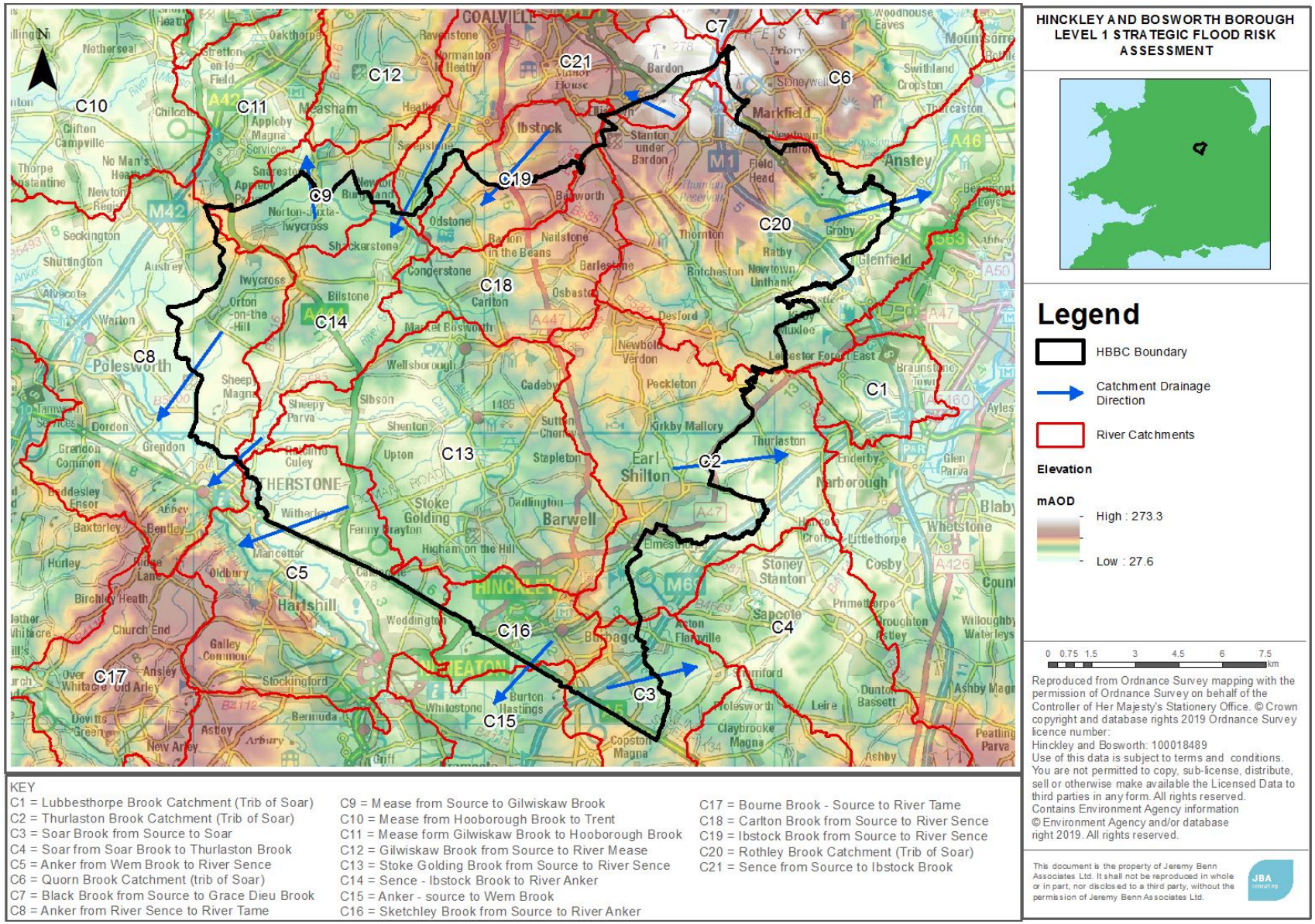


Figure 7-3: River Catchments and the direction of catchment drainage in or out of Hinckley and Bosworth borough



7.4 Cumulative Impact Assessment

A cumulative impact assessment was undertaken for this SFRA. To assess which catchments are at the highest risk of flooding and where the cumulative impact of development may have the biggest effect, historic flood risk and areas that are most sensitive to increases in flood risk were assessed.

The methodology for the Cumulative Impact Assessment is in Appendix F. The policy recommendations can be found in Chapter 10.

The results of the cumulative assessment can be summarised to give a rating of low, medium or high risk for each catchment. The rating of each catchment in each of these assessments was combined to give an overall ranking. The average scores for rating of each of the sub catchments was combined to give the rating of the overall catchment. The highest overall ranked catchments are shown in Table 7-2 and a map of the catchment ratings is shown in Figure 7-4.

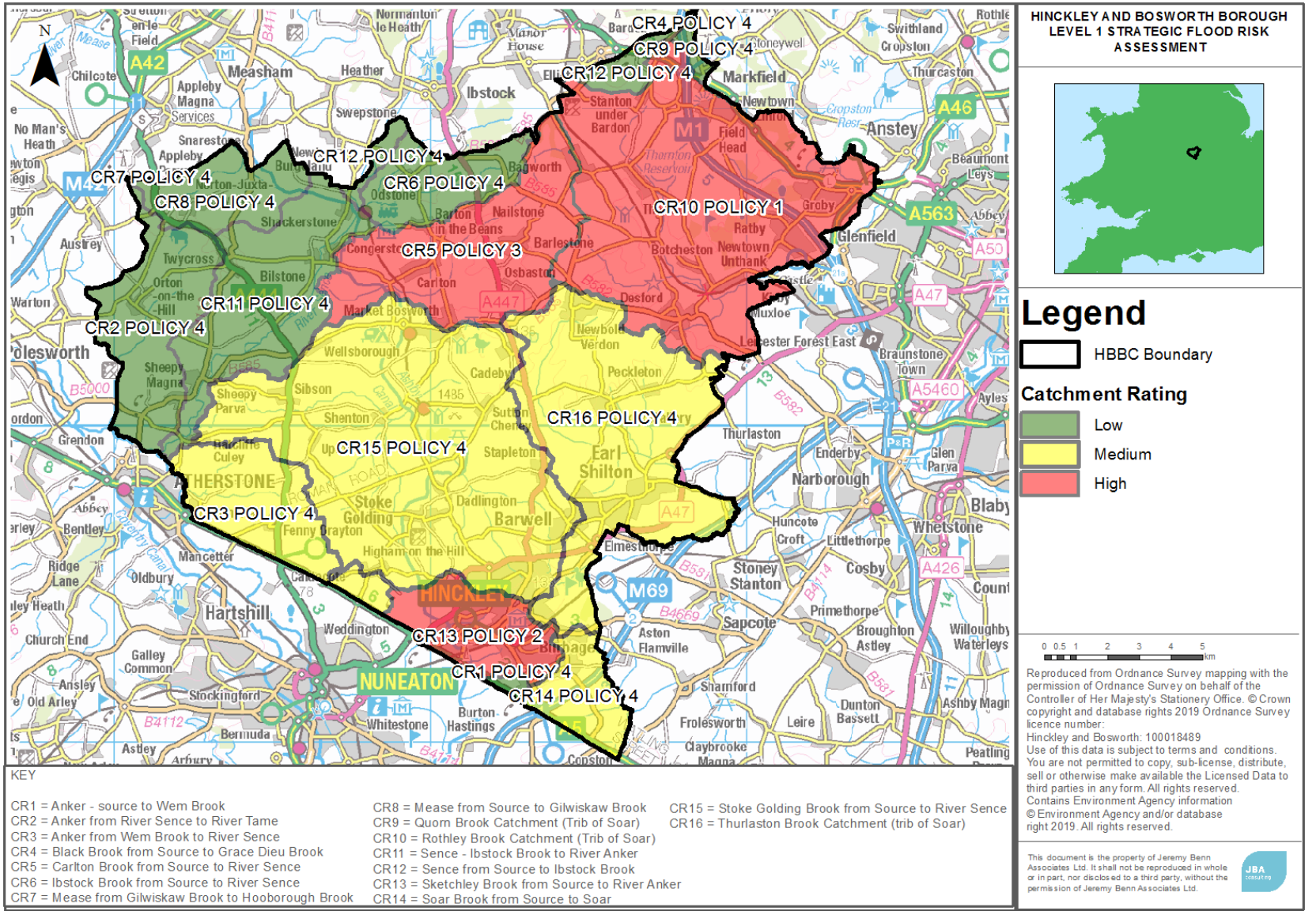
Table 7-2: The results of the highest risk catchments and sub catchments after the cumulative impact analysis

Catchment/Sub Catchment Name	Number of Historic Flood Events	Sensitivity to increases in flood flows*	Potential to impact neighbouring local authority	Potential for neighbouring local authority to impact flood risk	Total Score (max score of 6)	Final Rating*
Carlton Brook from Source to River Sence	7	267%	No	No	5	HIGH
Rothley Brook Catchment	14	533%	Yes	No	6	HIGH
Sketchley Brook from Source to River Anker	10	278%	No	No	5	HIGH
Anker from Wem Brook to River Sence	6	149%	Yes	No	6	HIGH
Ibstock Brook from Source to River Sence	1	269%	No	Yes	5	HIGH
Sence – Ibstock Brook to River Anker	2	193%	Yes	No	5	HIGH

* This is the measure of the increase in the number of properties at risk of surface water flooding in a 1 in 100-year event to a 1 in 1,000-year event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk.

* The final rating divides the Total Scores up into different bands to assign a rating of high, medium or low. A score of 5-6 = High, 3-4 = Medium and 0-2 = low.

Figure 7-4: Map of the results of the cumulative impact assessment for each of the catchments



The Cumulative Impact Assessment supports a tiered approach, with bespoke policy depending on the location of the development. Specific policy recommendations relate to:

- Rothley Brook Catchment (Policy Recommendation 1)
- High Risk Urban catchments (Policy Recommendation 2)
- High risk rural catchments (Policy Recommendation 3)

The remaining medium and low risk catchments in the borough are assigned a different policy Recommendation:

- All catchments borough wide including lower risk ones (Policy Recommendation 4)

Policies 1 to 3 relate to the high risk 'red' catchments seen in Figure 7-1, whereas Policy 4 relates to all catchments in the borough, 'yellow' and 'green'. More details regarding the Policies can be found in Chapter 10.

8 Guidance for developers

This section provides guidance on site-specific Flood Risk Assessments (FRAs). These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk Hinckley and Bosworth borough. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and any defences at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

8.1 Principles for new developments

8.1.1 1. Apply the Sequential and Exception Tests

Developers must provide evidence that the Sequential Test has been passed for windfall developments. If the Exception Test is needed, they must also provide evidence that all parts of the Test can be met for all developments, based on the findings of a detailed Flood Risk Assessment.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered:

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

8.1.2 2. Consult with statutory consultees at an early stage to understand their requirements.

Developers should consult with the Environment Agency, Leicestershire County Council as LLFA and Severn Trent Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

8.1.3 3. Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, Developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the 2019 Environment Agency climate change guidance and ensure the development has taken into account climate change adaptation measures.

8.1.44 Ensure that the development does not increase flood risk elsewhere

Chapter 9 sets out these requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

8.1.57. Ensure the development is safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard

8.1.68. Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment.

8.1.79. Consider and contribute to wider flood mitigation strategy and measures in the Borough and apply the relevant local planning policy for

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or natural flood management or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the borough can be found in Chapter 7.3. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where evidence of historical or recent flood events have been passed to the LPA
- In an area of significant surface water flood risk.

8.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature and location of the development. Site-specific FRAs should establish:

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

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Hinckley and Bosworth Borough Council. Guidance and advice for developers on the preparation of site-specific FRAs include:

- Standing Advice on Flood Risk (Environment Agency);
- Flood Risk Assessment for Planning Applications (Environment Agency) and
- Site-specific Flood Risk Assessment: CHECKLIST (NPPF PPG, Defra)

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – Flood Risk Assessment: Local Planning Authorities.

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

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.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones, to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as Green Infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

8.3.2 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C62430.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

8.3.3 Raised floor levels

If raised floor levels are proposed, these should be agreed with Hinckley and Bosworth Borough Council and the Environment Agency. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The Environment Agency advises that minimum finished floor levels should be set 600mm above the 100-year plus climate change peak flood level, where the new climate change allowances have been used (see Chapter 4 for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

8.3.4 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered.

8.3.5 Developer contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

8.4 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before resistance and resilience measures are replied on. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. The following measures are available:

Permanent barriers: Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

Temporary barriers: Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

Community resistance measures: These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.

Flood resilience measures: These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk.

8.5.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of a Flood Risk Assessment) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

8.5.3 Reservoirs

The risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
  - the Reservoir Risk Designation
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
  - operation: discharge rates / maximum discharge;
  - discharge during emergency drawdown; and
  - inspection / maintenance regime.
- The EA and NRW online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent, depths and velocities shown in these online maps.

Developers should consult the Leicester, Leicestershire and Rutland Prepared (LLR Prepared) about emergency plans for reservoir breach.

- Developers should use the above information to:
- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond.

- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site specific emergency plans if necessary and ensure the future users of the development are aware of these plans

8.6 Flood warning and emergency planning

Emergency planning covers three phases: before, during and after a flood. Measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The 2018 NPPF requires site level Flood Risk Assessments to demonstrate that

"d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites
- Sites with transient occupants e.g. hostels and hotels
- Developments at a high residual risk of flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences
- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of the Councils will not normally be appropriate.

The LLR Prepared provides Emergency Planning relevant information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including, preparation, understanding warnings, actions to limit exposure to risk and recovery.

Further information is available from:

- The National Planning Policy Guidance
- The Environment Agency and DEFRA's standing advice for FRAs
- Leicestershire County Council's "Emergency Planning"
- Hinckley and Bosworth Borough Council's 'Emergency Planning'
- Environment Agency's "How to plan ahead for flooding"
- Sign up for Flood Warnings with the Environment Agency
- The National Flood Forum
- GOV.UK - Make a Flood Plan guidance and templates

9 Surface water management and SuDS

This chapter provides guidance and advice on managing surface water runoff and flooding.

9.1 Role of the LLFA and Local Planning Authority in surface water management

In April 2015, Leicestershire County Council was made a statutory planning consultee on the management of surface water. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to ensure that onsite drainage systems are designed in accordance with the current legislation and guidance.

When considering planning applications, Leicestershire County Council will provide advice to the Planning Department on the management of surface water. As LPA, Hinckley and Bosworth Borough Council should satisfy themselves that the development's proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. To further inform development proposals at the master-planning stage, pre-application submissions are accepted by Hinckley and Bosworth Borough Council. This will assist with the delivery of well designed, appropriate and effective SuDS.

9.2 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place. Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

9.3.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

9.3.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation produced their practice guidance in 2016 to give further detail to the Non-statutory technical guidance.

9.3.4 Leicestershire County Council Flood Risk and Drainage Standing Advice

Leicestershire County Council's Flood risk and Draining Standing Advice gives advice on SuDS and flood risk for new developments.

9.3.5 Leicestershire County Council Consultation Checklist

The Consultation Checklist document provides a checklist of all the required documents and information for all major planning applications. There is also a supporting Guidance Document that should be used in conjunction with the checklist, which explains the items contained in the checklist.

9.3.6 Leicestershire County Council SuDS Guidance

Leicestershire County Council have not yet published a comprehensive SuDS Handbook which includes county-specific guidance for the design and implementation of SuDS in new developments. However there is limited SuDS guidance pertaining to Leicestershire itself within the Environmental Best Practice document. This document uses a number of examples from various sources including the River Restoration Centre and susdrain to illustrate a number of techniques that can be incorporated into SuDS designs.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

The Environment Agency have published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on Defra's interactive mapping.

9.4.2 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The Groundwater SPZ requires attenuated storage of runoff to prevent infiltration and contamination. Groundwater Source Protection Zones can be viewed on the Environment Agency's website.

The majority of Hinckley and Bosworth borough is outside of a Source Protection Zone. There is a small area of rural land to the north west of the borough which

is within Zone 3 (total catchment). The only other Source Protection Zone near the study area is to the north of Bardon in the north east of the borough, although this is not within the boundary. Depending on the nature of the proposed development and the location of the development site with regards to SPZs, restrictions may be in place on the types of SuDS used within appropriate areas. For example, infiltration SuDS are generally accepted within Zone 3, whereas in Zones 1 (Inner Protection Zone) or 2 (Outer Protection Zone), the Environment Agency will need to be consulted and infiltration SuDS may only be accepted if the correct treatments and permits are put in place. Any restrictions imposed on the discharge of the site generated runoff by the Environment Agency will be determined on a site by site basis using a risk-based approach.

9.4.3 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process.

Hinckley and Bosworth borough comprises of four different NVZs. The western half of the borough is part of a surface water NVZ, and the eastern part of the borough is another separate surface water NVZ. Additionally, Groby Pool Eutrophic lake NVZ, situated in the north east of the borough, is a eutrophic water NVZ, and Cropston & Swithland Reservoirs situated in the north east are eutrophic water NVZs.

10 Summary and Recommendations

10.1 Sources of Flood risk

- Past flooding information available for this study is limited. The data that does exist shows that the main risk is from surface water and culverted watercourses. The most affected areas for historic flooding correspond with the main urban areas in the borough, including Hinckley, Barwell, Earl Shilton, Desford, Ratby and Groby, although there are some records of historical flooding in rural areas.
- The main rivers associated with fluvial flooding are the River Anker and River Sence, which pose a flood risk to settlements including Sheepy Magna, Shackerstone, Witherley and the outskirts of Atherstone. Additionally, there is fluvial flood risk posed to the borough by a number of smaller watercourses. Within Hinckley and Burbage the Battle Brook, Harrow Brook and Sketchley brook pose a fluvial flooding risk. In the east of the borough, the Rothley Brook poses a fluvial flood risk to the urban areas of Groby and Ratby.
- The Areas Susceptible to Groundwater Flooding map shows that, in general, the majority of Hinckley and Bosworth borough is within the <25% susceptible classification, therefore it is at lower risk of groundwater flooding. Parts of the borough around Stoke Golding, Newbold Verdon and Desford, and the west of the borough along the River Sence fall within higher susceptibility classifications and are therefore at higher risk from groundwater flooding.
- There is one canal located within Hinckley and Bosworth borough, the Ashby Canal. These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been five recorded incidents of canal breach and three recorded incidents of canal overtopping in the borough. The canal breach incidents occurred in primarily rural locations on the stretch of the canal between Congerstone and Shenton. The canal overtopping incidents occurred in Stoke Golding and Hinckley.
- There is a potential risk of flooding from reservoirs both within the Borough and those outside. There are four reservoirs within Hinckley and Bosworth. There are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

10.2 Recommendations

Reduction of flood risk through site allocations and appropriate site design

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to Flood Zone 1. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken.
- After application of Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood

risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.

- Identify of long-term opportunities to remove development from the floodplain and to make space for water.
- Ordinary watercourses not currently afforded flood maps should be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development.
- Ensure development is 'safe', dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then as assessment should be made to detail the flood duration, depth, velocity and flood hazard rating in the 1 in 100-year plus climate change flood event, in line with FD2320.
- Raise residential and commercial finished floor levels 600mm above the 1 in 100 year plus climate change flood level. Protect and Promote Areas for Future Flood Alleviation Schemes.
- Safeguard functional floodplain from future development.
- Identify opportunities for brownfield sites in functional floodplain to reduce risk and provide flood risk betterment.
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Promote SuDS to mimic natural drainage routes to improve water quality

- SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features.
- Planning applications for phased developments should be accompanied by a Drainage Strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase.
- Use of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody.
- SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.

Reduce Surface Water Runoff from New Developments and Agricultural Land

- SuDS should be considered and implemented as part of all new development, in line with Leicestershire County Council's Environmental Best Practice document.
- Space should be provided for the inclusion of SuDS on all allocated sites and outline proposals

- Promote biodiversity, habitat improvements and Countryside Stewardship schemes to help prevent soil loss and to reduce runoff from agricultural land

Enhance and Restore River Corridors and Habitat

- Assess condition of existing assets and upgrade, if required, to ensure that the infrastructure can accommodate pressures / flows for the lifetime of the development.
- Natural drainage features should be maintained and enhanced.
- Identify opportunities for river restoration / enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and / or other infrastructure to cross, in line with CIRIA's Culvert design and operation guide, (C689) and to restrict development over culverts.
- There should be no built development within 8m from the top of a watercourse or Main River for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

Mitigate Against Risk, Improved Emergency Planning and Flood Awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 100-year rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 1 in 1,000-year event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within Hinckley and Bosworth borough.

10.2.1 Recommendations from the cumulative impact analysis

Policy Recommendation 1: High risk Catchments draining towards neighbouring Local Authorities

Mapping of these catchments can be found in Figure 7-4.

- Rothley Brook (CR10), a high-risk catchment (see Table 7-2).

The Charnwood Borough Council Level 1 SFRA shows there are a number of flooding issues to settlements in neighbouring Charnwood on the Rothley Brook, including Anstey and Rothley. The Joint 2014 SFRA for Hinckley and Bosworth, Blaby and Oadby and Wigston Borough Councils shows that there is a fluvial flood risk to Glenfield in the north east of the district from the Rothley Brook. Development on the high-risk sub-catchments identified in the cumulative impact assessment for this SFRA would potentially exacerbate these existing flood risk issues, as these sub-catchments drain from Hinckley and Bosworth borough into Charnwood borough and Blaby district.

To minimise cross boundary issues, the recommended policy is to:

- Work closely with neighbouring Local Authorities and the Lead Local Flood Authority to develop complementary Local Planning Policies for the Rothley Brook catchment
- Undertake more detailed drainage strategy work as part of a Level 2 SFRA or detailed local area Strategic Drainage Study to consider further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
- Seek to provide wider betterment by demonstrating in site specific Flood Risk Assessments and Surface Water Drainage Strategies what measures can be put in place to contribute to a reduction in flood risk downstream. This may either be by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors and/or by providing a Partnership Funding contribution towards any flood alleviation schemes. Consultation on the site-specific requirements should be undertaken with Leicestershire County Council as LLFA and the Environment Agency at the earliest opportunity.
- For the LPA to work closely with the Environment Agency, Leicestershire County Council and the Leicestershire and Rutland Wildlife Trust to identify areas of land in the upstream catchments of the Rothley Brook in Hinckley and Bosworth borough that should be safeguarded for the future use of natural flood management features.

Policy Recommendation 2: High risk urban catchments

Mapping of these catchments can be found in Figure 7-4**.**

- Sketchley Brook from Source to River Anker (CR13), a high-risk catchment (see Table 7-2).

Hinckley town centre falls within the Sketchley Brook from Source to River Anker catchment, which received a high-risk rating in the cumulative impact analysis. All new development (other than minor extensions) in this catchment should:

- Seek to provide wider betterment by demonstrating in site specific Flood Risk Assessments and Surface Water Drainage Strategies what measures can be put in place to contribute to a reduction in flood risk downstream. This may either be by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors and/or by providing a Partnership Funding contribution towards a wider community scheme. Consultation on the site-specific requirements should be undertaken with the LPA at the earliest opportunity.
- A Surface Water Drainage Strategy will be required for all developments in this catchment, regardless of development size.
- Leicestershire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major developments. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Hinckley and Bosworth Borough Council as LPA will review Surface Water Drainage Strategies for non-major developments.
- The Environment Agency, in consultation with the LPA and Leicestershire County Council, should consider whether to formally designate the catchment as a Critical Drainage Area. This would mean that a detailed Flood Risk Assessment would be required for all developments that are proposed, regardless of their size.
- The benefits of designating the Sketchley Brook as a Critical Drainage Area compared to the additional cost in resources for the Council should be assessed before this option is considered.

Policy Recommendation 3: High risk large rural catchments with localised flood risk issues e.g. the Carlton Brook

Mapping of these catchments can be found in Figure 7-4.

- The Carlton Brook (CR5), a high-risk catchment (see Table 7-2).
- Promote environmental land management practices to attenuate surface water runoff, through methods such as cover crops, riparian borders and infiltration techniques, to alleviate potential issues downstream.
- Promote community resilience in rural areas where immediate assistance following serious flood events might not be possible.
- The LPA should work closely with the Environment Agency and Leicestershire County Council as LLFA to identify areas of land that should be safeguarded for the future use of natural flood management features.

Policy Recommendation 4: Applicable across the borough to minimise Cumulative Impact

- This policy applies to all catchments that received a medium-risk or low risk catchment rating in the Cumulative Impact Assessment.

- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the Borough where practicable.
- Leicestershire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.

Appendices

A Interactive Flood Risk Mapping

B Data sources used in the SFRA

1 Appendix B - Data sources used in the SFRA

1.1 Fluvial flooding

1.1.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in Appendix B, show the same extent as the online Environment Agency's Flood Map for Planning (which incorporates latest modelled data), where available, and 2D generalised modelling from the 2014 SFRA for additional coverage. Over time, the online mapping is likely to be updated more often than the SFRA, so SFRA users should check there are no major changes in their area.

1.1.2 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b, as shown in Appendix B, has been compiled for the study area as part of this SFRA and is based on the 5% AEP (1 in 20-year chance of flooding in any given year) or 4% AEP (1 in 25-year chance of flooding in any given year) extents produced from Environment Agency detailed hydraulic models, where outputs were available. Outputs from the 2014 SFRA 2D generalised modelling were also used to derive Flood Zone 3b, using the 20-year flood extents. This information is only available in the SFRA and not shown on the online Flood Zone mapping.

For areas not covered by detailed EA models or 2D generalised modelling, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a (or Flood Zone 3b derived from 2D generalised modelling), further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

If the area of interest is in an area that has seen some major changes to the extent of the Flood Zones, having checked the online mapping, developers will also need to remap Flood Zone 3b as part of a detailed site-specific Flood Risk Assessment.

1.1.3 Climate change

Please refer to Chapter 4 for information on the approach to climate change in this SFRA.

1.1.4 Surface water

Mapping of surface water flood risk in study area has been taken from the Risk of Flooding from Surface Water (RoFfSW) maps published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table B-1).

Table B-1: RoFfSW risk categories

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale.

1.1.5 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater (AStGWF) dataset.

The AStGWF dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale.

1.1.6 Flood Defences

The Environment Agency supplied the location of all flood defences within the borough, including information relating to the type of flood defence and their standard of protection.

1.1.7 Historical Flooding

Leicestershire County Council as Lead Local Flood Authority provided details of historical flooding events in the borough through the Historic Flooding Incidents and Assets Register (HFIAR) record. The HFIAR database details the location and description of each historical flood incident recorded.

1.1.8 Sewers

Historical incidents of flooding are detailed by Severn Trent Water through their Historic Flood Risk Register (HFRR). The HFRR database records incidents of flooding relating to public foul, combined or surface water sewers and displays which

properties suffered flooding. The risk register was not received at the time of undertaking the SFRA.

1.1.9 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study. These outlines were the same as those on the Long-Term Risk of Flooding website at the time of publication. The Environment Agency are currently updating their national reservoir flood maps and SFRA users should check there are no major changes to the reservoir maps before relying on the mapping in the SFRA.

1.1.10 Flood Risk in Neighbouring Local Authorities

To inform the 'Existing Flood Risk Issues' column in Table 7-1 of the cumulative impact assessment, a number of publicly available documents were consulted, to ascertain any historical records of flooding to properties in settlements in the catchment, and any fluvial flood risk. Table B-2 lists the documents consulted.

Table B-2: List of public documents used to inform historic and fluvial flood risk to properties in neighbouring Local Authorities

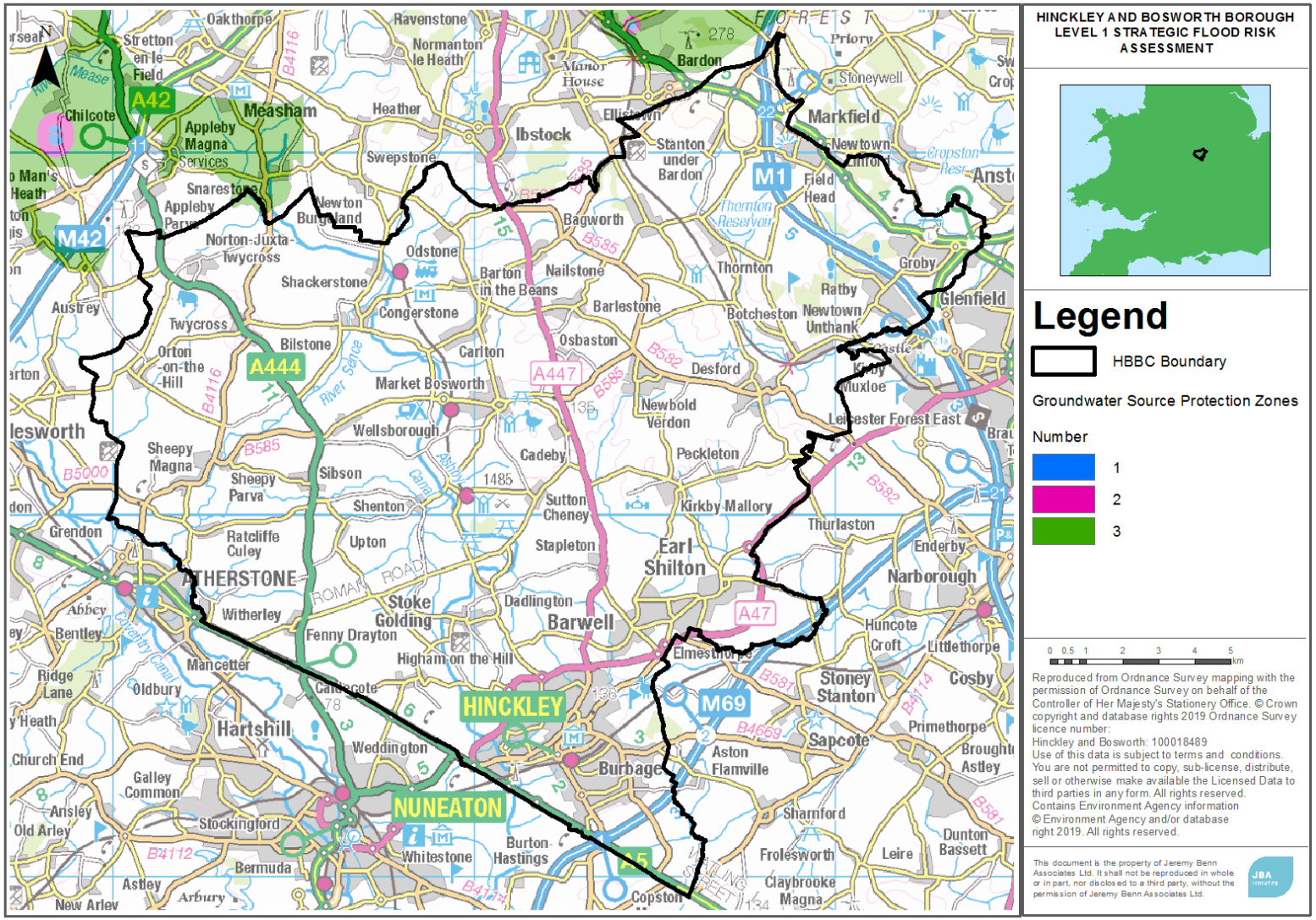
Document	Local Authority	Catchment
Charnwood Borough Council Level 1 Strategic Flood Risk Assessment (2018)	Charnwood Borough Council	Rothley Brook, Quorn Brook
Joint Level 1 SFRA for Hinckley and Bosworth Borough, Blaby District and Oadby and Wigston Borough Councils (2014)	Blaby District Council	Thurlaston Brook, Soar Brook from Source to Soar
Stratford-on-Avon DC, Warwickshire CC, North Warwickshire BC and Rugby BC Level 1 SFRA Report (2013)	Rugby Borough Council North Warwickshire Borough Council	Anker – Source to Wem Brook, Sketchley Brook from source to River Anker, Anker from Wem Brook to River Sence, Sence – Ibstock Brook to River Anker, Anker from River Sence to River Tame
Warwickshire County Council Strategic Flood Risk Assessment Level 1 (2008)	North Warwickshire	Anker from Wem Brook to River Sence, Sence – Ibstock Brook to River Anker, Anker from River Sence to River Tame

Overview of supplied data for the Hinckley and Bosworth borough SFRA

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines Hydraulic Modelling Reports	Environment Agency
	Historic flood incidents/records	Canal and River Trust
	Historic Flooding Incidents and Assets Register	Leicestershire County Council
Fluvial (including climate change)	River Anker Model (2010)	Environment Agency
	Flood Map for Planning Flood Zones	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map)	Environment Agency
Canal	Description of flood incidences	Canal and River Trust
Flood Defences	Location and description of flood defences	Environment Agency

C Groundwater Sources Protection Zones

Appendix C – Groundwater Source Protection Zones



D Flood Alerts and Flood Warnings

Appendix D - Flood Alert and Flood Warnings

1.1 Flood Alert Areas

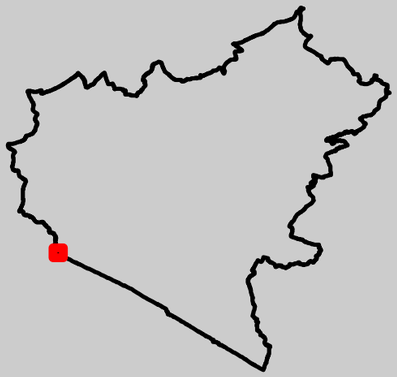
Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
033WAF307	River Anker and River Sense	River Anker, River Sense	Low-lying land and roads between Nuneaton and Tamworth on the River Anker and between Temple Mill and Ratcliffe Culey on the River Sense.
033WAF308	River Mease	River Mease	Low-lying land and roads between Ashby and Croxall.
034WAF402	Upper Soar Catchment	River Soar	River Soar in Leicestershire including tributaries from Sharnford to the River Wreake confluence at Syton.
034WAF403	Rothley Brook in Leicestershire	Rothley Brook	Rothley Brook and tributaries from Botcheston to the River Soar at Rothley.

1.2 Flood Warning Areas

Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
033FWF3ANKR005	River Anker at Mancetter, Witherley and Atherstone	River Anker	River Anker at Mancetter, Witherley and Atherstone including Lodge Close in Mancetter, Bridge Lane and Riverside in Witherley, Royal Meadow Drive, Ratcliffe Road and Aldermill Business Park in Atherstone.
033FWF3SENCE001	River Sence from Temple Mill to Sheepy Magna	River Sence	River Sence from Temple Mill to Sheepy Magna including Sibson Mill, Lovetts Bridge and Sheepy Parva.

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE



Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

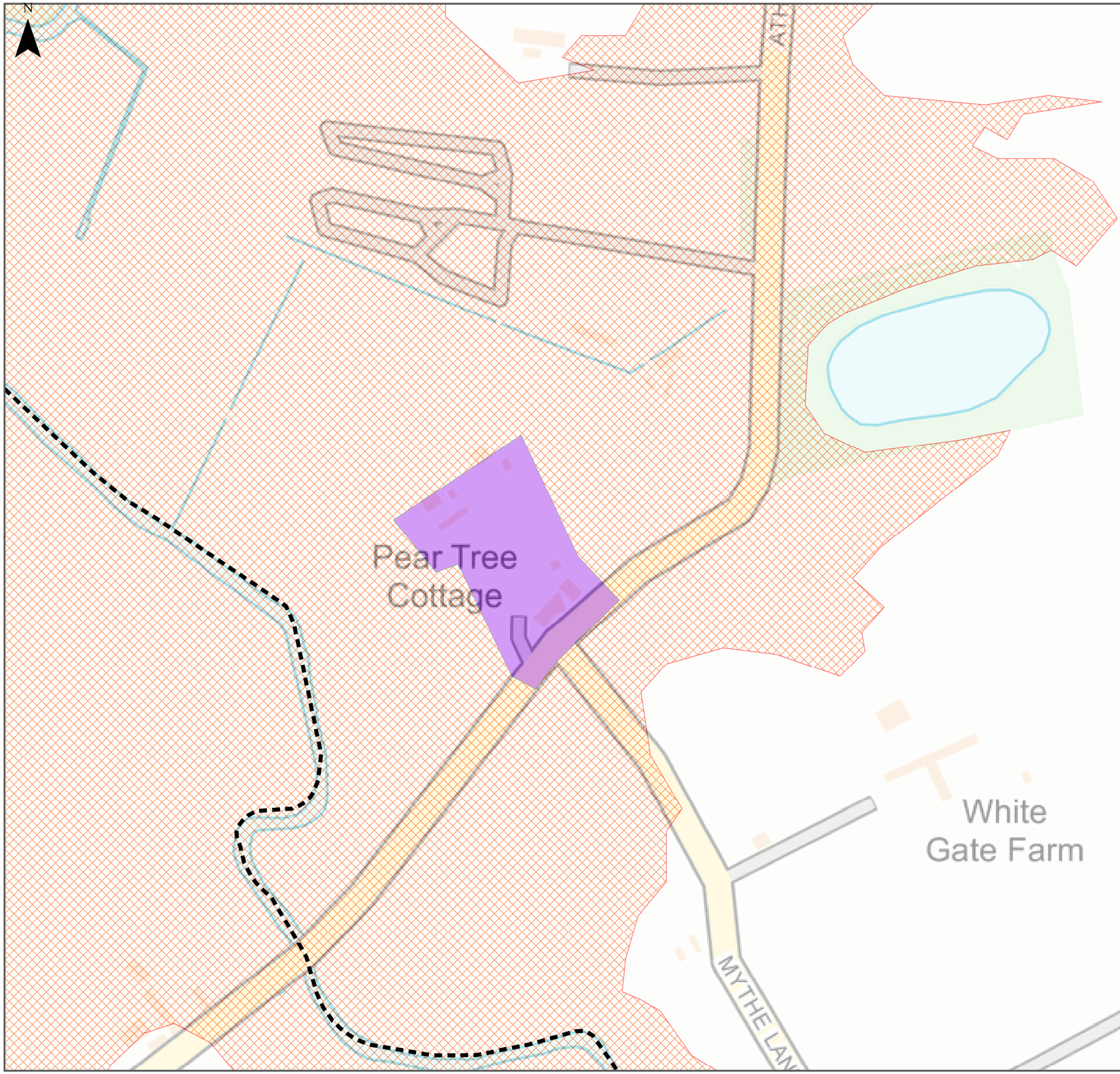
Not all Flood Alert Areas may be visible at this scale.

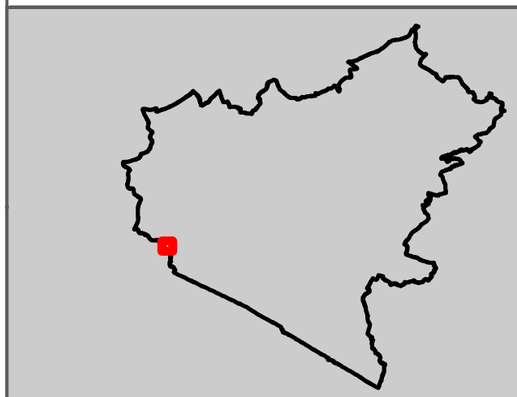
0 0.0475 0.095 0.19 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

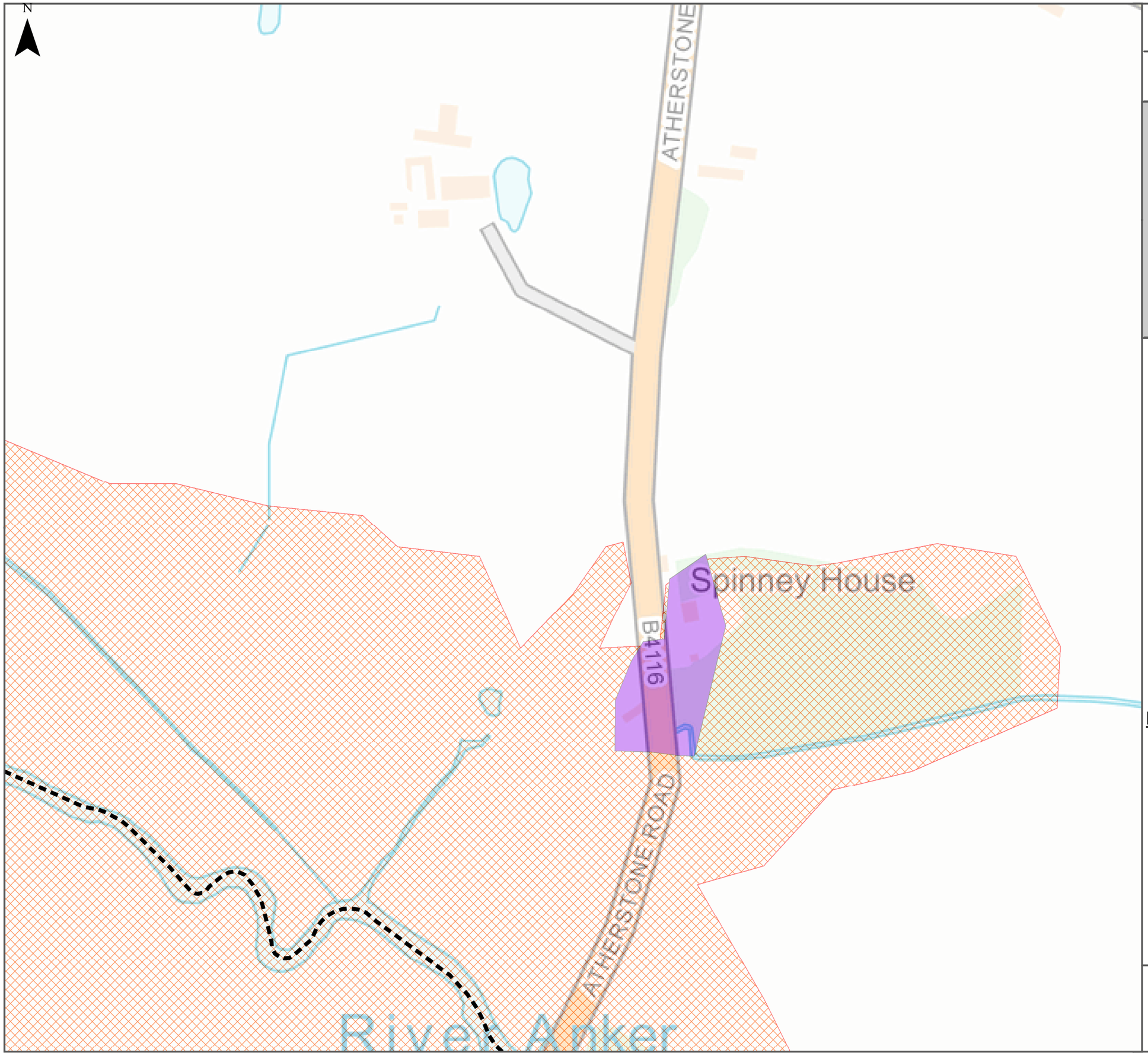
Not all Flood Alert Areas may be visible at this scale.

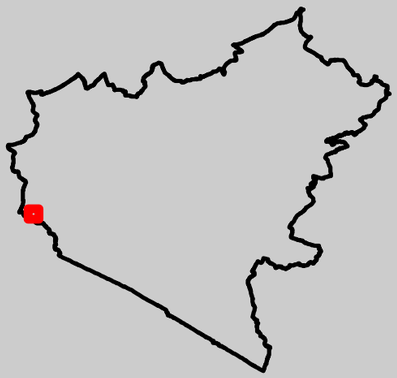
0 0.05 0.1 0.2 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

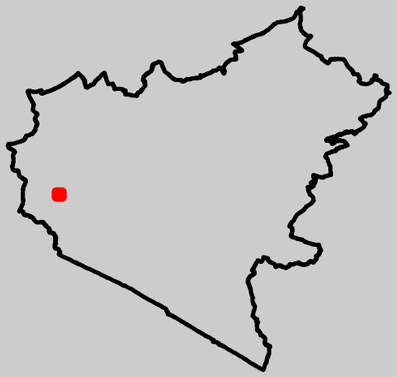
Not all Flood Alert Areas may be visible at this scale.

0 0.05 0.1 0.2 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE



Authority Information

Council Boundary

Flood Alert Areas

Flood Warnings

033FWF3ANKR005

033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

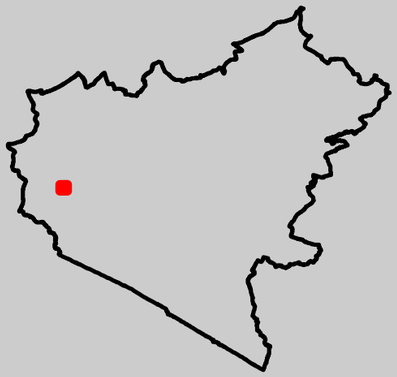
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

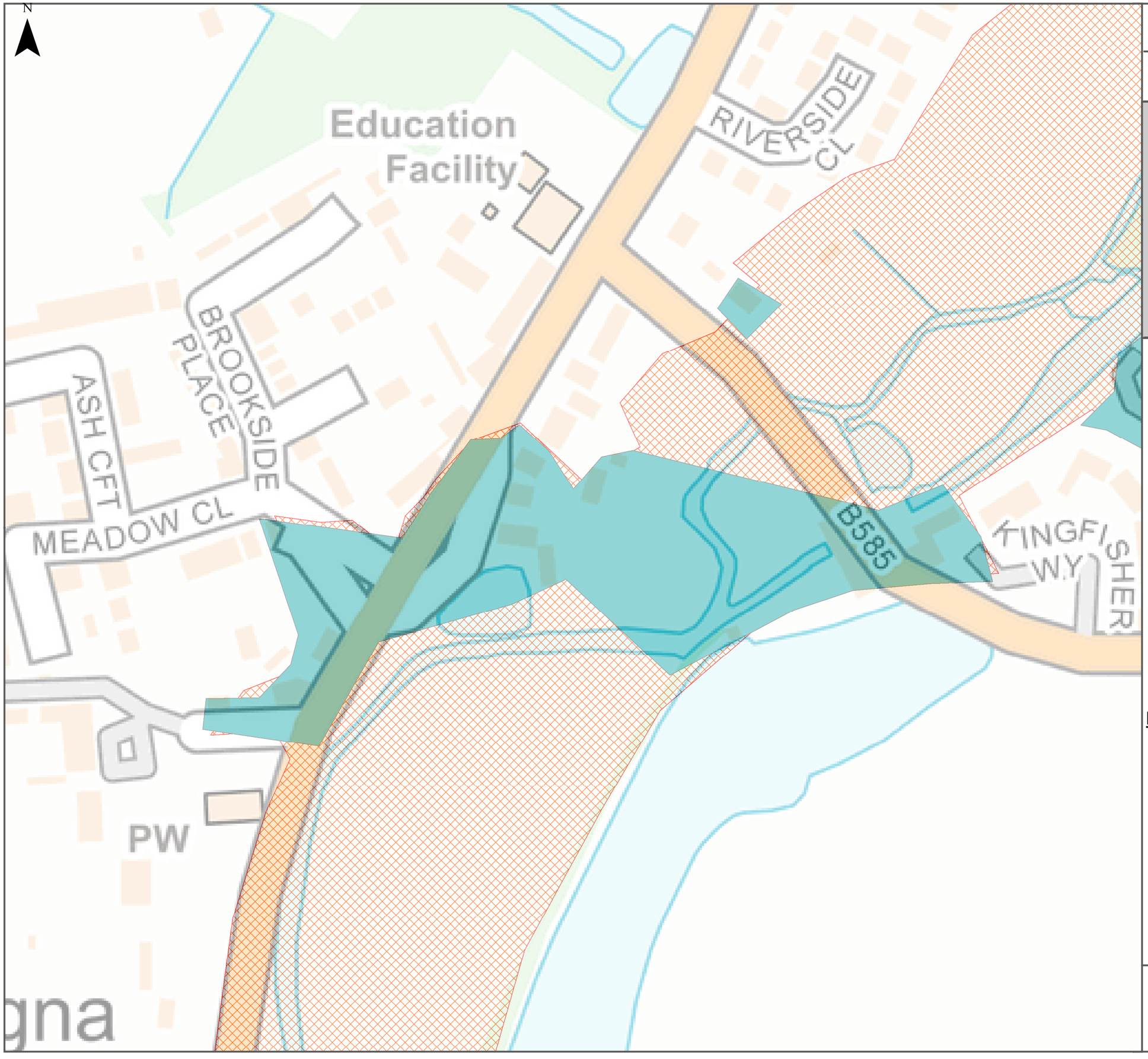
Not all Flood Alert Areas may be visible at this scale.

0 0.03 0.06 0.12 Km

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

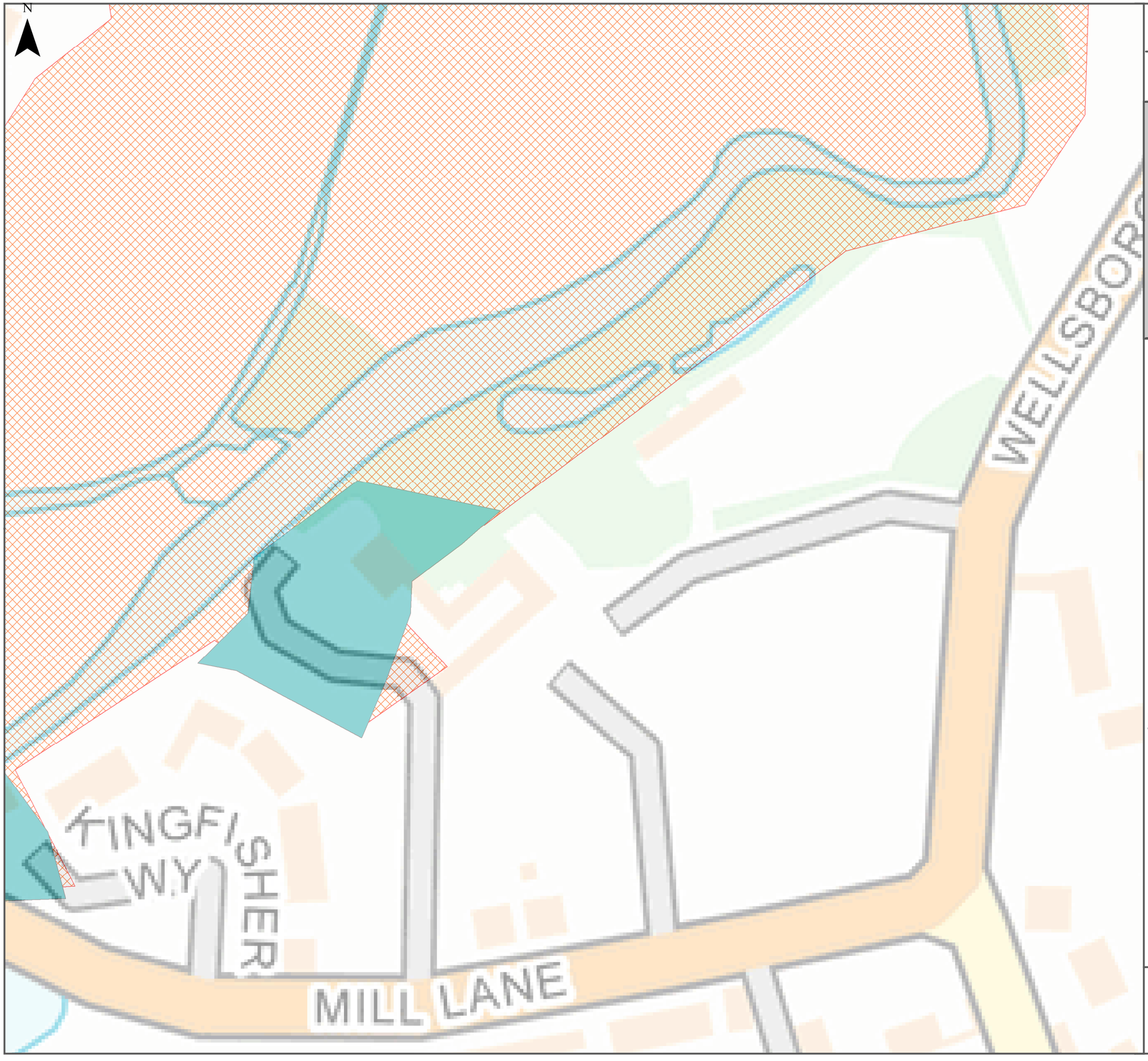
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

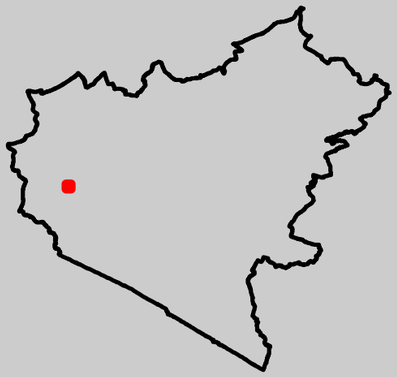
Not all Flood Alert Areas may be visible at this scale.

0 0.035 0.07 0.14 Km

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

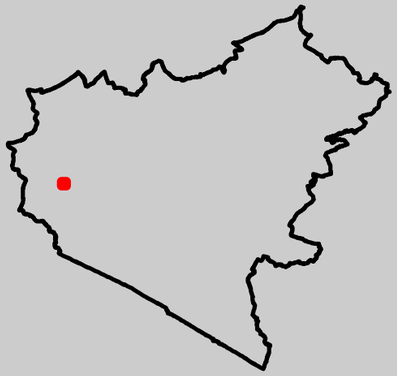
Not all Flood Alert Areas may be visible at this scale.

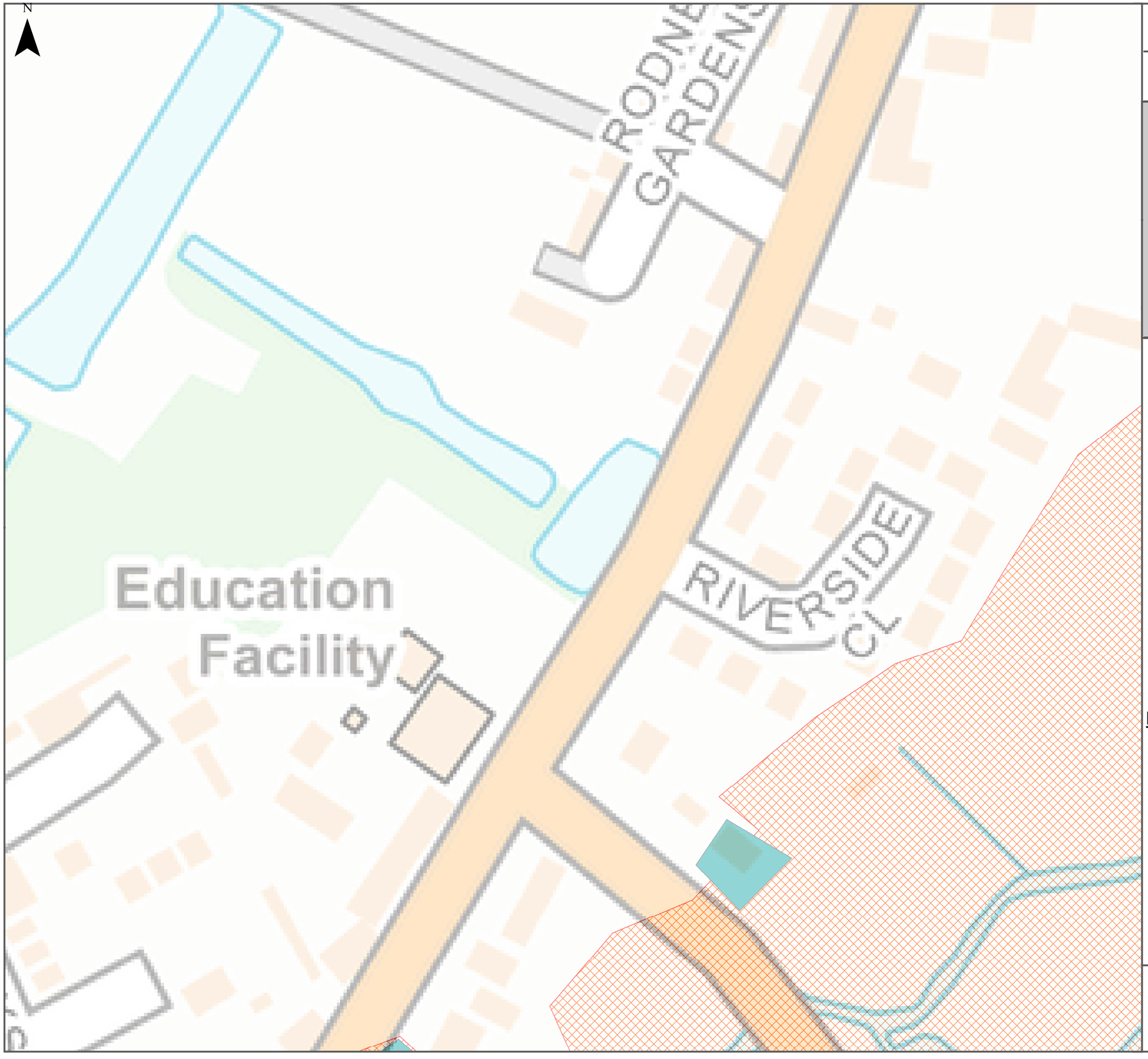
0 0.0225 0.045 0.09 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

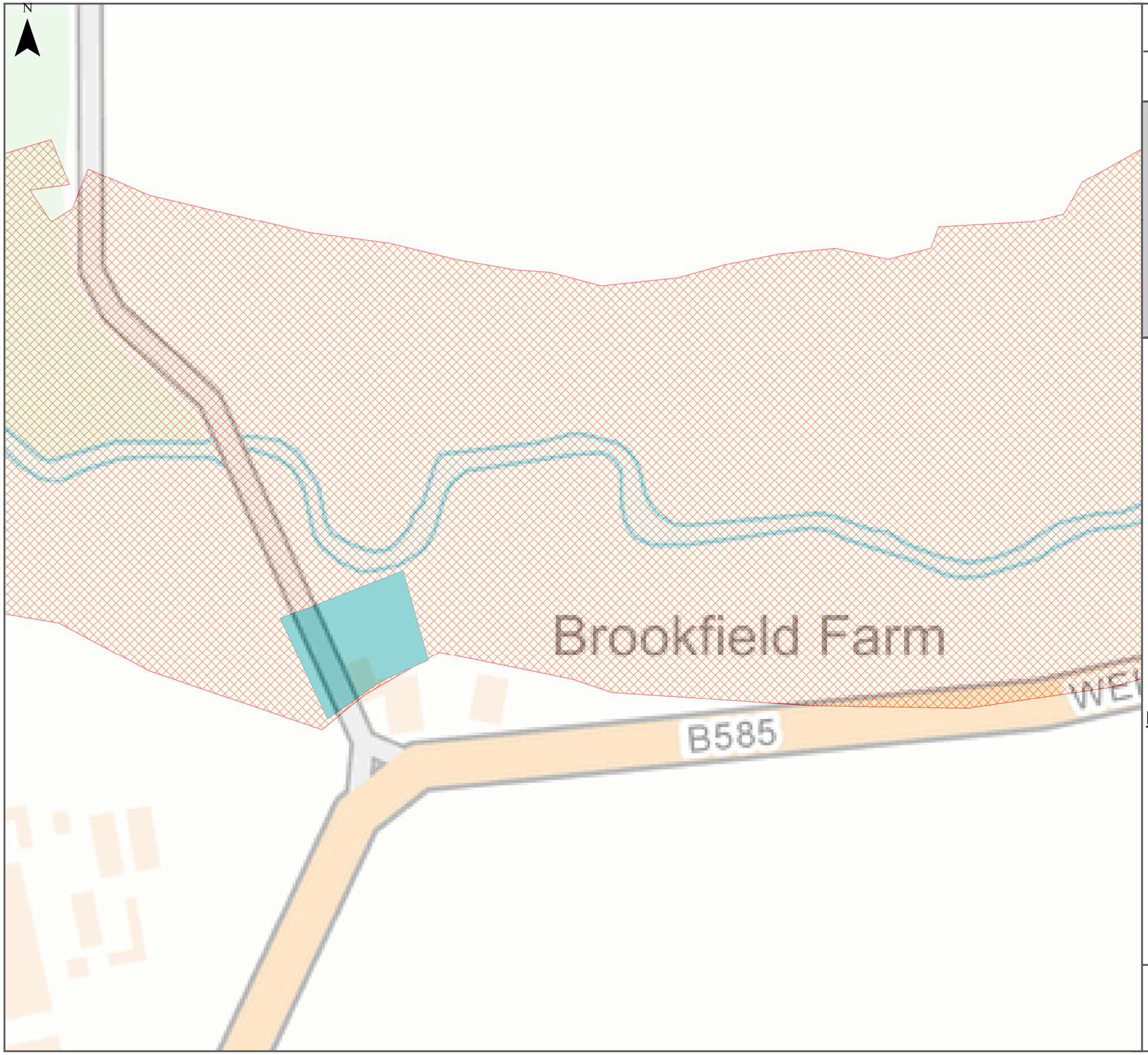
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

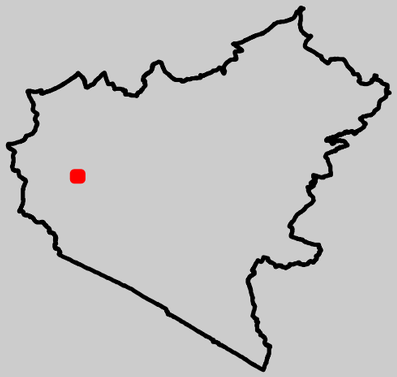
Not all Flood Alert Areas may be visible at this scale.

0 0.0225 0.045 0.09 Km

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

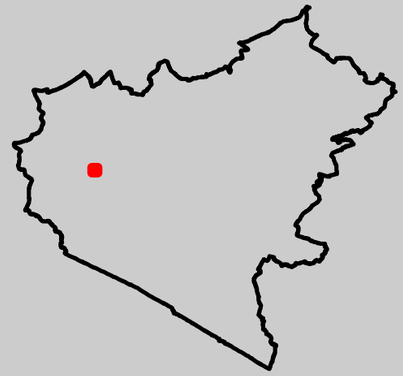
Not all Flood Alert Areas may be visible at this scale.

0 0.03 0.06 0.12 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE



Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

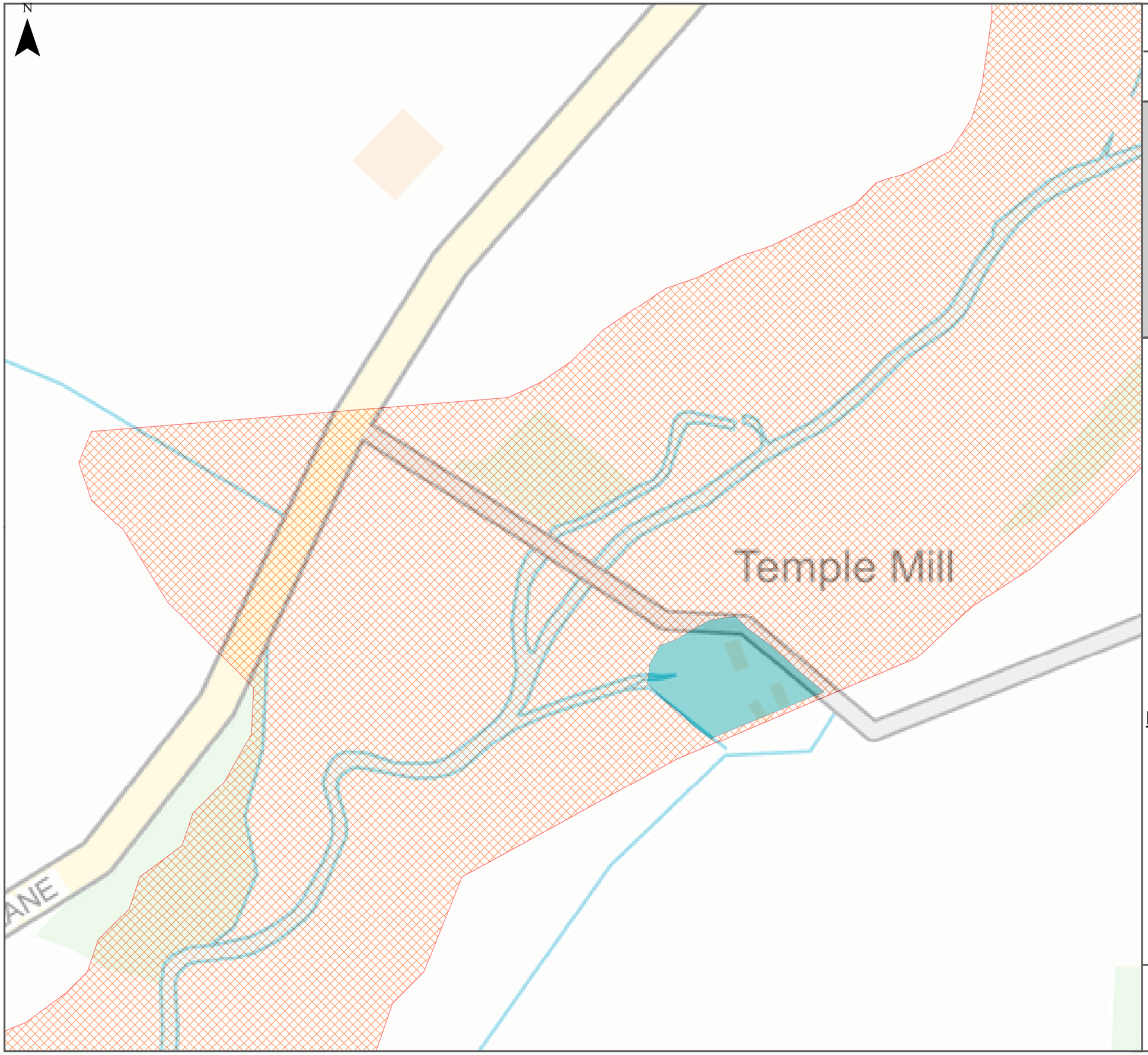
Not all Flood Alert Areas may be visible at this scale.

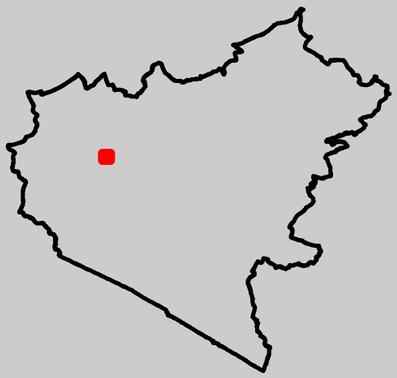
0 0.03 0.06 0.12 Km

JBA consulting

HINCKLEY AND BOSWORTH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX D: FLOOD ALERT AND WARNING COVERAGE





Authority Information

- Council Boundary
- Flood Alert Areas

Flood Warnings

- 033FWF3ANKR005
- 033FWF3SENCE001

Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

Not all Flood Alert Areas may be visible at this scale.

0 0.0375 0.075 0.15 Km

JBA consulting

E Summary of flood risk across the borough

Appendix E – Summary of flood risk in Hinckley and Bosworth borough

The table below summarises the flood risk in a number of wards and settlements within the borough.

Settlement/ ward	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
Hinckley Clarendon Ward	The Battling Brook rises in the adjacent ward of Hinckley Castle Ward and flows in a westerly direction. The fluvial flood risk is more or less confined to the channel, until the reach between Brodick Road and the Ashby Canal, where water spreads onto the floodplain. No properties are affected by this flood risk, and the area of land affected by the fluvial flood risk is designated as a flood storage area. The Harrow Brook enters the ward from the west and flows in a north-easterly direction towards the Ashby Canal. The fluvial flood outlines are well confined to the channel here, and no properties are affected. The Sketchley Brook enters the ward from the west and flows in an easterly direction towards the Ashby Canal. Water enters the floodplain outside of the ward to the west, and around the junction between the A5 and Nutt's Lane. This fluvial flood risk causes flooding to a number of properties and roads, including along Hammonds Way and Nutt's Lane. Flood Zone 2 covers a number of properties between Nutt's Lane and Hammonds Way, Flood Zone 3 affects several properties between the A5 and Nutts Lane.	A flood storage area is located to the east of the Ashby Canal and the west of Brodick Road.	Surface water flow paths follow the topography with high ground in the north east of the ward to lower ground in the south west. Surface water flow paths exist in the 30-year event along Barleston Drive, Bosworth Close, Roston Drive, Brodick Road and Lochmore Drive, ultimately draining into the Battling Brook. There are also overland flow routes in the south of the ward, including along Strathmore Road, Greyhound croft and Applebees Meadow. More overland flow routes become prominent in the 100-year and 1,000-year events, and areas of ponding become larger.	✓	✓			None	Four incidents of historic flooding, in 2013, 2012 and 2018, along Strathmore Road, Coventry Road and property adjacent to the A5.
Hinckley Castle Ward	The Battle Brook rises in Hinckley Castle Ward and flows in a western direction out of the ward. The majority of the fluvial flood risk associated with this watercourse is well confined to the channel and does not pose a risk of flooding to properties. A small side road off of Roston drive is however affected. Flood Zone 2 covers the end of the side road on Roston Drive, and no properties.	None	There are two prominent overland flow routes that exist within the ward in the 30-year event, which both follow the topography from high ground in the north east to low ground in the south. Surface water flow paths affect regent Street, Lancaster Road, Waterloo Road, Rugby Road, Clarendon Road, and Willowbank Road in the centre of the ward. Surface water flow paths in the north of the ward affect Westray Drive, Orkney Close and Sandy Crescent before joining the Battling Brook. More overland flow routes become prominent in the 100-year and 1,000-year events, and areas of ponding become larger.	✓	✓			None	One incident of historic flooding in 2016 on Hawley Road.
Hinckley Trinity Ward	Whilst there are a number of small unnamed drains in the ward, these drain out of the ward to the north and there is no fluvial flood risk posed to the ward.	None	Surface water flow paths follow the topography from high ground in the south to lower ground in the North. The main overland flow route exists along Stoke Road in the 30-year event and is associated with the unnamed drain adjacent to his road. There is prominent surface water pooling in the residential area to the south of Normandy Way. Incidents of surface water pooling become larger in the 100-year and 1,000-year events.	✓	✓			None	No historic flooding incidents. 1994- South West of the district impacted.
Hinckley De Montfort Ward	The source of the Thurlaston Brook is situated to the east of this ward and flows in an eastern direction out of the ward. There is fluvial flood risk associated with this watercourse, which affects some properties surrounding Burbage Common Road, including Houston Lodge. Flood Zone 3 covers a number of properties around Burage Common Road and the road itself.	None	There are a number of surface water flow routes in the north-western corner of the ward in the 30-year event. This affects a number of properties along roads including Tudor Road, Radmore Road, Middlefield Lane, Wheatfield Lane and Nelson Drive. The surface water flows to the north form high to low elevation and drains into the unnamed watercourse to the west of Nelson Drive. Throughout the rest of the ward there is mainly	✓	✓	✓	✓	None	There are six incidents of historic flooding. 2018 – Junction between Leicester Road and Butt Lane; 2016 – Property on Island Close; 2012 property on Sutton Close;

			small isolated areas of ponding, with larger areas of ponding on the lakes to the east of Ashby Road.						2014- Stoneygate Drive; 2013 – property on Ashby Road; 2013 – Middlefield Lane.
Burbage Sketchley and Stretton Ward	Two watercourses flow through this ward; the Sketchley Brook in the north of the ward, and the Soar Brook in the south east. The Sketchley Brook flows in a westerly direction out of the Ward and poses a fluvial flood risk to a number of properties and roads in the north of the ward. Water enters the floodplain and affects properties on Rugby Road, Crimson Way, Rugby Close, Olive Close, Logix Road and the industrial estate to the south of Logix Road. Flood Zone 3 covers a number of properties surrounding Crimson Way and Rugby Road, and Flood Zone 2 covers the industrial estate to the south of Logix Road. The Soar Brook rises in this ward and flows in an easterly direction. There is no risk of fluvial flooding to properties from this watercourse, although the water does enter the floodplain in the land surrounding the confluence with the Soar Brook and a number of unnamed watercourses.	None	Minor overland flow paths towards the Sketchley Brook exist in the 30-year event, including along Watling Way Rugby Road ND Crimson Way. There are small pockets of ponding in in the 30, 100 and 1,000-year events. There are also minor overland flow paths associated with the confluence between the Soar Brook and the two unnamed rains in the south of the ward in the 30-year event, as well as some minor ponding.	✓	✓	✓		None	There are seven incidents of historic flooding. Three are associated with the 09/03/2016 flood event, affecting property on Brockhurst Avenue, Sketchley Lane and Maroon Drive. Additional incidents occurred in 2013 on Sketchey Lane, Coventry Road and Britannia Road, and 2018 to the south west of B578
Burbage St Catherines and Lash Hill Ward	The Sketchley Brook rises in this ward and flows in a westerly direction. There is fluvial flood risk associated with this watercourse, particularly to a number of properties on East and West Close, to the north of Brookside road. The properties affected by this fluvial flooding are located within Flood Zone 3. An unnamed drain that joins the Sketchley Brook at Brookside Road causes fluvial flood risk to a number of properties on Holt Road, Farm Road and Forresters Road.	None	There are a number of overland surface water flow routes associated with the Sketchley Brook and the unnamed drain in the north of the Ward. Overland flow routes exist in the 30 and 100-year events on Brookside Road, Holt Road, Farm Road, Forresters Road, Far Lash, Hillrise and Higham way. There are also overland surface water flow routes associated with an unnamed watercourse in the east of the ward. Overland flow routes exist in the 30-year event on Sapcoat Road, Aston Flamville Road and the Meadows. There is also significant ponding around Burbage Wood. Incidents of surface water pooling become larger in the 100-year and 1,000-year events.	✓	✓			None	There are three incidents of historic flooding. 09/03/2016 on Bridge Road, and in 2016, where there were two incidents on Forresters Road and Balliol Road.
Barwell Ward	The Tweed River rises in this ward and flows in a north-westerly direction. Water is largely confined to the channel and the immediate floodplain, with no fluvial flood risk posed to any properties. There is some risk posed to the Ashby Road.	None	There are a number of overland surface water flow routes in the 100-year event within Barwell that drain into the Tweed River, including Stapleton Lane, Mill Street, Fair Acre Road and Boston Way. There is also significant ponding to the west of Barwell. In the south of the ward, there are significant overland surface water flow routes and ponding in the 100-year event around the A4, including Leicester Road and The Common, as well as causing flooding to a number of properties at Inglenook Farm. Additional overland surface water flow routes draining into the unnamed drain in the north east of the ward occur during the 100-year event. This affects properties on roads including Charnwood Road, The Drive and Moor Road.	✓				None	There are five incidents of historic flooding. 09/03/2016 on the junction between Stapleton Road and the A47; three events in 2013 on Mill Street, Shilton Road and Charnwood Road and 2014 incident on Wood Street
Earl Shilton Ward	The only source of fluvial flood risk in this ward is associated with the unnamed tributary of the Thurlaston Brook in the north of the ward. This causes flooding to a handful of properties around Liecester Road, which is situated in Flood Zone 3.	None	Surface water flow paths follow the topography from high ground in the north to lower ground in the south in Earl Shilton. Overland surface water flow routes in the 30-year and 100-year events impact a number of properties on roads including Land Society Lane, Wood Street, Station Road,	✓	✓	✓		None	There are two incidents of historic flooding, in 2014 and 2018 to a number of properties on Wood Street.

			Equity Road East, Meadow Court Road and Avenue South. Surface water here drains into the Thurlaston Brook. There are also minor pockets of ponding across the ward in all surface water events.						
Stoke Golding	There is no fluvial flood risk associated with Stoke Golding.	None	Stoke Golding is situated on an area of high ground, which reduces the settlements risk of surface water flooding. In the 30-year event there are only small isolated pockets of surface water flooding in the settlement, with the exception of a small flow route to the north of the settlement on Stoke Lane. In the 100-year this overland flow route is accentuated, and the extent affects properties on roads including Stoke Lane, Roseway, Whitemores Road and Greenhill Road, and affects the educational facility in the settlement. In the 1,000-year event, the overland surface water flow route in the north extends further southwards, affecting additional properties on roads including Sherwood Road and High Street. There are also additional overland flow routes to the south, affecting roads including Hinckley Road, Pine Close, Wykin Lane and Arnold Road.	✓	✓			None	There is one incident of historic flooding in 2014 at the junction of Hinckley Road and Convent Drive.
Market Bosworth	There is no fluvial flood risk associated with Market Bosworth	None	Surface water flow paths exist in the west of the settlements in the 30 and 100-year events, affecting properties on roads including the west of Station Road, Pistrelle Drive, Heath Road, Stanley Road, and the south of Barton Road. In the 1,000-year event, there is more significant flooding on the roads impacted in lower return periods, as well as additional roads including Springfield Avenue, York Close, Northumberland Avenue and Market Place. Market Bosworth Train station is also impacted by surface water flooding in the 1,000-year event only. Market Bosworth benefits from the surrounding topographical features, being situated on an area of high ground.	✓	✓			None	One incident of historic flooding on the 15-16th June 2016 on Back Lane.
Sheepy Magna	Sheepy Magna is at significant risk of flooding from fluvial sources. Fluvial flood risk here is associated with the River Sence, which flows in a south-westerly direction to the south of Sheepy Magna. Fluvial flooding impacts a number of properties on roads including Mill Lane, Kingfisher Way, the B4116, Riverside Close and Meadow Close.	None	Sheepy Magna is situated on the right bank floodplain of the River Sence, and the surrounding topography mean that overland surface water flow routes exist in the settlement as they rain into the Sence. In the 30-year event, there are surface water flow routes that affect properties on roads including Mill Lane, Sibson Road, the B4116, Meadow Close and Brookside Place. In the 100-year event, the overland surface water flow is confined to the same routes as the 30-year, but with large extents in areas surrounding Mill Lane. The 1,000-year event sees much large surface water extents associated with the River Sence compared to the 30 and 100-year events, as well as a much larger overland flow route entering the settlement from the north west around Podney Gardens.	✓		✓	✓	None	One incident of historic flooding in 2013 opposite Park View road on the B4116
Groby	There is fluvial flooding associated with an unnamed drain and a tributary of the Rothley Brook to the north of the settlement. The unnamed drain joins the Rothley Brook to the east of Castle Hill flowing in an easterly direction, and the tributary of the Rothley Brook flows in an easterly direction from Groby Pool. Fluvial flooding affects roads including Newtown Linford Lane, Markfield	None	The centre and north west of Groby are situated on an area of raised topography, whereas the south and north east of Groby are areas of low elevation. These areas of low elevation experience surface water overland flow routes. In the 30-year event there are overland flow routes in the north of Groby, on roads including Leicester Road, Field Court Road, Dalby Drive, Pymm Ley Lane,	✓	✓			The north east of Groby is potentially located within the extent of flooding from Groby Pool.	There is one incident of historic flooding in 2013 on the junction between Woodbank Road and Ratby Road.

	Road and Anstey Lane. Fluvial flooding does not pose a risk to the majority of the settlement and is instead confined to the floodplain north of Markfield Road. The properties in Castle Hill area at risk from fluvial flooding, and are located within Flood Zone 3.		Craneley Road and Ratby Road, which drains into the unnamed drain north of Markfield Road. There are additional overland flow routes in the south of Groby, situated on roads including Sachverless Way and Ratby Road. In the 100-year event, existing overland flow routes seen in the 30-year event increase in extent, and additional routes appear on Anstey Drive to the north and Woodbank Road to the south west. There are also additional isolated pockets of surface water flooding. In the 1,000-year event, the existing overland flow routes to the north and south of the settlement are more defined with larger extents, with surface water flooding on the majority of residential roads.						
Ratby	There is fluvial flooding associated with a tributary of the Rothley Brook to the south of the settlement, which flows in a north-easterly direction before joining the Rothley Brook at the A46. The south of Ratby is located either on or adjacent to the floodplain, and consequently fluvial flooding poses a risk to a number of roads and properties on the fringe of the settlement. These include Desford Lane, Brook Drive, Frank Watts Close, Taverner Drive and Station Road, which are situated in Flood Zone 2.	None	The north of Ratby is situated on an area of raised topography, and consequently the majority of surface water flow routes drain to the south into the tributary of the Rothley Brook. In the 30-year event, surface water drains along the southern boundary of the M1, causing flooding to a number of properties at the end of Taverner Drive and on Groby Road. There are additional smaller overland flow routes in the settlement on roads including Station road, Main Street, Cottage Close, Markfield Road and Cooperfield Lane. In the 100-year event, overland flow routes through the settlement become more defined as water flows from north west to south east. One route starts on Markfield Road and cuts across a number of properties on Cottage Close, Overfield Close and Copper Lane before entering an unnamed drain. Another route starts on Stamford Street before joining Main Street and flowing down the road into the tributary of the Rothley Brook. In the south east of the settlement, there are a number of smaller overland flow routes on Taverner Road and Nicholas Drive. The flow route adjacent to the M1 also increases in extent. In the 1,000-year event, all existing overland flow routes observed in the 100-year increase, with the majority of residential roads between Main Street and Taverner Drive affected.	✓	✓	✓		The South of Ratby is potentially located within the extent of flooding from Thorton Reservoir.	There are two incidents of historic flooding in the settlement. In 2016 there was an incident associated with the bridge on Station road over the Rothley Brook, and in 2018 there was an incident on Main Street.
Desford	There is no fluvial flood risk posed to this settlement.	None	Desford is situated on an area of elevated topography, with the eastern part of the settlement on lower ground. In the 30-year event, an overland surface water flow route passes through the settlement starting on Willow Street and flows in an easterly direction across properties on Kirby Road, Hamble Close, Parkstone Road and Peckleton Lane before entering an unnamed watercourse. In the 100-year event, the existing overland flow route observed in the 30-year event increases, and there is another overland flow route that starts to the south of the settlement and affects properties on Peckleton Lane. Moreover, there are additional overland flow routes that start in the north of the settlement, and flow in a northern direction on Lindridge Lane. In the 1,000-year event, all existing overland flow routes are greater, with additional overland flow routes on Main Street, Leicester Lane and Station Road.	✓		✓		None	There are two incidents of historical flooding in this settlement, both of which occurred in 2013. To the south of Desford to properties on Peckleton Lane, and to the north of Desford to properties on Grange Crescent.

Markfield	There is no fluvial flood risk posed to this settlement.	None	Surface water flow paths follow the topography from high ground to lower ground in the south. In the 30-year event, there is only one overland surface water flow route in the settlement, flowing south on Chitterman way before draining into an unnamed watercourse south of London Road. In the 100-year event, the existing overland flow route observed in the 30-year event is more accentuated and has additional flow routes join it from Linford Crescent, London Road and properties between Launde Road.	✓	✓			None	None

F Cumulative Impact Assessment

1 Appendix F – Cumulative Impact methodology

1.1 Methodology

1.1.1 Historic flood risk

Historic flood risk was determined using Leicestershire County Council's Historic Flooding Incidents and Assets Register and Leicestershire Fire and Rescue Service's Incident Recording System data. Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

Attribute data for each Historic Flooding Incident and Assets Register point includes the:

- Location of flood incident (Grid reference and street name)
- Year of incident
- Description of incident

Attribute data for each Incident Recording System data point includes the:

- Time
- Date
- Location (grid reference and street name)
- Description of incident

A count of each historical flood incident was conducted for each catchment and sub catchment to determine the historic flood risk of the catchments.

1.1.2 Sensitivity to increases in flood flows

This is the measure of the increase in the number of properties at risk of surface water flooding in a 1 in 100-year event to a 1 in 1000-year event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk.

The OS MasterMap data was used to identify all the properties within Hinckley and Bosworth borough.

This data was intersected with the 1,000-year and 100-year surface water flood extents separately to determine the number of properties in each catchment, in each surface water flood extent.

The difference between the two was then taken as a percentage of the number of properties in the 100-year surface water flood extent, e.g. if 250 properties are in the 100-year surface water flood extent, and 500 properties are in the 1,000-year surface water extent, this would be a 100% increase in properties at risk of flooding due to an increase in flood risk upstream.

A summary of the datasets used to calculate the historic flood risk and the sensitivity to increases in flood flows for each catchment is shown in Table F-1.

A summary of the studies that were used to assess the nature of flood risk in regions downstream of catchments draining out of Hinckley and Bosworth borough is shown in Table F-2.

Table F-1: Summary of datasets used in the cumulative impact assessment

Dataset	Coverage	Source of data	Use of data
Catchment boundaries	Hinckley and Bosworth Borough study area	Water Framework Directive (WFD) catchments	Defining catchment boundaries
Neighbouring Local Plan allocations	Neighbouring authorities	Neighbouring authorities	For identifying cross boundary issues with catchments that are shared by Hinckley and Bosworth borough and neighbouring authorities.
Historic flooding incidents	Hinckley and Bosworth borough study area	Leicestershire County Council	Assessing the number of historic flooding records in each catchment
OS MasterMap	Hinckley and Bosworth borough study area	Ordnance Survey supplied by Hinckley and Bosworth Borough Council	Location of buildings in the District for assessing those at risk from surface water flooding
Risk of flooding from surface water map (RoFSW) 100-year extent and 1000- year extent	Hinckley and Bosworth borough study area	Environment Agency	Assessing the number of properties within the 100-year and 1000-year surface water flooding extent, and to work out predicted increase in surface water flood risk to sites.

Table F-2: Summary of studies used to assess nature of flood risk downstream of Hinckley and Bosworth

Document	Local Authority	Catchment
Charnwood Borough Council Level 1 Strategic Flood Risk Assessment (2018)	Charnwood Borough Council	Rothley Brook, Quorn Brook
Joint Level 1 SFRA for Hinckley and Bosworth Borough, Blaby District and Oadby and Wigston Borough Councils (2014)	Blaby District Council	Thurlaston Brook, Soar Brook from Source to Soar
Stratford-on-Avon DC, Warwickshire CC, North Warwickshire BC and Rugby	Rugby Borough Council North Warwickshire Borough Council	Anker – Source to Wem Brook, Sketchley Brook from source to River Anker, Anker from Wem Brook to River

BC Level 1 SFRA Report (2013)		Sence, Sence – Ibstock Brook to River Anker, Anker from River Sence to River Tame
Warwickshire County Council Strategic Flood Risk Assessment Level 1 (2008)	North Warwickshire	Anker from Wem Brook to River Sence, Sence – Ibstock Brook to River Anker, Anker from River Sence to River Tame

1.1.3 Ranking the results

The results for each assessment were ranked into high, medium and low risk as shown in Table F-3 below.

Table F-3: Ranking the results

Flood risk ranking	% increase in properties within each catchment at risk of flooding in a 1-100 year to 1-1000 year event	Total number of data points in LCC's Historic Flooding Incidents and Assets Register and Leicestershire F&R Incident Recording System
Low risk	<250%	<5
Medium risk	250 to 500%	5 to 7
High Risk	>500%	>7

The ranking results were combined from both assessments to give an overall high, medium and low ranking for all catchments within the borough as shown in Table F-4. Specific policies are provided for each risk category. To enable a quantitative ranking of catchments, a score was assigned to each of the rankings;

- High = 3
- Medium = 2
- Low = 1

Table F-4: Final combined rankings

		Historic flood risk ranking		
		High	**Medium**	**Low**
Predicted flood risk ranking	**High**	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

1.1.4 Additional considerations

These additional factors were considered:

Large catchments:

The Environment Agency's WFD river catchments data was initially used to define the catchments used in this assessment. The largest catchments that dominate the study area (Rothley Brook Catchment, Thurlaston Brook Catchment and Stoke Golding Brook from source to River Sence) were then split up into sub-catchments based on the LiDAR dataset available, to produce more locally specific results. Once the cumulative analysis was conducted on each of the sub-catchments, the average score for the predicted

increase in properties at risk of flooding and the total number of historic flood events was calculated for all of the sub catchments, to give the overall catchment ranking. The ranking of all the sub catchments was considered when calculating the overall catchment's ranking e.g. if all of the sub catchments achieved a ranking of low, but the overall catchment achieved a ranking of high, a rank of medium would be assigned.

Skewed results:

Due to the nature of the assessment, catchments with a very small number of properties within the surface water extents could see skewed results, e.g. the Quorn Brook Catchment, which has 0 properties within the 100-year surface water flood extent and 7 within the 1,000-year surface water flood extent. This gave a result of 700% increase in properties at risk between a 1-100 year and 1-1000 year event. This meant that this catchment had an overall ranking of high, however the catchment is largely outside of the study area.

Incidences of this mainly occurred where only a small area of the catchment lies within Hinckley and Bosworth borough and therefore the effect on the study area is minimal.

For this reason, the Quorn Brook, Sence from Source to Ibstock Brook, Anker from Source to Wem Brook, Mease from Gilwiskaw Brook to Hooborough Brook and Black Brook catchments were given a final ranking of low.

Growth in neighbouring authorities:

Development in neighbouring authorities can affect flood risk in Hinckley and Bosworth borough, especially if the catchment is draining towards the study area. Development sites in neighbouring authorities were assessed to determine if any neighbouring development would affect flood risk in Hinckley and Bosworth borough.

There were 18 development sites found within North West Leicestershire that are located in the Sence from Source to Ibstock Brook catchment that drains into the north of Hinckley and Bosworth borough. This included eight housing allocations and ten employment allocations. In the remaining neighbouring authorities, there are no significant development sites on catchments draining into Hinckley and Bosworth borough. With there being so few allocated sites for development within North West Leicestershire, it is unlikely that this will have a significant impact on flood risk within Hinckley. However, it is recommended that Hinckley and Bosworth Borough and North West Leicestershire District Councils work together to ensure policies on flood risk and drainage are compatible.

Growth in Hinckley and Bosworth borough:

Development within Hinckley and Bosworth borough has the potential to affect flood risk in neighbouring authorities, especially if there are existing flood risk issues. A summary of this is shown in Table 7-1 in the SFRA report. Previous SFRA studies have been used to identify if each of the catchments that drain into neighbouring Local Authorities have existing flood risk issues, including:

- Joint 2014 SFRA for Hinckley and Bosworth, Blaby and Oadby and Wigston Borough Councils
- Leicestershire and Leicester City 2017 SFRA
- Charnwood Borough Council 2018 Level 1 SFRA

All catchments identified as having the potential to impact existing flood risk issues in neighbouring Local Authorities were assigned a score of 2, to contribute to the final score of the catchment and the subsequent rating.

A number of settlements on the Rothley Brook in Charnwood borough and Blaby district, including Anstey, Rothley and Glenfield, have existing flood risk issues. Development in the upper catchments of the Rothley Brook that exist within Hinckley and Bosworth borough have the potential to exacerbate this issue.

For this reason, the Rothley Brook Catchment (trib of Soar) – Desford, Rothley Brook Catchment (trib of Soar) – Groby, Rothley Brook Catchment (trib of Soar) - Groby Pool and Rothley Brook Catchment (trib of Soar) – Ratby sub-catchments have all been given an automatic final ranking of high.

1.1.5 Assumptions

The assumptions made when conducting the cumulative impact assessment are shown in Table F-5.

Table F-5: Assumptions of the cumulative impact assessment

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Sensitivity to increases in flood flows	Location of properties	Assumption that all properties have been included in the in the OS MasterMap. It may not include all new build properties.	This was the most up to date and accurate data available.
LLFA Historic Flooding Incidents and Assets Register	Severity of historic flooding	Each point represents a location where it is known there has been at least one flood event (however the nature and scale of these flood events varies significantly). The severity of the historic flooding event relating to the point has not been considered, just the total number of points within each catchment where there has been a historic flood event.	This is a conservative approach to consider the 'worst case' of flood risk.
Leicestershire Fire and Rescue	Severity of flood incident	Each point represents a location where it is known there has been at least one flood incident. The	This is a conservative approach to consider the 'worst case' of flood risk.

flooding incident data		severity of the historic flooding event relating to the point has not been considered, just the total number of points within each catchment where there has been a flood incident.	

The results of the assessment and policy recommendations can be found Chapter 7 and Chapter 10 of the main SFRA report.

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007