Charnwood Borough Council Level 2 Strategic Flood Risk Assessment

Final Report

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Charnwood Borough Council

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This report describes work commissioned by Geoff Brown, on behalf of Charnwood Borough Council, by an email dated 20th January 2020. Joanne Chillingworth, Alex Clark, Anna Hastings and Sabrina Sidhu of JBA Consulting carried out this work.

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Purpose

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- Charnwood Borough Council
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Executive summary

Introduction and context

This Level 2 Strategic Flood Risk Assessment (SFRA) document was created with the purpose of supporting the production of the Charnwood Borough Council Local Plan to 2037. It follows on from the Level 1 SFRA completed in 2018 and assesses sites identified by the Council for new homes and jobs.

There are 23 new proposed development sites being assessed in this Level 2 SFRA assessment. These have been identified from 90 initial proposed sites to be at particular risk of flooding, thus requiring Level 2 assessments. In addition, since the previous SFRA was published, there have been updates to national and local planning policy, including the release of updated SFRA guidance in August 2019.

This 2020/ 2021 Level 2 SFRA has updated information on flood data, flood risk policy and recommendations for the cumulative impact of development.

SFRA objectives

The Government's Planning Practice Guidance (PPG) on Flood Risk and Coastal Change advocates a tiered approach to risk assessment and identifies Level 1 and Level 2 assessments.

The aim of the Level 2 assessment is to build on identified risks from Level 1 for proposed development sites, to provide a greater understanding of fluvial, surface water, groundwater and reservoir related flooding risks to the site. From this the Local Council and Developers can make more informed decisions and pursue development in an effective and efficient manner. The Level 2 assessment also identifies sites for further risk analysis at the site-specific Flood Risk Assessment (FRA) stage.

Level 2 SFRA outputs

The Level 2 assessment includes detailed assessments of the proposed site options. These include:

- An assessment of all sources of flooding including fluvial flooding, surface water flooding, groundwater flooding, mapping of the functional floodplain and the potential increase in fluvial flood risk due to climate change.
- Reporting on current conditions of flood defence infrastructure, where applicable.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of sustainable drainage systems for managing surface water runoff.
- Advice on whether the sites are likely to pass the second part of the Exception Test with regards to flood risk and on the requirements for a site-specific FRA.

Summary of Level 2 SFRA

Charnwood Borough Council provided 90 sites for assessment. These were chosen through a combination of a site's potential for allocation and its flood risk as determined through the site assessment process. These sites were screened against flood risk datasets to assess how many were to be carried forward to a Level 2 SFRA assessment. In total, 23 sites were carried forward to a Level 2 assessment, and lower risk sites are also flagged in this report with general recommendations for developers. Detailed site summary tables and GeoPDF mapping have been produced, provided in Appendix A.

The summary tables set out the flood risk to each site, including maps of extent, depth and velocity of flooding as well as hazard mapping for the 100-year defended event and climate change extents where modelled outputs were available. Where there were no hydraulic models present, Flood Zone 2 was used as indicative extent

for fluvial climate change and the 1,000-year surface water extent as an indication of surface water climate change. The surface water mapping depth and velocity data was also used as an indication of flood risk for small watercourses. Each table sets out the NPPF requirements for the site as well as guidance for site-specific FRAs. A broadscale assessment of suitable SuDS options has been provided, giving an indication where there may be constraints to certain types of SuDS techniques.

To accompany each site summary table, there is an Interactive GeoPDF map, with all the mapped flood risk outputs per site. This is displayed centrally, with easy-to-use 'tick box' layers down the right-hand side and bottom of the mapping, to allow easy navigation of the data.

The following points summarise the Level 2 assessment:

- The majority of sites with a detailed Level 2 summary table are at fluvial flood risk. The degree of flood risk varies, with some sites being only marginally affected along their boundaries, and other sites being more significantly affected within the site, such as sites PSH343 and PSH260. These will require more detailed investigations on sequential site layouts, SuDS possibilities, safe access and egress and so on, as part of a site-specific Flood Risk Assessment at the planning application stage.
- Most sites at fluvial risk are also at risk from surface water flooding; however, there is not always a direct correlation between fluvial and surface water risk. For example, PSH260 has a higher fluvial risk than PSH483, but the latter is at a higher risk from surface water flooding, with more areas of ponding in the higher return period events. As a result, some sites not at fluvial risk were subject to a Level 2 assessment where surface water risk was deemed to be significant from professional judgement (surface water should also be considered when assessing safe access and egress to and from the site).
- Surface water tends to follow topographic flow routes, for example along the watercourses or isolated pockets of ponding where there are topographic depressions.
- Fluvial climate change mapping indicates that flood extents will increase. As a result, the depths, velocities and hazard of flooding may also increase. The significance of the increase tends to depend on the topography of site and the percentage allowance used; extents would be larger than Flood Zone 3, but maximum extents are likely to be similar to Flood Zone 2. The Council and the Environment Agency require the 100-year plus 20%, 30% and 50% climate change fluvial scenarios to be considered in future developments. The 1,000-year surface water flood extent can also be used as an indication of climate change to surface water risk. Site-specific FRAs should confirm the impact of climate change using latest guidance.
- Additional climate change assessments were undertaken: the H++ allowance (100-year +65%) was run for the Wreake, Lower Upper Soar and Loughborough Tributaries models, where urban extensions are proposed to particular settlements. Also, the potential impacts of climate change on the functional floodplain were assessed by comparing the difference between the 20-year model extent and the nearest equivalent return period event, for example the 50-year/ 75-year extents. Where these assessments were relevant, these have been commented on in the site summary tables in Appendix A.
- The four sites considered in Loughborough town centre present unique challenges for developing the sites (PSH487, PSH488, PSH245 and SH48). The latest EA Wood Brook fluvial modelling shows the sites to only be at actual fluvial risk in the 100-year defended plus climate change events and higher, but it is the surface water extents which are more significant down the valley albeit in the 1,000-year event. This dataset does not account for culverts and hence there is a lower level of confidence in these extents in the absence of

an integrated hydraulic model. When undertaking a site-specific FRA at these sites, developers will need to consider surface water flood risk in more detail.

- Three of the four sites are also located on top of/ adjacent to the Wood Brook where it is in culvert, presenting easement challenges. Any sites located where there is Main River (including culverted reaches of Main River) will require an easement of 8m either side. This will have constraints regarding what development will be possible on top of the culvert. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk.
- Residual risk was considered at the sites. Blockage locations were determined by visual inspection of the OS mapping and ground topography in the vicinity of the site, to determine whether a structure upstream, downstream, or within the site could have an impact on the site. These would need to be considered further as part of a site-specific assessment.
- A strategic assessment was conducted of SuDS options using regional datasets. A detailed site-specific assessment of suitable SuDS techniques would need to be undertaken at site-specific level to understand which SuDS option would be best.
- For some sites, there is the potential for safe access and egress to be impacted by fluvial or surface water flooding. Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to whether the risk forms a flow path or bisects the site where access from one side to another may be compromised.
- In respect of cumulative impact assessment, there are a number of development sites proposed that have the potential to provide a betterment to existing communities downstream within the catchment. However, all of these developments also have the potential to increase flood risk offsite if both National and Local SuDS Standards are not applied. They also offer a great potential to enhance the wider Green and Blue Infrastructure of the local area through integrated planning for flood risk, sustainable drainage, biodiversity, amenity and sustainable transport provision.
- Developers proposing windfall sites in the high-risk Cumulative Impact Assessment catchments should demonstrate through a site-specific FRA how SuDS and surface water mitigation techniques will ensure that development does not increase flood risk elsewhere and seeks to reduce flood risk to existing communities. The catchment based Cumulative Impact Assessment used the latest available data for the Level 2 SFRA.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses where there are no detailed hydraulic models present, to verify flood extent (including latest **climate change allowances**), inform development zoning within the site and prove, if required, whether the Exception Test can be passed.

For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the Developer must design the site such that is appropriate flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA.

For developments that have not been allocated in the Local Plan, developers must undertake the Exception Test and present this information to the Local Planning Authority for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should look into in more detail to inform the Exception Test for windfall sites.

It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific Flood Risk Assessment and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals.

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Abbreviations and glossary of terms

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.
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
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.

Flood 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
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
JBA	Jeremy Benn Associates
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
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
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.
RBMP	River Basin Management Plan
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 (RMA)	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
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.
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

> ***"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.".***
>
> (National Planning Policy Framework, paragraph 156)

This Level 2 Strategic Flood Risk Assessment (SFRA) 2021 document provides a Level 2 assessment of strategic sites identified for potential allocation.

1.2 Levels of SFRA

The **Planning Practice Guidance**[1] (PPG) advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- **Level One:** where flooding is not a major issue in relation to potential development sites and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.
- **Level Two:** where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the National Planning Policy Framework's (NPPF) 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 update fulfils the requirements of a **Level 2** SFRA.

1.3 SFRA objectives

The objectives of this 2021 Level 2 SFRA are to:

1. Provide individual flood risk analysis for site options using the latest available flood risk data, thereby assisting the Council in applying the Exception Test to its proposed site options in preparation of its Local Plan.
2. Using available data, provide information and a comprehensive set of maps presenting flood risk from all sources for each site option.
3. Where the Exception Test is required, provide recommendations for making the site safe throughout its lifetime.
4. Take into account most recent policy and legislation in the NPPF, PPG and LLFA SuDS guidance.
5. Update the catchments that are most sensitive to new development in flood risk terms and further review policy and recommendations for these catchments.

1.4 Context of the Level 2 assessment

JBA Consulting were commissioned by Charnwood Borough Council to prepare a Level 2 Strategic Flood Risk Assessment (SFRA), following on from the Level 1 SFRA completed in 2018. The purpose of this study is to provide a comprehensive and robust evidence base to inform the preparation of the Local Plan to 2037.

This 2021 Level 2 SFRA builds on the work undertaken in the Level 1 SFRA and assesses flood risk at potential site allocations. In addition, there have been updates

[1] Planning Practice Guidance – Flood Risk and Coastal Change - Paragraph: 012 Reference ID: 7-012-20140306

to national and local planning policy, flood event data and recommendations for the cumulative impact of development.

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

Information on the study area can be found in the Level 1 SFRA (Section 1.4).

1.5 Consultation

SFRAs should be prepared in consultation with other risk management authorities. The following parties (external to Charnwood Borough Council) have been consulted during the preparation of this Level 2 SFRA:

- Environment Agency
- Leicestershire County Council Environment and Planning (Flooding and Drainage)
- Leicestershire County Council Highways
- Leicestershire Fire and Rescue
- Canal and River Trust
- Severn Trent Water
- Neighbouring authorities including:
    - Hinckley and Bosworth Borough Council
    - Melton Borough Council
    - Blaby District Council
    - Leicester City Council
    - Harborough District Council
    - Rushcliffe Borough Council
    - North West Leicestershire District Council
- Other stakeholders were contacted as part of the Level 1 SFRA (Severn Trent Water, Fire and Rescue, Canal and Rivers Trust)

1.6 How to use this report

The primary purpose of this SFRA data is to provide an evidence base to inform Charnwood Borough Council's Local Plan and any future flood risk policies, as detailed in the objectives listed in Section 1.3. Table 1-1 sets out the structure and content of the SFRA report and associated mapping, alongside how the data can be used, primarily by Charnwood Borough Council or private developers.

Table 1-1 SFRA report guide

Section	Contents	How to use
1. Introduction	Outlines the purpose and objectives of the Level 2 SFRA	For general information and context.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management	Users should use this section to understand and follow the steps required for the Sequential and

	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.	Exception Tests.
4. 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	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
5. Sources of information used in preparing the Level 2 SFRA	Summarises the data used in the Level 2 assessments and GeoPDF mapping	Users should refer to this section in conjunction with the summary tables and GeoPDF mapping to understand the data presented. Developers should refer back to this section when understanding data requirements for a site-specific FRA.
6. Level 2 Assessment Methodology	Summarises the sites taken forward to a Level 2 assessment and the outputs produced for each of these sites.	This section should be used in conjunction with the site summary tables and GeoPDF mapping to understand the data presented.
7. Flood risk management requirements for developers	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Refers back to relevant sections in the L1 SFRA for mitigation guidance.	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed. Developers should also refer to the L1 SFRA for further information on flood mitigation options.
8. Surface water management and SuDS	An overview of any specific local standards and guidance for Sustainable Drainage Systems (SuDS) from the Lead Local Flood Authority. Refers back to relevant sections in the L1 SFRA for information on SuDS and surface water management.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided. Developers should also refer to the L1 SFRA for further information on types of SuDS, the hierarchy and management trains information.
9. Cumulative impact of development and strategic solutions	Identifies the cumulative impact of development in the site catchments and provides recommendations for storage and betterment for all potential development sites in the catchment. Summarises ongoing or pipeline flood risk management schemes.	Planners should use this section to help develop policy recommendations for the sites specified. Developers should use this section to understand the potential storage requirements and betterment opportunities for the sites assessed, as well as any flood alleviation schemes.
10. Summary of Level 2 assessment and recommendations	Summarises the results and conclusions of the Level 2 assessment, and signposts to the L1 SFRA for planning policy recommendations.	Developers and planners should use this section to provide an overview of the Level 2 assessment.

		Planners should use this section to identify which potential site allocations have the least risk of flooding. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendix A: Level 2 assessment - Site summary tables and Interactive mapping	Provides a detailed summary of flood risk for sites requiring a more detailed assessment. The section considers flood risk, emergency planning, climate change, broadscale assessment of possible SuDS, exception test requirements and requirements for site-specific FRAs. Provides interactive PDF mapping for each Level 2 assessed site showing flood risk at and around the site.	Planners should use this section to inform the application of the Sequential and Exception Tests, as relevant. Developers should use these tables to understand flood risk, access and egress requirements, climate change, SuDS and FRA requirements for site-specific assessments. Planners and developers should use these maps in conjunction with the site summary tables to understand the nature and location of flood risk.

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

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

2 The Planning Framework and Flood Risk Policy

This section sets out the Flood Risk Management roles and responsibilities for different organisations and relevant legislation, policy and strategy.

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the Level 2 SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities of stakeholders, given the changes since the previous SFRA publications. In preparing the subsequent sections of this SFRA, appropriate planning and policy amendments have been acknowledged and taken into account.

SFRAs contain information that should be referred to in responding to the Flood Risk Regulations and the formulation of local flood risk management strategies and plans. SFRAs are also linked to the preparation of Catchment Flood Management Plans (CFMPs), Surface Water Management Plans (SWMPs) and Water Cycle Strategies (WCSs).

2.2 Roles and responsibilities for Flood Risk Management in Charnwood

There are several different organisations in and around Charnwood 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. The Leicestershire Local Flood Risk Management Strategy (2015) also sets out RMA roles and responsibilities in detail.

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. More information can be found in the Environment Agency publication **Owning a watercourse** (2018).

When it comes to undertaking works to reduce flood risk, the Environment Agency and Leicestershire County Council as LLFA do have powers, but limited resources must be prioritised and targeted to where they can have the greatest effect.

Table 2-1 Roles and responsibilities for flood risk management within Charnwood

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 • Reservoirs	• Statutory consultee for development in Flood Zones 2 and 3
Leicestershire County Council as Lead Local Flood Authority (LLFA)	• Flood Risk Assessment • Local Flood Risk Management Strategy • Coordinate partnership working between relevant organisations • Represent Leicestershire on the Trent Regional Flood and Coastal	• Surface Water • Groundwater • Ordinary Watercourses (consenting and enforcement) • Ordinary watercourses (works) • Investigate flooding	• Statutory consultee for all major developments

	Committee • Comply with European Flood Directive	incidents • Hold a register of and build new flood alleviation assets • Enforce lad drainage legislation • Designate third party assets acting as flood defences so they cannot be altered or removed	
Charnwood Borough Council	• Local Plans as Local Planning Authorities • Land Drainage	• Determination of Planning Applications as Local Planning Authorities • Managing open spaces under Council ownership • Local land drainage work, such as consenting and enforcement on behalf of the LLFA	• As left
Water Companies: ***Severn Trent Water***	• Asset Management Plans supported by Periodic Reviews (business cases) • Develop Drainage and Wastewater management plans	• Public sewers	• Non-statutory consultee
Highways Authorities: ***Highways England (motorways and trunk roads)*** ***Charnwood Borough Council (other adopted roads)***	• Highway drainage policy and planning	• Highway drainage	• Internal planning consultee regarding highways and design standards and options

2.3 Relevant legislation

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

- **Flood Risk Regulations (2009)** transpose the EU Floods Directive (2000) into UK law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments (PFRAs) 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 a six-year cycle of work and the second cycle started in 2017.
- **Town and County Planning Act (1990)**, **Water Industry Act (1991)**, **Land Drainage Act (1991)**, Environment Act (2005) and **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.

- **Land Drainage Act (1991)** and **Environmental Permitting Regulations (2016)** 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.
- **Water Environment Regulations (2017)** transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produces River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reach '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.
- Leicestershire County Council's **Preliminary Flood Risk Assessment (2011)** and **update in 2017** provide information on significant past and future flood risk from localised flooding in Leicestershire. Multiple areas within Charnwood have been categorised as being above the flood risk threshold, including Loughborough, Birstall and Thurmaston, as well as other areas scattered throughout the borough. The Environment Agency were currently undertaking a PFRA for river, sea and reservoir flooding and identifying nationally significant Flood Risk Areas for these sources.

2.4 Relevant flood risk policy and strategy documents

Table 2-2 summarises some of the relevant national, regional and local flood risk policy and strategy documents and how these apply to development and flood risk. There are hyperlinks to the documents in the table. 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 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 Charnwood.
- 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 Erosion Risk Management Strategy** (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026
	National Planning Policy Framework and Guidance (MCHLG) 2019/2015	No	No	Yes	Updates to PPG
	Building Regulations Part H (MCHLG) 2010	No	No	Yes	-
Regional	Leicestershire County Council's **Local Flood Risk Management Strategy** (EA) 2015	Yes	Yes	No	-
	Humber Flood Risk Management Strategy (Environment Agency) 2008	Yes	Yes	No	2021
	Humber Basin Management Strategy (Environment Agency) 2016	No	Yes	No	2021
	Climate Change guidance for development and flood risk (Environment Agency) 2019	No	No	Yes	2020 for fluvial and rainfall allowances
Local	**Leicester SuDS Guidance** (Leicestershire County Council) 2015 **Leicestershire Surface Water Guidance Notes** (LCC) 2015	Yes	No	Yes	-
	Loughborough Surface Water Management Plan (LCC) 2013	Yes	Yes	Yes	-

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
	Leicester Surface Water Management Plan (LCC) 2012	Yes	Yes	Yes	-
	Leicester Supplementary Planning Document (LCC) 2011				
	Leicestershire Local Flood Risk Management Strategy (2015)	Yes	Yes	No	2021
	Drainage and Wastewater Management Plan (Severn Trent Water) due 2023	Yes	Yes	No	-
	Flood Investigations (LCC) 2014-2020	Yes	No	No	-
	Leicester City and Leicestershire Strategic Water Cycle Study (LCC) 2017	Yes	No	No	-

2.5 Relevant flood risk management studies and documents

2.5.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The **National Flood and Coastal Erosion Risk Management Strategy** (FCERM) for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The new Strategy has been in preparation since 2018. The Environment Agency brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy is much more ambitious than the previous one from 2011 and looks ahead to 2100 and the action needed to address the challenge of climate change.

The Strategy has been split into 3 high level ambitions: climate resilient places, today's growth and infrastructure resilient in tomorrow's climate and a nation ready to respond and adapt to flooding and coastal change. Measures include updating the national river, coastal and surface water flood risk mapping and the understanding of long term investment needs for flood and coastal infrastructure, trialling new and innovative funding models, flood resilience pilot studies, developing an adaptive approach to the impacts of climate change, seeking nature based solutions towards flooding and erosion issues, integrating natural flood management into the new Environmental Land Management scheme, considering long term adaptive approaches in Local Plans, maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals, investing in flood risk infrastructure that supports sustainable growth, aligning long term strategic planning cycles for flood and coastal work between stakeholders, mainstreaming property flood resilience measures and 'building back better' after flooding, consistent approaches to asset management and record keeping, updating guidance on managing high risk reservoirs in light of climate change, critical infrastructure resilience, education, skills and capacity building, research, innovation and sharing of best practise, supporting communities to plan for flood events, develop world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences, development of digital tools to communicate flood risk and transforming the flood warning service and increasing flood response and recovery support.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a New **National Policy Statement for Flood and Coastal Erosion Risk Management.** The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. Upgrading and expanding flood defences and infrastructure across the country,
2. Managing the flow of water to both reduce flood risk and manage drought,
3. Harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. Better preparing communities for when flooding and erosion does occur, and
5. Ensuring every area of England has a comprehensive local plan for dealing with flooding and coastal erosion.

2.5.2 Leicestershire County Council Local Flood Risk Management Strategy (LFRMS) 2015

Leicestershire County Council, as the LLFA, is responsible for developing, maintaining, applying and monitoring a **LFRMS**. The most recent Strategy was published in August 2015 and is used as a means by which the LLFA co-ordinates Flood Risk Management on a day-to-day basis. The seven high-level objectives proposed in the Strategy for managing flood risk include:

- **Work Collaboratively** – Adopt a collaborative approach to managing local flood risk by working with local partners and stakeholders to identify, secure and optimise resources, expertise and opportunities for reducing flood risk and increasing resilience to flooding.
- **Improve Understanding and Awareness** – Develop a greater understanding of local flood risk by improving the scope of local knowledge and understanding of current and future local flood risks.
- **Enhance the Natural and Historic Environment** – Adopt a sustainable approach to reducing local flood risk, seeking to lessen the risk of localised flooding using mechanisms that are economically viable, deliver wider environmental benefits and promote the wellbeing of local people.
- **Improve Resilience** – Reduce the harmful consequences of local flooding to communities and human health through proactive actions, activities and education programmes that enhance preparedness and resilience to local flood risk and contribute to minimising community disruption.
- **Encourage Sustainable Development** – Aim to mitigate and manage flood risk relating to development by producing guidance, setting standards, promoting the sustainable use of water and supporting the development of local policies and guidance.
- **Use Resources Effectively** – ensure the financial viability of flood related schemes through the development of appropriate policies and assessment tools to ensure that flood risk management measures provide value for money whilst minimising the long-term revenue costs. Seeking to use natural processes where possible or source the costs of any maintenance from the financial beneficiaries of the development.
- **Promote Riparian Responsibilities** – Encourage flood management activities by working with riparian owners of ordinary watercourses.

The Action Plan referred to in section 8 of the Strategy sets out how the objectives will be delivered and by whom. The actions are monitored by a Strategic Flood Risk Management Board.

2.5.3 LLFAs, surface water and SuDS

The 2019 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165). When considering planning applications, local planning authorities should consult the LLFA on the management of surface water in order to satisfy that:

- The proposed minimum standards of operation are appropriate
- Through the use of planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime

Leicestershire County Council's requirements for new developments on SuDS are set out on their **website**, alongside supporting documents. At the time of writing this SFRA, documents for developers and policies relevant to SuDS and surface water are:

- **Surface water drainage for developments**
- **Interim LLFA Guidance Note: Planning and Development in Leicestershire**
- **Planning Applications: LLFA Statutory Consultation Checklist**

- Local Flood Risk Management Strategy, Objective 5: Encourage Sustainable Development
- Charnwood Borough Council Local Plan: Adopted Core Strategy. Policy CS16: Sustainable Construction and Energy

The 2019 NPPF states that flood risk should be managed "using opportunities provided by new development to reduce causes and impacts of flooding." As such, Leicestershire County Council expects SuDS to be incorporated on minor development as well as major development.

2.5.4 Surface water management plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in an area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

Leicestershire County Council has published Loughborough and Leicester City specific SWMPs, links to which can be found in Table 2-2. A **SWMP for Loughborough** was produced by Leicestershire County Council and published in October 2013. This highlighted high risk areas, options for mitigation, sources of risk, produced surface water maps and aids in the development of a strategic overview. The SWMP identifies four Critical Drainage Areas (CDAs) which are defined as "discrete geographic areas (usually within an urban setting) where there may be multiple and interlinked sources of flood risk and where severe weather is known to cause flooding of these areas thereby affecting people, property or local infrastructure." Flood Risk Assessments are required for all proposed developments, regardless of their size that fall within a CDA. The four CDAs in Loughborough are:

- Willow Brook
- Grammar School Brook
- Wood Brook
- Burleigh Brook

2.5.5 Updated Strategic Flood Risk Assessment guidance

There was an update to the **'How to prepare a Strategic Flood Risk Assessment guidance'** in August 2019, which had some key additions to both Level 1 and Level 2 assessments. The Level 2 assessment is undertaken in accordance with this guidance.

2.5.6 Water Cycle Studies

Water Cycle Studies assist local authorities to select and develop growth proposals that minimise impacts on the environment, water quality, water resources, infrastructure and flood risk and help to identify ways of mitigating such impacts.

The **Leicester City and Leicestershire Strategic Water Cycle Study (2017)** is inclusive of Charnwood. The report highlighted the following that are relevant to Charnwood Borough Council:

- Water resources: Charnwood is within the Soar CAMS area and is classified as "moderate water stress" and "water is available for licencing during the high flows and restricted flow is available during low flows". Charnwood is included in the Severn Trent Water Limited (STWL) Strategic Grid Water Resource Zone.

It is noted that the Strategic Grid is likely to require significant investment to cope with rapid growth. Despite this growth the water company indicates that the water supply is not expected to constrain development.

- Wastewater and Sewerage: The following are Sewage Treatment Works (STW) within Charnwood which are predicted to receive additional wastewater flows 10% or higher of their existing Maximum DWF Permit (2011-2013). These are likely to require extensive updates to existing infrastructure or the construction of new wastewater treatment facilities.
    - Shepshed STW
    - Loughborough STW
- Water Quality: With the predicted growth in the borough, water quality can become an issue. Where it is predicted to be an issue, discharge to the watercourses should be limited to achieve no deterioration of water quality as well as to demonstrate if growth will make it more difficult to achieve the requirements of the Water Framework Directive. It is likely that significant investment will be required in treatment to reduce the pollutant load discharged into the water environment.

Leicester City Council have commissioned an updated Water Cycle Study.

3 Planning policy for flood risk management

This section summarises 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 February 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.

Important note on Flood Zone information in this SFRA

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses (only catchments >3km^2). As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, it may be that there is actually a degree of flood risk from smaller watercourses not shown in the Flood Zones.
Flood Zones 2, 3a and 3b are identified as land which would flood with an annual probability of 1 in 1,000 years, 1 in 100 years and 1 in 20 years respectively. Flood Zones 2 and 3a have been taken from the Environment Agency's 2020 Flood Map for Planning, which incorporates existing modelled watercourses, except for the latest Environment Agency Wood Brook model (2021), which was in progress at the time of the SFRA. Due to the significant difference between the EA's current Flood Map for Planning in this area (which is formed from the River Soar modelling) and new Wood Brook model results, the new model results have been used to derive the Flood Zones for the purpose of the L2 SFRA at the four Loughborough sites. The draft defended and undefended 100-year extents have been merged to form a composite Flood Zone 3a extent, and the defended and undefended 1,000-year flood extents have been merged with the Historic Flood Map to form a composite Flood Zone 2 extent. It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.

For Flood Zone 3b, this has been derived from the defended 20-year modelled extents, where detailed modelling exists, for example the Upper Lower Soar, River Wreake, Loughborough Tributaries, Black Brook and new Wood Brook models. In the absence of detailed models, Flood Zone 3a has been used as an 'Indicative Flood Zone 3b'.
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.

3.3 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** (Flood risk and coastal change) 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

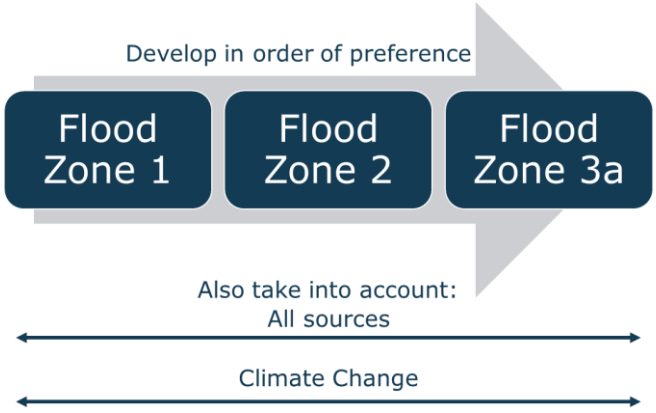
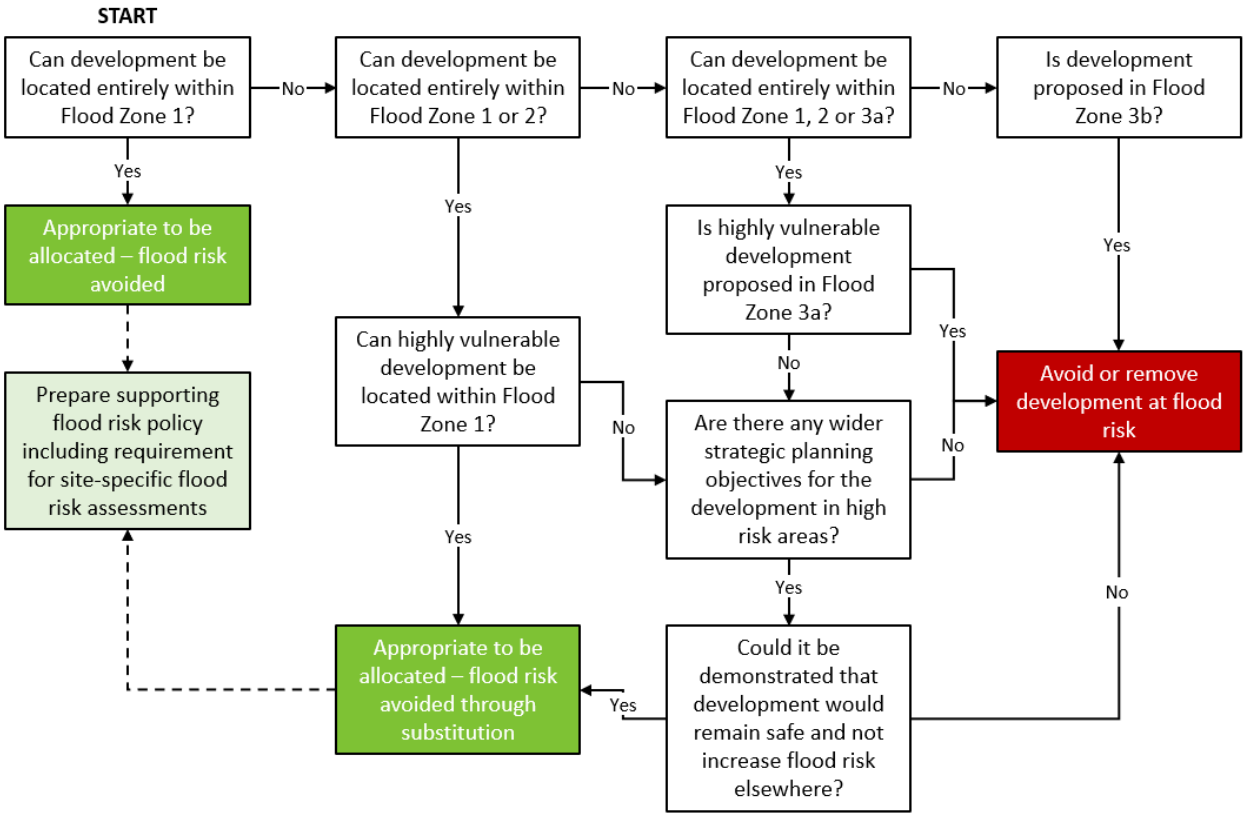


Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

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



3.3.1 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.

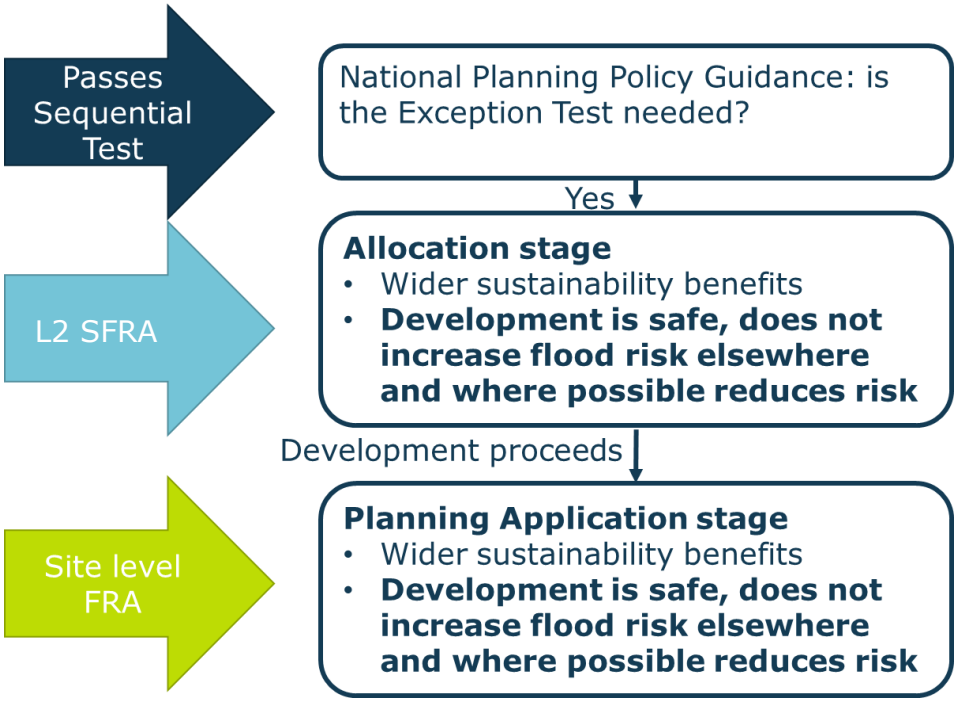
The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances:

- 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. For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the Developer must design the site such that is appropriate flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan, developers must undertake the Exception Test and present this information to the Local Planning Authority for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should look into in more detail to inform the Exception Test for windfall sites.

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.

At the stage of allocating development sites, Local Planning Authorities should consider wider sustainability objectives, such as those set out 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.

The Local Planning Authority should consider the sustainability issues the development will address and how doing so 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.

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.

3.3.2 Making a site safe from flood risk over its lifetime

Local Planning Authorities will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial 1% chance flood in any year event is a key event to consider because the National Planning Policy Guidance refers to this as the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
- The effects of an extreme 0.1% chance flood in any year event. Where there are defences this could cause them to overtop, which may lead to failure if this causes them to erode, and/ or
- Structural failure of any flood defences, such as breaches in embankments or walls.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

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

3.4.1 Sequential Test

Charnwood Borough Council, with advice from the Environment Agency, is 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 risk.

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

3.4.2 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.

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 so 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

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 taken into account.

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

In 2018, Leicestershire County Council published its **Environment Strategy** for 2018-2030, which sets out a series of aims and objectives for six key environmental areas including Carbon and Climate Change Impacts. To support government targets, the Strategy states that Leicestershire County Council aim to reduce greenhouse gas emission by 30% from Council operations by 2025, and 38% by 2030. Charnwood Borough Council's **Climate Change Strategy 2018-2022** sets out the Council's commitment to local action on climate change by raising awareness, reducing impact on climate change and resilience.

4.1 Revised climate change guidance

The Environment Agency published **updated climate change guidance** in 2019 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. Whilst the guidance was updated in 2019, fluvial allowances are still to be updated from those in the original 2016 guidance.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency are currently using these to further update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances. 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 likely to be due in mid-2021.

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 – Charnwood 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 'built in' resilience measures used, for example, raised floor levels
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

4.3 Relevant allowances for Charnwood

Table 4-1 shows the peak river flow allowances that apply to Charnwood for fluvial flood risk, and Table 4-2 shows the peak rainfall intensity allowances that apply in Charnwood when considering surface water flood risk. For large catchments (more than 5km^2) and

rural catchments, the allowances in Table 4-1 are used for peak rainfall intensity. Both the central and upper end allowances should be considered to understand the range of impact.

Table 4-1 Peak river flow allowances: Humber River Basin

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Humber	Upper end	20%	30%	50%
	Higher central	15%	20%	30%
	Central	10%	15%	20%

Table 4-2 Peak rainfall intensity allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

4.3.1 High ++ allowances

High (H)++ allowances only apply in assessments for developments that are very sensitive to flood risk and that have lifetimes beyond the end of the century. Further information is provided in the Environment Agency publication, **Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities.**

H++ equates to the 100-year +65% in the Humber basin for the 2080s epoch. This has been run for the Wreake, Upper Lower Soar and the Loughborough Tributaries models, as these cover settlements where urban extensions are proposed. This involved scaling the 100-year flows up by +65%. Comments were added to relevant site summary tables where this was undertaken, though in general, flood extents would be similar to those of Flood Zone 2.

4.4 Representing climate change in the Level 2 SFRA

For this Level 2 SFRA, the following hydraulic model outputs were provided by the Environment Agency: 2018 Black Brook, 2015 Lower Wreake and tributaries, 2012 Upper Lower Soar and tributaries, 2016-17 Loughborough Tributaries and the latest 2021 Wood Brook (the latter was not publicly available at the time of the study, but initial outputs were received from the EA in January 2021 for inclusion into the SFRA).

These hydraulic models were run (where results were not already provided) for latest climate change allowances, whereby the 100-year event was upscaled by the three climate change allowances for the '2080s' timeframe in the Humber River Basin District, i.e. the 100-year plus 20%, 30% and 50% defended scenarios.

For any sites not covered by the EA's detailed modelling, Flood Zone 2 was used as an indicative climate change extent. This is appropriate given the 100-year +50% flows are often similar to the Flood Zone 2 extents. The 1,000-year surface water extent was also used as an indication of surface water risk, and risk to smaller watercourses, which are too small to be covered by the EA's Flood Zones.

The H++ allowance (100-year +65%) was run on the relevant models where large urban extension sites are proposed (River Wreake, Loughborough Tributaries and Upper Lower Soar). This has also been mapped and commented on in relevant site tables in Appendix A.

The potential impacts from Flood Zone 3b + climate change were also considered, by comparing the 20-year modelled output with a representative return period, e.g. 50-year, or 75-year extent, and comments were added to the site summary tables where this was considered.

Developers may need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic survey. The Environment Agency should be consulted to provide further advice for developers on how best to apply the new climate change guidance.

Climate change mapping has been provided in Appendix A: GeoPDFs. In summary, the climate change outputs on the GeoPDF maps for the SFRA may be from:

- 'Indicative Climate Change (FZ2)': Flood Zone 2, which is used outside of the areas covered by specific flood models and should be considered to be indicative.
- 'Climate Change Central, Higher Central and Upper End': Where detailed hydraulic models exist and were run for the EA allowances.

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. It is recommended that the impact of climate change on a proposed site is considered as part of a detailed Flood Risk Assessment, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. The Environment Agency should be consulted to provide further advice for developers on how best to apply the new climate change guidance.

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.
- Refer to Chapter 7 which provides further details on climate change for developers, as part of the FRA guidance.

4.5 Impact of climate change on the functional floodplain

The potential impacts from Flood Zone 3b (20-year modelled extent) plus climate change were also considered. No additional hydraulic modelling was undertaken, but the modelled 20-year output, where available, was compared against a return period similar to that expected if the 20-year flow was to be uplifted by say 30% or 50% as per the EA's guidance. This equated to approximately a 50-year or 75-year flood event. Elsewhere, it could be assumed that FZ3a could be considered an indicative extent for FZ3b with climate change.

Where model results were available, a comment was added to the site summary tables in Appendix A.

4.6 Impact of climate change on groundwater flood risk

The effect of climate change on groundwater flooding, and those watercourses where groundwater has a large influence on winter flood flows, is more uncertain. There is no technical modelling data available to assess climate change impacts on groundwater. It would depend on the flooding mechanism, historic evidence of known flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

4.7 Impact of climate change on sewers

Surface water and fluvial flooding with climate change have the potential to impact on the sewerage system, so careful management of these is needed for development. Due

to differing ages of settlements, there will be drainage systems consisting of different types of sewers. Increasing pressures from climate change, urban creep and infill development could impact on the performance of the sewerage system.

Severn Trent Water advise that surface water is to be kept separate from foul sewerage wherever possible, as this will result in a more resilient sewerage system.

4.8 Adapting to climate change

The **NPPG Climate Change guidance** contains 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.
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. The Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option.

It is recommended that the differences in flood extents from climate change are compared by the Council when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall.

5 Sources of information used in preparing the Level 2 SFRA

This chapter outlines the datasets used in assessing the sites in the Level 2 SFRA.

5.1 Data used to inform the SFRA

Table 5-1 provides an overview of the supplied data, used to inform the appraisal of flood risk for Charnwood.

Table 5-1 Overview of supplied data for Charnwood Level 2 SFRA

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map and Recorded Outlines Hydraulic Modelling Reports, where provided	Environment Agency
	2018 L1 SFRA	Charnwood Borough Council
	Historic flood incidents/records, including from February 2020 floods	Charnwood Borough Council
	Flood Risk Register – observed and verified reports of rainfall induce sewer flooding	Severn Trent Water
	2018-2020 internal flooding data across Charnwood	Leicestershire County Council
Fluvial (including climate change)	Black Brook (2018) Lower Soar and tributaries (2012) Lower Wreake and tributaries (2015) Loughborough Tributaries Scheme (2016-17) Wood Brook (2021)	Environment Agency
	Flood Zones	
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits dataset	Environment Agency
Sewer	Flood Risk Register Historic flooding records	Severn Trent Water

Reservoir	National Inundation Reservoir Mapping	Environment Agency
Canal	Description of flood incidences	Canal and Rivers Trust

5.2 Latest Wood Brook modelling

The Environment Agency have been updating the fluvial Wood Brook hydraulic model in 2020-2021; this was being undertaken at the same time as the SFRA and therefore the model had not been formally approved and further work is required by the Environment Agency prior to the model outputs being published. However, following discussions between the Council, JBA, the EA and LLFA, approved draft outputs have been supplied for use in the SFRA, given the importance of site flood risk assessments in Loughborough.

The hydrology, modelling and outputs are focussed on the tributaries (Wood Brook, Burleigh Brook) rather than the River Soar, though the interactions between the tributaries, the Grand Union Canal and the Soar have been better represented in the model, where the Soar can enter the canal and interact with the tributaries and cause a double peak. When comparing the flood extents against the 2016 Loughborough Tributaries modelling, the flood extents are fairly similar, with the main difference shown around the north bank of the canal. Model outputs also tie in well with past observed flood events.

The intention is to use this model in future for flood alleviation scheme appraisals, for example on the Burleigh Brook and Wood Brook.

It is advised that developers contact the EA for latest updates on the Wood Brook modelling for site-specific assessments, and that results in this SFRA are treated with caution given the study is not finalised.

5.3 Flood Zones 2 and 3a

Flood Zones 2 and 3a have been taken from the 2020 EA Flood Map for Planning datasets, which incorporates model data. Where there are no detailed models, the Flood Zones are represented by older 2D generalised model outputs (EA's Flood Map for Planning).

The EA Flood Map for Planning does not currently represent the latest Environment Agency's 2021 Wood Brook modelling, which was in progress at the time of the SFRA, and hence the current EA Flood Zones 3a and 2 largely overestimate flood risk along this watercourse, with them being based on the Lower Soar modelling. Due to the significant difference between the EA's current Flood Map for Planning in this area and new Wood Brook model results, the new model results have been used to derive the Flood Zones for the purpose of the L2 SFRA at the four Loughborough sites. The draft defended and undefended 100-year extents have been merged to form a composite Flood Zone 3a extent, and the defended and undefended 1,000-year flood extents have been merged with the Historic Flood Map to form a composite Flood Zone 2 extent. It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.

5.3.1 Flood Zone 3b

Flood Zone 3b has been identified as land which would flood with an annual probability of 1 in 20 years (5% AEP). It has been derived from the 20-year defended modelled flood extent (or 25-year in the absence of 20-year), where detailed Environment Agency hydraulic models exist, and where no detailed models exist, Flood Zone 3a should be used as an indication of Flood Zone 3b.

Note on the Environment Agency Flood Map for Planning

Where flood outlines are not informed by detailed hydraulic modelling, the Flood Map for Planning is based on generalised modelling to provide an indication of flood risk. Whilst the generalised modelling is generally accurate on a large scale, they are not provided for specific sites or for land where the catchment of the watercourse falls below 3km^2.

For watercourses with smaller catchments, the Risk of Flooding from Surface Water map provides an indication of the floodplain of small watercourses and ditches. It is more accurate in upper to mid river valley locations than lower valley locations near the coast. This is because it does not represent the floodplain for small watercourses as well in largely flat areas.

Even where more detailed models of Main Rivers have been used by the Environment Agency to inform the Flood Map for Planning, they will be largely based on remotely detected ground model data and not topographic survey. In this area, the Flood Map for Planning does not include all modelled outputs, hence the SFRA deriving its own Flood Zones based on latest available data.

For this reason, the Flood Map for Planning is not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to the site. Accordingly, for site-specific assessments it will be necessary to perform more detailed studies in circumstances where flood risk is an issue.

5.4 Climate change

For this Level 2 SFRA, the following hydraulic model outputs were provided by the Environment Agency: 2018 Black Brook, 2015 Lower Wreake and tributaries, 2012 Upper Lower Soar and tributaries, 2016-17 Loughborough Tributaries and the latest 2021 Wood Brook (the latter was not publicly available at the time of the study, but draft outputs were received from the EA in January 2021 for inclusion into the SFRA).

These hydraulic models were run (where results were not already provided) for latest climate change allowances, whereby the 100-year event was upscaled by the three climate change allowances for the '2080s' timeframe in the Humber River Basin District, i.e. the 100-year plus 20%, 30% and 50% defended scenarios.

For any sites not covered by the EA's detailed modelling, Flood Zone 2 was used as an indicative climate change extent. This is appropriate given the 100-year +50% flows are often similar to the Flood Zone 2 extents.

The 1,000-year surface water extent was also used as an indication of surface water risk, and risk to smaller watercourses, which are too small to be covered by the EA's Flood Zones.

The H++ allowance (100-year +65%) was run on the relevant models where large urban extension sites are proposed (River Wreake, Loughborough Tributaries and Upper Lower Soar). This has also been mapped and commented on in relevant site tables in Appendix A.

Developers may need to undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the **climate change guidance** set out by the Environment Agency. They should also contact the Environment Agency to determine the latest models publicly available.

5.5 Surface Water

Mapping of surface water flood risk in Charnwood has been taken from the Environment Agency's Risk of Flooding from Surface Water (RoFfSW) mapping, which is a slightly more detailed resolution than that published online by the Environment Agency. Surface water flood risk is subdivided into the following four categories:

- **High**: An area has a chance of flooding greater than 1 in 30 (3.3%) each year.
- **Medium**: An area has a chance of flooding between 1 in 100 (0.1%) and 1in 30 (3.3%) each year.
- **Low**: An area has a chance of flooding between 1 in 1,000 (0.1%) and 1in 100 (1%) each year.
- **Very Low**: An area has a chance of flooding of less than 1 in 1,000 (0.1%) each year.

The results should be used for high-level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be required to more accurately illustrate the flood risk at a site-specific scale. Such an assessment should use the RoFSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

Detailed modelling based on site survey will be necessary where there is a significant risk of surface water flooding.

Further details on surface water flooding are discussed in the L1 SFRA (7.4).

5.6 Groundwater

In comparison to fluvial flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Groundwater level monitoring records are available for areas on Major Aquifers; however, for lower lying valley areas, which can be susceptible to groundwater flooding caused by a high-water table in mudstones, clays and superficial alluvial deposits, very few records are available. Additionally, there is increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding (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. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually 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 where finer resolution datasets exist.

Groundwater susceptibility mapping of Charnwood has been provided in Appendix A. The majority of the borough is shown to be within the <25% susceptible classification, at a lower probability of groundwater flooding. Areas with higher susceptibilities and more likely to flood from groundwater are found along the River Soar and River Wreake.

The geology of the borough is largely of low permeability, therefore there will be higher percentages of runoff and groundwater flood risk issues are less likely.

5.7 River networks

Main Rivers are represented by the Environment Agency's Statutory Main River layer. Ordinary Watercourses are represented by the Environment Agency's Detailed River Network Layer. Caution should be taken when using these layers to identify culverted watercourses which may appear as straight lines but in reality, are not.

Developers should be aware of the need to identify the route of and flood risk associated with culverts. CCTV condition survey will be required to establish the current condition of the culvert and hydraulic assessments will be necessary to establish culvert capacity of both culverts on site and those immediately offsite that could pose a risk to the site. The risk of flooding should be established using site survey, including the residual risk of culvert blockage.

5.8 Flood warning

Flood Warning Areas are represented by the Environment Agency's Flood Warning Area GIS dataset.

5.9 Reservoirs

The risk of inundation as a result of reservoir breach or failure of a number of reservoirs within the area has been identified from the Environment Agency's **Long Term Flood Risk Information website.** Section 7.8 in the L1 SFRA details reservoir flooding risks.

5.10 Sewer flooding

Historical incidents of flooding are detailed by Severn Trent Water through their sewer flooding register. The sewer flooding register records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. Due to licencing and confidentiality restrictions, sewer flooding data has not been represented on the mapping. There is further detail on sewer flooding in Charnwood in the L1 SFRA (Section 7.6).

5.11 Historic flooding

Historic flooding was assessed using the Environment Agency's Historic Flood Map, as well as any incidents picked up in the historic flooding register provided by Leicestershire County Council as LLFA.

Chapter 7 in the Level 1 SFRA details documents historic flood records in Charnwood. Between 2018-2020, there have been 87 LLFA reports of internal flooding to properties, as documented in the table below.

Loughborough is also one of the 40 highlighted priority settlements for the purpose of the Local Flood Risk Management Strategy, coming in the top 5 settlements at risk from surface water, with most properties at risk.

Table 5-2: Internal flood to properties incidents 2018-2020

Settlement	Number or internal flooding records
Loughborough	32
Sileby	5
Mountsorrel	17
Anstey	1
Barrow upon Soar	1
Swithland	5

Hathern	1
Cossington	4
Newtown Linford	5
Woodhouse	5
Rothley	8
Syston	1
Wymeswold	1
Shepshed	1

5.12 Canal flooding

The residual risk from canals tends to be associated with lower probability events such as overtopping and embankment failure (breach and sudden escape of the water retained in the canal channel). Section 7.7 in the L1 SFRA details the presence of the Grand Union Canal in Charnwood and risks relating to it.

5.13 Flood defences

Flood defences are represented by Environment Agency's Asset Information Management System (AIMS) Spatial Defences data set. Their current condition and standard of protection are based on those recorded in the tabulated shapefile data. Chapter 8 of the Level 1 SFRA details all the formal flood defences in Charnwood. The Council's asset register was also obtained in the Level 1 SFRA.

5.14 Residual risk

The residual flood risk to sites is identified as where potential blockages or overtopping/ breach of defences could result in the inundation of a site, with the sudden release of water with little warning.

Potential culvert blockages that may affect a site were identified on OS Mapping and the Environment Agency's Detailed River Network Layer to determine where watercourses flow into culverts or through structures (i.e. bridges) in the vicinity of the sites. Any potential locations were flagged in the site summary tables. These will need to be considered by the developer as part of a site-specific Flood Risk Assessment.

Residual risk from breaches to flood defences, whilst rare, needs to be considered in Flood Risk Assessments. Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. Work is currently being undertaken by the Environment Agency to collate and standardise these methodologies. It is recommended that the Environment Agency are consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the approach for the breach assessment.

5.15 Depth, velocity and hazard to people

The Level 2 assessment seeks to map the probable depth and velocity of flooding as well as the hazard to people during the defended fluvial 100-year event. The 100-year flood event has been investigated in further detail because the Level 2 assessment helps inform the Exception Test and usually flood mitigation measures and access/ egress requirements focus on flood events lower than the 1,000-year event (e.g. the 100-year plus climate change event).

Where detailed model outputs were available, the 100-year depth, velocity and hazard data has been used (e.g. Wreake, Upper Lower Soar, Wood Brook). For some models, only the depth results were available (Loughborough Tributaries). In the absence of

detailed hydraulic models, the Risk of Flooding from Rivers and Sea dataset has been used, as well as the Risk of Flooding from Surface Water datasets. The depth, hazard and velocity of the 100-year surface water flood event has also been considered in this assessment. Hazard to people has been calculated using the below formula as suggested in Defra's FD2321/TR2 "Flood Risk to People". The different hazard categories are shown in Table 5-3. Developers should also test the impact of climate change depths, velocities and hazard on the site, at Flood Risk Assessment stage.

Table 5-3 Defra's FD2321/TR2 "Flood Risks to People" classifications

Description of Flood Hazard Rating	Flood Hazard Rating	Classification Explanation
Very Low Hazard	< 0.75	Flood zone with shallow flowing water or deep standing water"
Danger for some (i.e. children)	0.75 - 1.25	"Danger: flood zone with deep or fast flowing water"
Danger for most	1.25 - 2.00	Danger: flood zone with deep fast flowing water"
Danger for all	>2.00	"Extreme danger: flood zone with deep fast flowing water"

As part of a site-specific FRA, developers will need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood depth, velocity and hazard based on the relevant 100-year plus climate change event, using the relevant climate change allowance based on the type of development and its associated vulnerability classification. Not all of this information is known at the strategic scale.

5.16 Note on SuDS suitability

The hydraulic and geological characteristics of each site were assessed to determine the constraining factors for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The assessment is based on catchment characteristics and additional datasets such as the AStGWF map and Mapping and British Geological Survey (BGS) Soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site-by-site basis. LIDAR data was used as a basis for determining the topography and average slope across each development site. Other datasets were used to determine other factors. These datasets include:

- Historic landfill sites
- Groundwater Source Protection Zones
- Detailed River Network
- Flood Zones derived as part of this Level 2 SFRA

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Figure 5-3. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 5-4: Summary of SuDS categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under-drained Swale, Wet Swale

The suitability of each SuDS type for the site options has been described in the summary tables, where applicable. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. Leicestershire County Council as LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors. SuDS in Charnwood must be designed so that they are in accordance with the Leicestershire **SuDS Guidance** and the **Supplementary Planning Document**.

6 Level 2 assessment methodology

This chapter outlines how sites were screened against flood risk datasets to determine which sites needed a Level 2 assessment. It also identifies other sites at lower risk with general recommendations for developers.

6.1 Site screening

Charnwood Borough Council provided 90 sites for assessment. These were chosen through a combination of a site's potential for allocation and its flood risk as determined through the site assessment process. These sites were screened against a suite of available flood risk information and spatial data to provide a summary of risk to each site. Sites were screened to provide a summary of flood risk to each site, including:

- The proportion of the site in each Flood Zone
- Whether the site is shown to be at risk from surface water flooding in the RoFfSW and, if so, the lowest return period from which the site is at surface water flood risk
- Whether the site is within, or partially within, the Environment Agency's Historic Flood Map.

The screening was undertaken using JBA in-house software called "FRISM". FRISM is an internal JBA GIS package that computes a range of flood risk metrics based on flood and receptor datasets.

The results of the screening provide a quick and efficient way of identifying sites that are likely to require a Level 2 Assessment, assisting Charnwood Borough Council with Sequential Test decision-making so that flood risk is taken into account when considering allocation options.

The screening also provides an opportunity to identify sites which have an ordinary watercourse flowing through or adjacent to them but for which no Flood Zone information is currently available. *Note: although there are no Flood Zone maps available for these watercourses, it does not mean the watercourse does not pose a risk, it just means no modelling has yet been undertaken to identify the risk.*

The EA's Flood Zones are not provided for specific sites or land where the catchment of the watercourse falls below 3km^2. For this reason, the Flood Zones are not of a resolution to be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to the site. The Risk of Flooding from Surface Water has been used in these cases because this provides a reasonable representation of the floodplain of such watercourses to use for a strategic assessment.

6.2 Sites taken forward to a Level 2 assessment

Out of the 90 sites provided, 23 sites were carried forward to a Level 2 assessment.

A Red-Amber-Green system was applied to the sites on the basis, that: red sites needed a Level 2, amber sites did not need a Level 2 due to less significant flood risk but were still to be flagged in this report (recommendations provided in Chapter 10), and green sites that had no/ negligible risk.

Sites were taken forward if they were shown to be at fluvial flood risk or if surface water risk was deemed significant. In order to assess whether a site was deemed to have significant surface water risk, professional judgment was used based on the extent and location of the surface water issues relative to the site and access and egress. For example, if there was an area of deep ponding, a prominent flow route bisecting a site,

immediate constraints to site access at the boundary, potential for highly vulnerable types of development to occupy a site etc.

For other sites with less significant but still noteworthy surface water issues, these have been highlighted in Table 6-2 and the LLFA expect the developer to take these into account at an early stage when planning the form and layout of the site, the surface water drainage system and any surface water mitigation measures that may be necessary.

Table 6-1 summarises the sites which have been taken forward to the Level 2 assessment on this basis.

Table 6-1: Sites carried forward to a Level 2 assessment

SHLAA Reference	Site name	Reason for Level 2*	Updated Flood Zones %**				Risk of flooding from surface water %		
			FZ3b	FZ3a	FZ2	FZ1	30yr	100yr	1,000 yr
PSH69	Land south east of Syston	Fluvial, OW and SW	<1%	<1%	40%	60%	7%	8%	100%
PSH21	Extend Park Grange Farm, Loughborough	SW	<1%	<1%	100%	0%	4%	8%	20%
SH48	Former Limehurst Depot	Fluvial	3%	3%	28%	0%	4%	22%	77%
PSH260	Land to rear of Derry's Garden Centre, Cossington	SW	15%	15%	16%	84%	3%	6%	6%
PSH24	Land off Fairway Road	SW and OW	0%	0%	0%	100%	4%	7%	17%
PSH120	Land east of Leicester Road, Thurcaston	Fluvial and SW	15%	15%	17%	83%	6%	11%	25%
PSH493	Ratcliffe Road, Sileby	Fluvial and SW	3%	3%	4%	96%	3%	5%	19%
PSH62	Land at Tickow Lane, Shepshed	SW and OW	0%	0%	0%	100%	2%	4%	8%
PSH484	Land off Cotes Road, Barrow	SW	1%	1%	1%	99%	3%	6%	9%
PSH287	Queniborough Lodge	Fluvial and SW	0%	1%	19%	81%	<1%	2%	9%
PSH14	Land at Gynsill Land and Anstey Lane	SW	0%	0%	0%	100%	3%	5%	13%
PSH405	Land west of the B591/ Ingleberry Road and north	SW	0%	0%	0%	100%	1%	3%	24%

	of Iveshead Lane								
PSH343	Lougborough Road	Fluvial and SW	33%	33%	47%	53%	<1%	1%	21%
PSH296	East Road/ Narrow Lane Wymeswold	Fluvial and OW	0%	0%	0%	100%	7%	15%	29%
PSH487	Devonshire Square	Fluvial	<1%	<1%	77%	0%	<1%	1%	31%
PSH488	Market Street	Fluvial	0%	18%	82%	0%	7%	8%	100%
PSH245	Carillon Court Shopping Centre Derby Square	Fluvial and SW	0%	59%	100%	0%	54%	91%	100%
PSH476	Woodgate Nurseries, Barkby Lane	SW & OW	0%	0%	23%	77%	0%	1%	7%
PSH483	Land south of Ashby Road Central	SW and access	0%	0%	0%	100%	6%	7%	14%
PSH441	Land north of Barkby Road	SW	0%	0%	0%	100%	13%	19%	31%
PSH353	Land rear of The Maltings site High Street	SW	2%	2%	1%	99%	1%	2%	6%
SH141	Brook Street	Fluvial	0%	1%	19%	81%	0%	0%	<1%
PSH352	21 Garendon Road, LE12 9NU	SW	0%	0%	0%	100%	2%	4%	32%

**OW = Ordinary Watercourse, SW = Surface Water*

***Flood Zones updated using latest modelling data; hence these may differ from the EA's Flood Map for Planning Flood Zones.*

'Unmodelled' fluvial risk relates to there being the presence of watercourses on OS mapping, but the catchments are smaller than those represented in the EA's Flood Zones.

The Flood Zone values quoted show the percentage of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone. For example: If 50% of a site is in the Flood Zones, taking each Flood Zone individually, 50% would be in Flood Zone 2 but say only 30% might be in Flood Zone 3a and only 10% in Flood Zone 3b. This would be displayed as stated above, i.e. the total % of that particular Flood Zone in that site. Flood Zone 1 is the remaining area of the site outside of Flood Zone 2, so Flood Zone 2 + Flood Zone 1 will equal 100%.

6.3 Recommendations for sites not taken forward to a Level 2 assessment

The 'amber' sites identified as having some lower-level flood risk, but not requiring a Level 2 assessment, are shown in Table 6-2 below.

Table 6-2: Sites flagged at lower flood risk

SHLAA Reference	Site name	Nature of low flood risk/ considerations for the developer
PSH189	Land off Barkby Thorpe Lane (2 parcels)	This site is in 2 parts; the southern parcel is low risk, whereas the northern parcel, north of Roundhill, has risk of surface water ponding in the eastern half of the site. Considered as 1 site (both parcels), the surface water coverage looks low. In the northern parcel alone, the 30-year is relatively minor, the 100-year is approximately a quarter of the site and the 1,000-year a third of the site, so development should be steered away from this side of the site and safe access considered.
PSH389	Land off Groby Road, Antsey	This site bounds the Rothley Brook. Fluvial risk is not currently shown to enter the site, but access and development should be away from the eastern edge adjacent to the river.
PSH439	Land off Barnards Drive	The site is bound along its north-western edge by surface water flood risk and the Sileby Brook. Access and development should be steered away from this boundary. At this location, the Environment Agency would have concerns about any encroachment into the channel and would advise that a blue-green corridor is maintained.
PSH387	High Leys Farm/ Manor Farm 1	A surface water flow path bisects site from west to east in the centre, where the topography forms a valley.
PSH267	Land off Beacon Road	The surface water 1,000-year event floods 20% of the site area and forms a flow path bisecting the site. This site is also on land which was previously within Beacon Road Landfill's permitted boundary; the EA advise caution when considering construction of residential development adjacent to the landfill.
SH56	Former petrol station, Pinfold Gate	The site is bound along the north-western edge by a surface water flow path in all events. Consider access and egress away from this risk.
PSH291	Land at Tickow Lane (Phase 2)	The site is surrounded to the north and south by 100-year and 1,000-year surface water risk, so consideration for access is needed.
PSH149	20 Moscow Lane	There is an ordinary watercourse and surface water flow path adjacent to the eastern boundary, which may need to be considered in more detail.
PSH391	Land south of Melton Road	Surface water ponding in an area of low topography at the north end of the site by Melton Road. Consider access along this road where there is surface water risk.
SH121	32 Charnwood Road	Surface water flooding at the eastern boundary of the site. This is associated with an unmodelled ordinary watercourse.
PSH404	Land west of Tickow Lane	There is a surface water flow path across the north eastern end of the site. This is associated with an unmodelled ordinary watercourse. The site's western boundary is also close to the Black Brook, though situated on higher land,

		except for where the unmodelled ordinary watercourse meets, north of Tickow Lane. There would be opportunities to restore the Brook as part of the development and provide multi-benefit interventions. Early engagement with a wider stakeholder group could benefit the development.
PSH463	Land off Cliffe Road/ Henson Close, Birstall	Surface water flooding associated with an unmodelled watercourse along the site's western border. Consider steering development away from this boundary edge.
PSH138	Land fronting Ashby Road and Ingleberry Road, Shepshed	Isolated areas of ponding across the site. Surface water flow routes across the western end of the site.
PSH388	High Leys farm/ Manor Farm, Anstey II	Surface water flow routes though the site in the 1,000-year event. These originate in the site itself and flow either north or east to meet other surface water flow paths.

Some recommendations are stated in Chapter 11 for consideration at the site-specific Flood Risk Assessment stage.

6.4 Site summary tables

As part of the Level 2 SFRA, detailed site summary tables have been produced for the sites listed above in Table 6-1. The summary tables can be found in Appendix A.

Where available, the results from existing detailed Environment Agency hydraulic models were used in the assessment to provide depth, velocity, and hazard information.

Using the model information combined with the Flood Zones, climate change and Risk of Flooding from Surface Water (RoFfSW) extents, detailed site summary tables have been produced for the site options (see Appendix A). Each table sets out the following information:

- Basic site information
  - Site code, address (name), area, current land use (greenfield/ brownfield), proposed site use
- Sources of flood risk
  - Topography
  - Existing drainage features
  - Fluvial – proportion of site at risk including description from mapping/ modelling
  - Surface Water – proportion of site at risk including description from RoFfSW mapping
  - Groundwater
  - Reservoir
  - Flood History
- Flood risk management infrastructure
  - Defences – type, Standard of Protection, and condition (if known), and description
  - Description of residual risk (blockage scenarios)
- Emergency Planning

- Flood Warning Areas
- Access and egress

- Climate change
  - Summary of climate change allowances and increase in flood extent compared to Flood Zones
- Requirements for drainage control and impact mitigation
  - Bedrock and superficial geology description
  - Soil description
  - Groundwater Source Protection Zone
  - Historic Landfill Site
  - Broadscale assessment of possible SuDS to provide indicative surface water drainage advice for each site assessed for the Level 2 SFRA.
- NPPF Planning implications
  - Exception Test requirements
  - Requirements and guidance for site-specific FRA (including consideration of opportunities for strategic flood risk solutions to reduce flood risk)
- Key messages – summarising considerations for the Exception Test to be passed
- Mapping information – description of data sources for the following mapped outputs:
  - Flood Zones
  - Climate change
  - Fluvial depth, velocity, and hazard mapping
  - Surface water
  - Surface water depth velocity and hazard mapping

6.4.1 Interactive GeoPDF mapping

To accompany each site summary table, there is an Interactive GeoPDF map, with all the mapped flood risk outputs per site. This is displayed centrally, with easy-to-use 'tick box' layers down the right-hand side and bottom of the mapping, to allow navigation of the data.

Flood risk information in the GeoPDFs include:

- Site boundary and Council boundary
- Title bar showing area, grid reference, site name, proposed development use (e.g. residential/ employment) and percentage Flood Zone coverage
- Flood Zones 2, 3a and 3b (functional floodplain) and indicative FZ3b (FZ3a in the absence of detailed models)
- Modelled 100-year fluvial depth, velocity, and hazard rating (where available)
- Risk of Flooding from Rivers and Sea
- Fluvial climate change extents – Central, Higher Central and Upper End allowances (where detailed models are available) and Indicative climate change extents (FZ2, where no detailed models are available)
- Flood risk from Risk of Flooding from Surface Water dataset (30-years, 100-years, and 1,000-years)

- Areas Susceptible to Groundwater Flooding
- Flood Warning and Flood Alert Areas
- Historic Landfill
- Defences (embankment and wall)
- Main Rivers/ Ordinary watercourses

7 Flood risk management requirements for developers

This chapter 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 in Charnwood. 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 Flood Risk Assessment (FRA) may show that a site is not appropriate for development of a particular vulnerability or even at all. However, a detailed Flood Risk Assessment undertaken for a windfall site[2] may find that the site is entirely inappropriate for development of a particular vulnerability, or even at all.

7.1 Principles for new developments

Apply the Sequential and Exception Tests

Developers should refer to Section 3 for more information on how to consider the Sequential and Exception Tests. For allocated sites, Charnwood Borough Council has already applied the Sequential and Exception Tests. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not be seen as an alternative to proving these tests have been met.

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?

Consult with the 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 as the water and sewerage company, at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

[2] 'Windfall sites' is used to refer to those sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

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.

Ensure that development does not increase flood risk elsewhere and in line with the NPPF, seeks to reduce the causes and impacts of flooding

Chapter 8 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.

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.

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. Developers should open up existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

Consider and contribute to wider flood mitigation strategy and measures in Leicestershire and apply the relevant local planning policy

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. Developers must demonstrate in an FRA how this has been considered at a site level.

7.2 Requirements for site-specific Flood Risk Assessments

7.2.1 When is a 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); the Environment Agency should be contacted to agree the breach assessment approach.
- Where evidence of historical or recent flood events have been passed to the LPA.
- In an area of significant surface water flood risk.

7.2.2 Objectives of site-specific FRAs

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

- whether a proposed development will be at risk of flooding, from all sources, both now and in the future, taking into account climate change.
- 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 Leicestershire County 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);
- FRA Guidance Note (Environment Agency SHWG area);
- **Leicestershire's Flood Risk Management Website**;
- **Leicestershire County Council's flood risk advice for developers**;
- **Leicestershire County Council's Planning and development guidance notes** 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**.

7.3 Local requirements for mitigation measures

The Level 1 SFRA provides details on the following mitigation measures in Section 10.3, and should be referred to alongside this report:

- Site layout and design (10.3.1)
- Raised floor levels (8.3.2)

- Access and egress (10.3.3)
- Modification of ground levels (10.3.4)
- Development and raised defences (8.3.5)
- Developer contributions (8.3.6)
- Resistance and resilience measures (10.4)

7.4 Flood warning and emergency planning

Section 7.9 of the Level 1 SFRA discusses NPPF requirements and what an Emergency Plan will need to consider. It also references the **Leicester, Leicestershire and Rutland Local Resilience Forum** and other relevant information on emergency planning.

7.5 Reducing flood risk from other sources

Section 10.6 of the Level 1 SFRA discusses how to reduce flood risk from other sources, such as groundwater, surface water and sewer flooding.

7.6 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.
- The GOV.UK website on **Reservoirs: owner and operator requirements** provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report and incident.

Developers should consult the **Leicester, Leicestershire and Rutland Local Resilience Forum** 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, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- 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 and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand, similar to the response to the Toddbrook Reservoir incident in Whaley Bridge, Derbyshire, 2019.

7.7 Duration and onset of flooding

The duration and onset of flooding affecting a site depends on a number of factors:

- The position of the site within a river catchment, with those at the top of a catchment likely to flood sooner than those lower down. The duration of flooding tends to be longer for areas in lower catchments.

  The River Humber and its larger tributaries drain a very large area of the Midlands and Yorkshire. Upstream reservoirs in these catchments will provide some online flood storage that reduce the flood risk downstream and delays the onset of flooding. At the confluence of the larger watercourses and smaller tributaries, there may be different timings of peak flows, for example smaller tributaries would peak much earlier than the larger catchments.

- The principal source of flooding. Where this is surface water, depending on the intensity and location of the rainfall, flooding could be experienced within 30 minutes of the heavy rainfall event e.g. a thunderstorm. Typically, the duration of flooding for areas at risk of surface water flooding or from flash flooding from small watercourses is short (hours rather than days).

- The preceding weather conditions prior to the flooding. Wet weather lasting several weeks will lead to saturated ground. Rivers respond much quicker to rainfall in these conditions.

- Whether a site is defended, noting that if the defences were to fail, a site could be affected by very fast flowing and hazardous water within 15 minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life. There are no Level 2 sites assessed that could be affected by a breach in flood defences within the Council area; however, future developments located near flood defences, should consider the potential risk from a breach.

- Catchment geology, for example chalk catchments take longer to respond than typical clay catchments.

Table 7-1: Guidelines on the duration of and onset of flooding

Principal source of flooding	Duration	Onset
Surface water	Up to 4 hours	Within 30 minutes
Fluvial	4 – 24* hours	Within 2 - 8 hours

**Depending on where in the catchment a site is located, flooding could be rapid and flashy in the upper catchment or urban catchments (e.g. Wood Brook), and slower responding and longer in duration in the lower catchment (e.g. River Soar).*

It is recommended that a site-specific Flood Risk Assessment refines this information, based on more detailed modelling work where necessary.

8 Surface water management and SuDS

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

The Level 1 SFRA summarises guidance and advice on managing surface water runoff and flooding in Chapter 11. Below is a guide to what is included in sections not expanded on here, for reference alongside this Level 2 SFRA:

- Section 11.1 – What is meant by Surface Water Flooding?
- Section 11.2 – Role of the LLFA and Local Planning Authority in surface water management and the four pillars of SuDS design

8.1 Sources of SuDS guidance

8.1.1 Leicestershire County Council – guidance notes

Leicestershire County Council are currently in the process of producing a SuDS guide for developers and should be consulted upon when complete. The following have already been produced by Leicestershire County Council addressing SuDS:

- **Surface water drainage advice for developments;**
- **Surface water guidance note;**
- **Environmental best practice guidance note; and**
- **Planning and development guidance note.**

8.1.2 C753 CIRIA SuDS Manual (2015)

The **C753 CIRIA SuDS Manual** (2015) replaces and updates the previous version (C697) providing up to date guidance on planning, design, construction and maintenance of SuDS. The document is designed to help the implementation of these features into new and existing developments, whilst maximising the key benefits regarding flood risk and water quality. 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. It is recommended that developers and the LPA utilise the information within the manual to help design SuDS which are appropriate for a development.

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

Non-Statutory Technical guidance has been developed by Defra to sit alongside PPG to provide non-statutory standards as to the expected design and performance for SuDS. It considers the following: flood risk inside and outside the development, peak flow, volume control, structural integrity, designing for maintenance considerations and construction.

8.1.4 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.

8.2 Recommendations for developers from Severn Trent Water

In December 2019, Severn Trent Water responded on the Local Plan Consultation. Recommendations were made with regards to surface water and sewer management,

some of which are referenced below as useful considerations for developers when undertaking surface water and SUDS strategies:

- The consideration of SuDS early within the planning process is encouraged, ideally from the outset, as this will define natural sub-catchments that could utilise source control techniques, managing surface water at source.
- Severn Trent Water are developing a guidance document on what SuDS elements can be adopted and the extent of the adoption for different features by Severn Trent as the Sewerage provider. Developers may need to consider this document when planning surface water drainage strategies.
- Surface water needs to be managed sustainably; for new developments it expected that surface water is not conveyed to their foul or combined sewage system and, where practicable, they support the removal of surface water already connected to foul or combined sewer.
- Current best practice requires new development to be designed around separate foul and surface water systems. It is recommended that all opportunities to separate surface water on site and discharge in accordance with the drainage hierarchy are delivered. It is recommended to consider sustainable surface water outfalls before the existing outfalls are utilised.
- If sewers are to be provided on new developments, these should safely accommodate floods which exceed the design capacity of the sewers; greater emphasis is needed on the impacts of extreme rainfall and avoiding development in natural drainage paths.
- It is advised that when developing sites, opportunities to direct surface water to the most sustainable outfall is undertaken in accordance with the drainage hierarchy, as outlined within Planning Practice Guidance paragraph 80. This approach is also key when redeveloping brownfield sites which may have an existing surface water connection to a combined sewer, as the removal of surface water from this part of the combined sewer will help to develop a more resilient drainage system.
- Surface water should aim to be directed to sustainable outfalls, keeping surface water out of the sewerage system where possible, as it represents the most sustainable and resilient system.

8.3 Other surface water considerations

8.3.1 Groundwater Vulnerability Zones

The Environment Agency 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 the underlying bedrock. The maps show the vulnerability of groundwater at a location based on the hydrological, hydrogeological and soil properties 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.**

8.3.2 Groundwater Source Protection Zones (GSPZ)

In addition to the AStGWF data the Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including

public/private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks. The Groundwater SPZs can be viewed on **Defra's interactive mapping.**

The location of the Groundwater SPZs in relation to Charnwood are shown in Figure 11-2 in the Level 1 SFRA. The vast majority of Charnwood is not located within a Groundwater SPZ. There is a small area covered by a SPZ in the borough to the south of Shepshed where the Black Brook forms the border of the borough.

For SuDS techniques that are designed to encourage infiltration, it is imperative that the water table is low enough and a site-specific infiltration test is conducted early on as part of the design of the development. Infiltration should be considered with caution within areas of possible subsidence or sinkholes. Where sites lie within or close to Groundwater Source Protection Zones (GSPZs) or aquifers or near areas of contaminated land/areas of former mining works, further restrictions may be applicable, and guidance should be sought from the LLFA.

8.4 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.

Charnwood is located entirely within a surface water NVZ. A small part of the borough in the west of the study area from Nanpantan through south Shepshed is located within a Groundwater NVZ. The south-west of the borough is located within a Eutrophic Water NVZ around Cropston and Swithland Reservoirs.

The NVZ coverage can be viewed on the **Environment Agency's online maps**.

8.5 SuDS suitability across the study area

The suitability of SuDS techniques is dependent upon many variables, including the hydraulic and geological characteristics of the catchment.

The permeability of the underlying soils can determine the infiltration capacity and percolation capacities. As such, a high-level review of the soil characteristics has been undertaken using BGS soil maps of England and Wales which allow for a basic assessment of the soil characteristics and infiltration capacity. The results of the assessment are shown in the Level 1 SFRA – Table 9-1 and mapping of the soil characteristics is shown in the Level 1 SFRA – Figure 9-1 and Figure 9-2.
There are no Severn Trent assets of Source Protection Zones (SPZs) located in the vicinity of the boundaries of the proposed development sites.

This strategic assessment should not be used as a definitive site guide as to which SuDS would be suitable but rather as an indicative guide of general suitability based solely on soil type. Several other factors can determine the suitability of SuDS techniques including land contamination, the depth and fluctuation of the water table, the gradient of local topography and primary source of runoff etc. When considering NVZs and if areas have pollutants, infiltration may only be suitable where treatment measures are provided, prior to any discharge to surface or groundwaters.

Further site-specific investigation should be conducted to determine what SuDS techniques could be utilised at a particular development. The result of this assessment does not remove the requirements for geotechnical investigation or detailed infiltration testing and does not substitute the results of site-specific assessments and

investigations. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

9 Cumulative impact of development and strategic solutions

9.1 Introduction

Under the revised 2019 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).

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

Conditions imposed by the Borough Council should allow for mitigation measures so any increase in runoff as a result of development is properly managed and should not exacerbate flood risk issues, either within, or outside of the Council's administrative areas.

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and where possible the development should be used to reduce existing flood risk issues.

9.2 Strategic flood risk solutions

Leicestershire County Council as Lead Local Flood Authority have a vision for the future management of flood risk and drainage in the County. 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. The Local Flood Risk Management Strategy for Leicestershire (2015) and Humber Flood Risk Management Plan set out specific actions for the region.

The Level 1 SFRA details Flood Alleviation Schemes (Chapter 8 and Section 8.3) and Strategic flood risk solutions (Chapter 12). This section, alongside Chapter 2, sets out strategic plans that exist for Leicestershire. 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 Catchment Flood Management Plan (CFMP) and River Basin Management Plan (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 Leicestershire, 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 Humber River Basin. 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 the districts/ boroughs.

- 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 outside Leicestershire. The Trent CFMP highlights opportunities for additional flood storage areas within the River Soar catchment.
- 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. The LFRMS reviews land management methods.
- Development should maintain conveyance of watercourses through hamlets and villages 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 (for example the schemes mentioned in Section 9.3 below); and
- Promote and consider SuDS at the earliest stage of site development.

9.3 Flood Alleviation Schemes in Charnwood

The following are Leicestershire County Council (LLFA), EA or Charnwood Borough Council flood mitigation schemes in Charnwood at the time of the Level 2 SFRA:

- **Loughborough Road, Mountsorrel**
  This is a completed flood scheme to recondition a riparian culvert on Betty Hensers Lane and install an overflow route to prevent excess water backing up and flooding several properties on Loughborough Road, Mountsorrel.
- **Swithland Brook**
  The LLFA are currently rolling out a scheme to provide Property Level Resilience (PLR) to up to 37 properties at risk in Swithland. The PLR scheme will protect properties from both fluvial and surface water sources and is expected to be completed early 2021.
- **River Soar Natural Flood Management Project**
  A multi-agency project looking at potential NFM scheme works along the river and its catchments. This is a high-level scheme currently and there are no specific details available yet.
- **Charnwood Property Resilience Scheme**
  Led by Charnwood Borough Council, this scheme aims to provide Property Level Resilience to properties flooded internally in November and February 2019/2020.
- **Loughborough Wood Brook Scheme**
  The Environment Agency are working on a Wood Brook flood alleviation scheme in the upper catchment (beyond the suburban extent), which will help to reduce flood risk in Loughborough. A scheme has been previously appraised on the Wood Brook, identifying two storage areas to take forward.
  New fluvial hydraulic modelling has been undertaken in 2020-2021, which takes into how the Wood Brook is culverted in the Town Centre. The benefits of the scheme would be seen at some residential areas downstream and Loughborough University Campus. There may also be some benefit for surface water risk due

to slowing down the fluvial flows, allowing the surface water drainage to outfall to the channel.
An Initial Business Case has been developed for the scheme. Further phases of work may involve defence works along the canal and downstream system, where the watercourse crosses the canal and siphon, and overtops into the canal (like a circular system).

At the time of the L2 SFRA, the Environment Agency and LLFA had some ongoing projects on several of the watercourses in Charnwood. There is the potential for developers to contribute towards such work financially or in kind through works on site:

- **Sileby Brook** - The Environment Agency and LLFA currently have a project looking at the feasibility of multi-benefit interventions in the Sileby Brook catchment, involving new hydraulic modelling. The Brook suffers from reduced water quality and biodiversity and has recently flooded. New developments could add to the pressures on the Brook; however, there may be opportunities for developments to include river restoration and biodiversity gains which could provide benefit the watercourse locally and further downstream.
- **Barkby Brook** - The Environment Agency and LLFA currently have a project looking at the feasibility of multi-benefit interventions in the Barkby Brook which runs through Syston. This involves re-modelling of the Barkby Brook upstream and investigating Natural Flood Management and restoration in the village. The Brook suffers from reduced water quality and biodiversity; although the new developments proposed are not adjacent to the Brook, development could increase flood risk and reduce water quality in general. The EA would like development to contribute to improvement in the quality of the river, biodiversity and reduce flood risk. High quality and high-functioning SuDS schemes could benefit the river downstream.
- **Black Brook** - There would be opportunities to restore the Black Brook as part of new developments and provide multi-benefit interventions, in addition to the defences at Thorpe Acre. Early engagement with a wider stakeholder group could benefit developments.

9.4 Cross-boundary issues

The topography of Charnwood directs the majority of smaller rivers into the River Soar that flows into and through the study area and into neighbouring authorities. As such, future development both within and outside Charnwood can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation. Charnwood has boundaries with the following Local Authorities, which can be seen in Figure 9-1:

- Leicester City Council
- Hinckley and Bosworth Borough Council
- Melton Borough Council
- Harborough District Council
- Blaby District Council
- North West Leicestershire District Council
- Rushcliffe Borough Council
- Oadby and Wigston District Council

GIS data provided for the Level 2 SFRA was used to consider the effect of proposed development in neighbouring authorities on flood risk in Charnwood.

This data showed that there is development planned in neighbouring authorities on catchments draining into Charnwood, primarily in Hinckley and Bosworth District, Melton District, North West Leicestershire District and Blaby District. Hinckley and Bosworth District poses the most significant impact as development is likely to flow into the Rothley Brook. Due to the relative size of the catchments draining into the River Soar from upstream, any small-scale developments on these watercourses draining into the Soar upstream of Charnwood are unlikely to have a significant impact on flows in the River Soar.

9.5 Assessing catchments most sensitive to changes in flood risk

An assessment has been undertaken of where the cumulative impacts of development may have the biggest effect on flood risk based on historic and predicted flood risk. This assessment uses:

- historic flooding data provided by Leicestershire County Council
- an understanding of relative increases in flood risk between properties at risk from the 100-year and 1,000-year surface water flooding extents. This shows which catchments might be most sensitive to increases in flood risk from any cause e.g. climate change, land use change, new development. It is use in relative terms for the assessment to compare catchments with each other.
- the latest development allocation data to understand which catchments might see the largest degree of development in Charnwood and within neighbouring authorities upstream of Charnwood.

The final results of this assessment gave a rating of low, medium or high sensitivity for each catchment within the study area, the boundaries of which were derived from Water Framework Directive (WFD) and Flood Estimation Handbook (FEH) datasets.

A map of this is shown in Figure 9-1 and results are outlined below.

The catchments rated as high-risk (i.e. most sensitive to increases in flood risk that may be caused by new development) are:

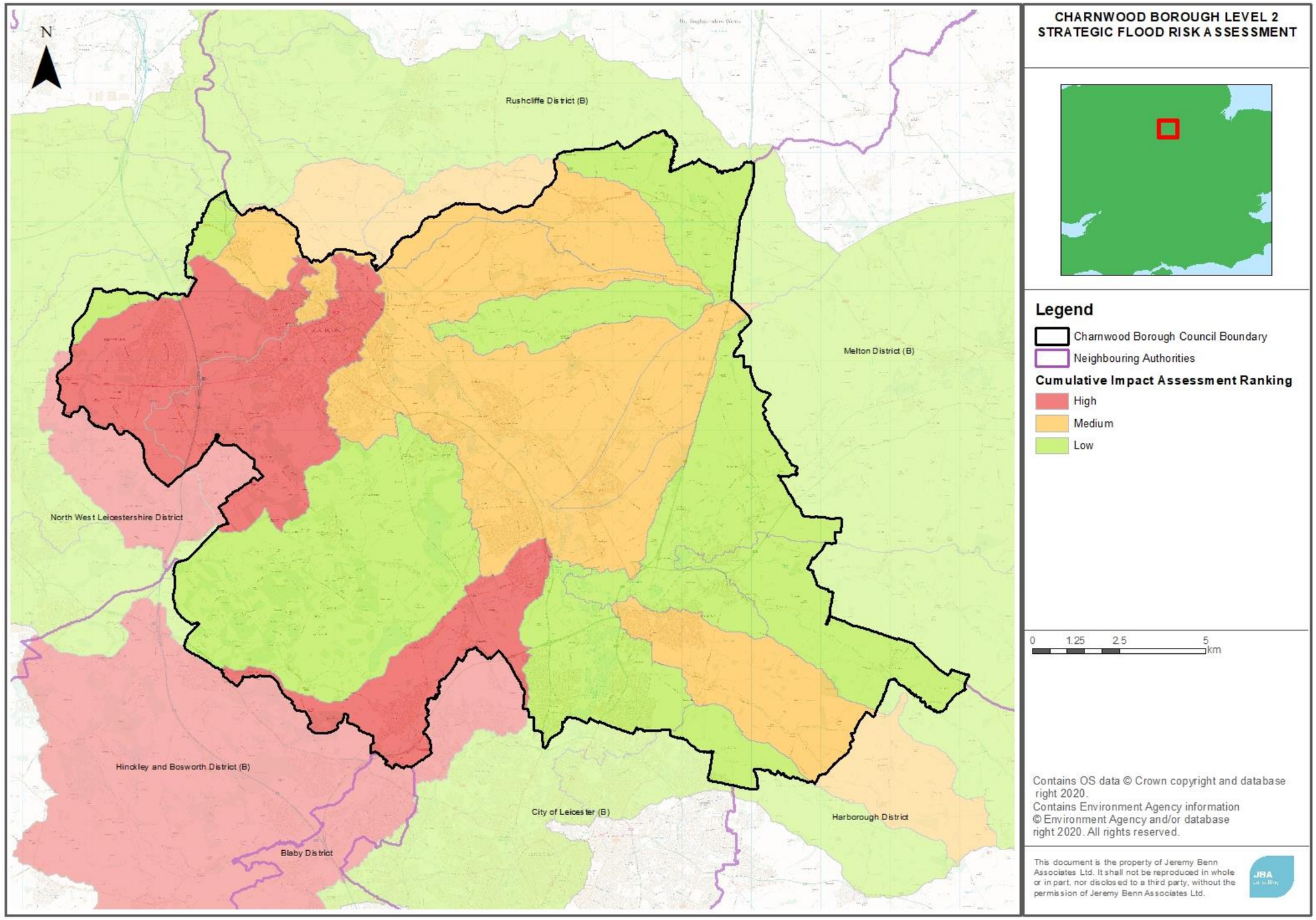
- Wood Brook
- Black Brook
- Rothley Brook

The catchments rated as medium risk are:

- River Soar (from Rothley Brook to Long Whatton Brook)
- Sileby Brook
- King's Brook
- Syston Brook

Policy recommendations for these catchments can be found in Chapter 10.

Figure 9-1 Final risk rating of catchments in Charnwood



9.6 Further assessment of high-risk catchments

Of the 81 final sites allocated in Charnwood, 41 of these sites fall within the high-risk catchment boundaries. Thirty-one of these sites lie wholly within a single catchment whilst ten sites extend across multiple catchment boundaries. Table 9-1 displays the proposed development sites and the catchments that each site falls within.

Table 9-1 Site areas within high-risk catchments

SHLAA Reference	Catchment 1	area within catchment (ha)	% site within catchment	Catchment 2	area within catchment (ha)	% within catchment
PSH24	Black Brook	24.88	100	-	-	-
PSH291	Black Brook	14.57	100	-	-	-
PSH405	Black Brook	5.56	59.8	Wood Brook	3.73083	40.2
PSH174	Black Brook	6.03	100	-	-	-
PSH348	Black Brook	0.10	100	-	-	-
PSH322	Black Brook	3.73	100	-	-	-
PSH149	Black Brook	1.98	100	-	-	-
SH121	Black Brook	0.23	100	-	-	-
PSH404	Black Brook	16.85	100	-	-	-
PSH293	Black Brook	11.50	79.0	Grace Dieu Brook	3.05	21.0
PSH352	Black Brook	0.30	100	-	-	-
PSH138	Black Brook	11.06	100	-	-	-
PSH62	Black Brook	11.87	100	-	-	-
PSH387	Rothley Brook	5.82	100	-	-	-
PSH411	Rothley Brook	0.03	7.24	River Soar*	0.33	92.8
PSH53	Rothley Brook	0.03	1.24	River Soar*	2.34	98.8
PSH144	Rothley Brook	20.43	100	-	-	-
PSH460	Rothley Brook	1.21	100	-	-	-
PSH463	Rothley Brook	4.72	61.9	River Soar *	2.91	38.1
PSH388	Rothley Brook	41.54	100	-	-	-
PSH389	Rothley Brook	12.62	100	-	-	-
PSH300	Rothley Brook	0.65	100	-	-	-
PSH477	Rothley Brook	1.74	100	-	-	-
PSH492	Rothley Brook	0.66	65.55	River Soar*	0.35	34.5
PSH389	Rothley Brook	5.92	100	-	-	-
PSH120	Rothley Brook	38.70	100	-	-	-
PSH47	Rothley Brook	1.24	100	-	-	-
SH102	Wood Brook	0.10	76.8	River Soar **	0.03	23.2

SH34	Wood Brook	0.005	1.3	River Soar **	0.35	98.7
PSH171	Wood Brook	0.27	100	-	-	-
SH60	Wood Brook	0.06	67.4	River Soar **	0.03	32.6
PSH313	Wood Brook	0.51	100	-	-	-
PSH447	Wood Brook	1.68	100	-	-	-
PSH133	Wood Brook	5.49	100	-	-	-
PSH245	Wood Brook	0.22	100	-	-	-
SH84	Wood Brook	0.24	31.5	River Soar **	0.51	68.5
PSH488	Wood Brook	0.34	100	-	-	-
SH48	Wood Brook	0.75	100	-	-	-
PSH487	Wood Brook	0.22	100	-	-	-
PSH21	Wood Brook	50.48	100	-	-	-
PSH25	Wood Brook	6.84	100	-	-	-

**River Soar (From Sence to Rothley Brook)*

*** River Soar (From Rothley Brook to Long Whatton Brook)*

9.7 Methodology

9.7.1 Impact of proposed development

To ascertain the impact of the proposed development on downstream flows, catchment descriptors from the FEH Webservice were downloaded for each catchment. These catchment descriptors were then amended to account for modification to the catchment boundaries based on topography data and for the proposed development in the catchment. The URBEXT (urban extent) value was increased in line with the total area of development proposed in the catchment. The imperviousness factor was assumed to be 0.4 across all catchments. This value assumes that 40% of built-up areas in the catchment is covered by impermeable surfaces.

From this information hydrographs showing the flood response in both a pre-development and post-development scenario in each catchment were generated for the 100-year flood event. It should be noted that these hydrographs have been derived from ReFH2 using catchment descriptors only, a detailed hydrological assessment to obtain these hydrographs has not been undertaken.

The pre- and post-development hydrographs produced with REFH2 were compared to calculate the additional volume of storm water passing through the catchment as a result of increased impermeable surfaces from development. This value represents the volume of on-site storage required across the whole catchment to limit peak flow rates to the existing greenfield response. An additional scenario was calculated for each catchment hydrograph to show the potential impacts of the installation of SuDS across a catchment in a post-development scenario. Peak hydrograph flow was limited to pre-development levels and the additional volume generated in the post-development scenario was added onto the falling limb of the hydrograph. The results display how SuDS can limit the peak flow and release excess stormflows through the catchment at a lower rate, potentially reducing flood risk downstream.

9.7.2 Assessing the storage need at potential development sites

The UK SuDS Website provides a variety of tools for the design and evaluation of sustainable drainage systems. The surface water storage volume estimation tool was used to provide estimates of storage volume requirements needed to meet best practice criteria from Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory technical standards for SuDS (Defra, 2015). It should be noted that the estimates from this tool should not be used for the detailed design of drainage systems and sewer modelling is recommended when designing a drainage scheme.

The tool works by selecting a point on a map for the calculation and entering characteristics for the proposed development site. For this assessment, the most downstream point of each catchment was selected, the site area was entered, and a developable area/ impermeable area was assumed based on council recommendations and similar values from neighbouring authority SHLAA methodologies. The impermeable area of the site was assumed to be 70% of the total site area for both residential and employment sites.

All other variables in the tool were left as default, to avoid a large number of assumptions. The REFH2 method to calculate surface water storage requirements was used to allow comparison to the catchment scale assessment.

Where a site only partially fell into a high-risk catchment, storage estimations have been provided for two scenarios: the first assuming that the entire site will discharge into the chosen catchment and the second assuming only the proportion of the site within the catchment will discharge to this catchment, with the rest discharging to another catchment. In reality, a site will generally discharge all to one catchment and where a site will discharge to is not yet known, this should be considered at a site-specific stage.

These analyses are carried out for the purpose of developing strategic planning policy by highlighting the need for considering drainage amongst sites or groups of sites within a catchment. It is not intended at this stage to set out the absolute level of storage that must be provided at site level because specific information about development sites is not yet known, such as how much of the site will be developed and in what way, as well as information on underlying geological and soil conditions based on ground investigations. At a site-level, developers will need to undertake detailed drainage strategies to refine calculations of the amount of storage required on site. In line with national planning policy and national requirements for SuDS, storage will always be required for the 100-year plus applicable climate change scenario. Whether any additional storage would benefit downstream areas depends on where the site is located within the catchment.

9.8 Cumulative impact within high-risk catchments

9.8.1 Black Brook

There are 13 sites that lie within, or partially within the Black Brook catchment, shown in Figure 9-2. The thirteen sites within the Black Brook are located primarily in the upper catchment and headwaters in and around the settlement of Shepshed. These cover 3.1% of the catchment area, with two sites crossing into neighbouring catchments, as shown in Table 9-1. Site PSH405 crosses into the Wood Brook (see section 1.7.3), and site PSH293 crosses into the Grace Dieu Brook, a tributary of the Black Brook.

Figure 9-2 Proposed development and historic flooding in the Black Brook catchment

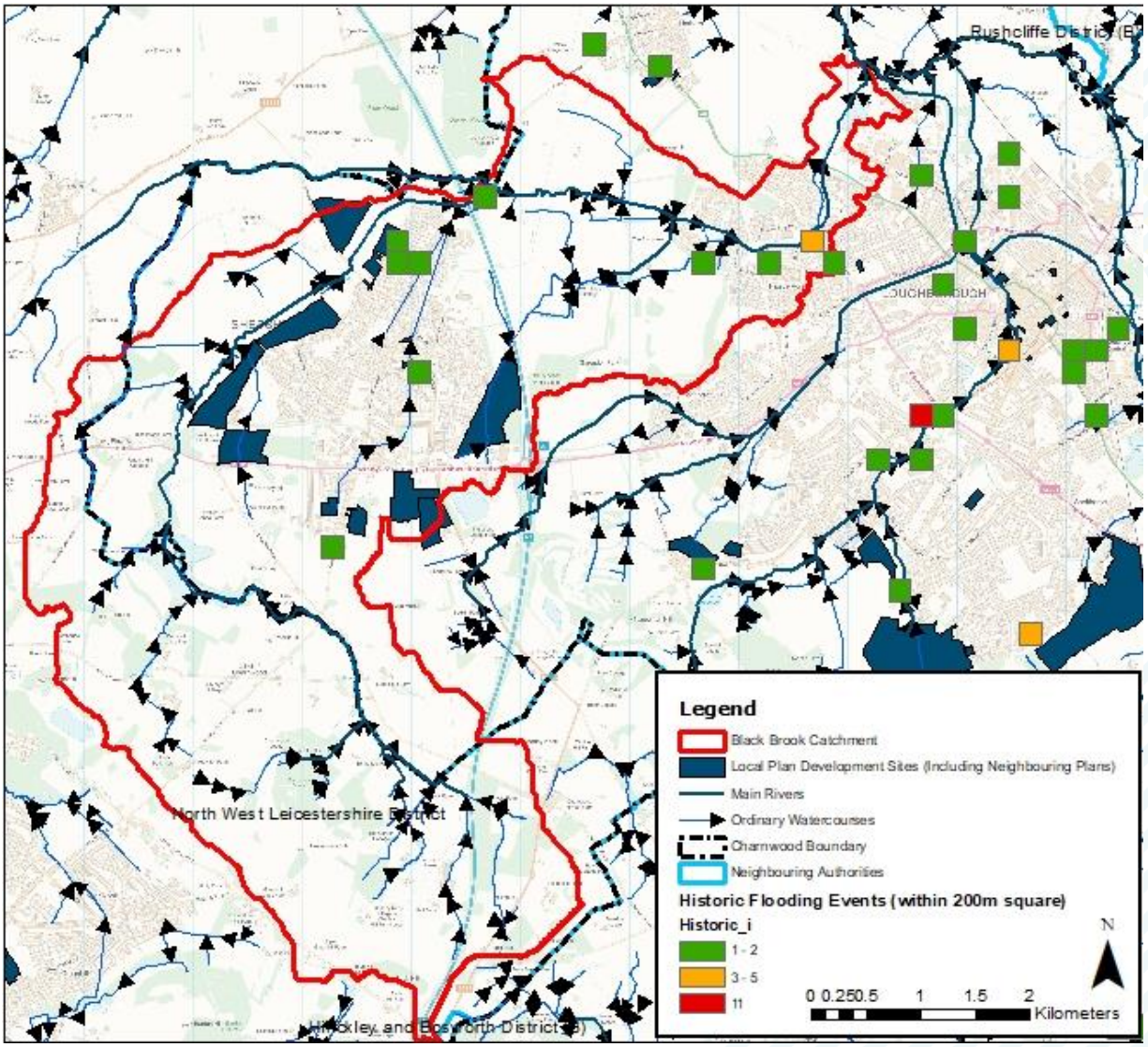


Figure 9-3 Pre- and post-development and SuDS hydrographs in the Black Brook catchment

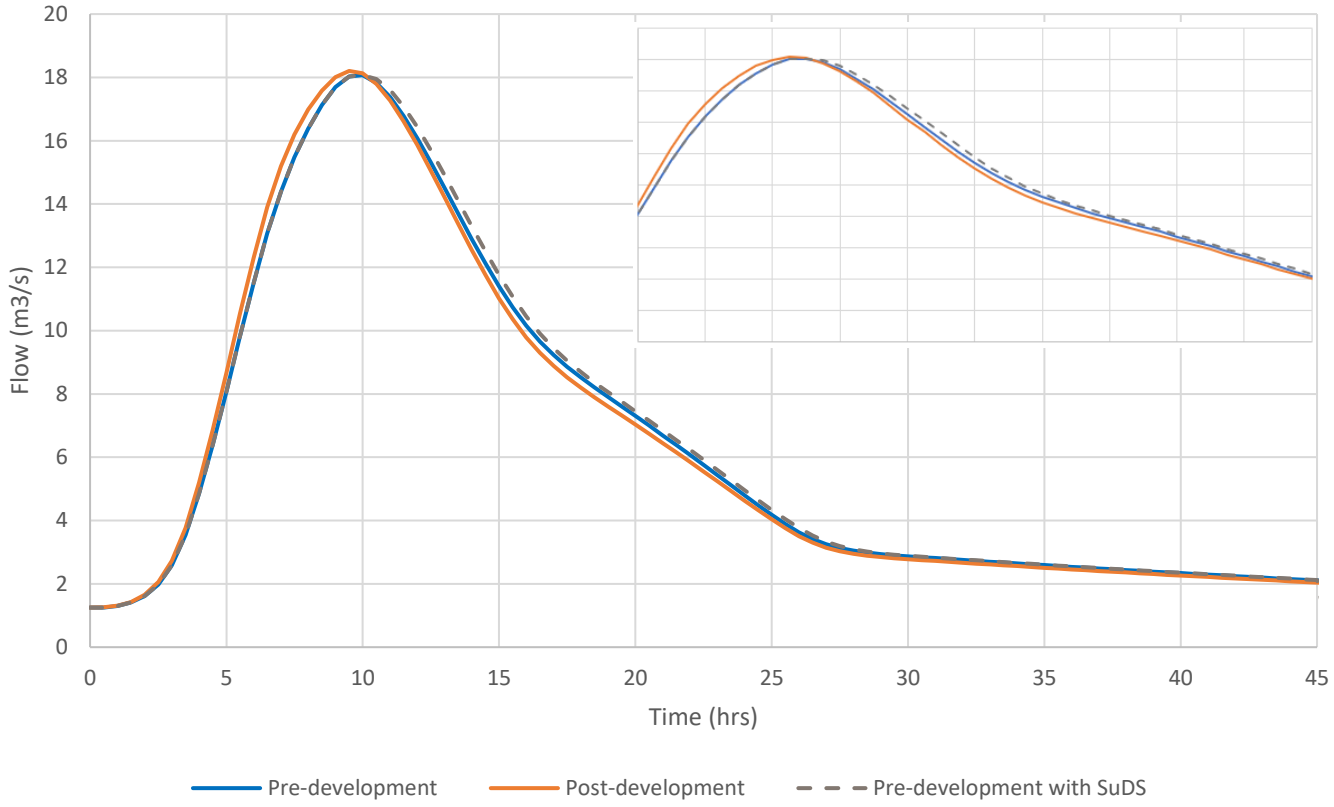


Table 9-2 suggests that at a site-specific scale a total of 14973m^3* is required in long-term storage in the Black Brook catchment in order to ensure that surface water runoff rates remain at the same level as current greenfield runoff rates.

**Volume assumes site areas within the Black Brook catchment only.*

Table 9-2 Estimated storage volumes required at sites in the Black Brook catchment, taken from the UK SUDS website

Settlement	Site	Attenuation Storage 1 in 100 years (m^3)	Long Term Storage 1 in 100 years (m^3)	Total Storage 1 in 100 years (m^3)
Shepshed	PSH24	7927	2854	10826
	PSH291	4667	1671	6337
	PSH405	4662	1669	6331
	PSH174	1931	691	2622
	PSH348	8	0	8
	PSH322	1194	427	1622
	PSH149	579	113	692
	SH121	38	0	38
	PSH404	5399	1933	7331
	PSH293	4662*	1669*	6331*

		3684**	1319**	5003**
	PSH352	56	0	56
	PSH138	3545	1269	4814
	PSH62	3800	1358	5158

**Storage assuming entire site is discharged into the Black Brook catchment*

***Storage assuming only site area within the Black Brook catchment is being discharged to the catchment, with the remaining site area discharging to another catchment*

9.8.2 Rothley Brook

This tributary drains a largely rural catchment which is mostly located in the neighbouring Hinckley and Bosworth District, with small sections also in Blaby District, City of Leicester, and North West Leicestershire District. In a recent Level 2 SFRA for Hinckley and Bosworth District Council, the Rothley Brook was identified as High Risk (in respect of being highly sensitive to increases in flood risk that could be caused by new development). This, alongside the development proposals within the Charnwood section, located furthest downstream in the catchment, has resulted in it being identified as High Risk in this SFRA also.

There are 13 sites that lie within, or partially within the Rothley Brook catchment, shown in Figure 9-4. The thirteen sites within the Rothley Brook are located primarily in the lower catchment near the confluence with the River Soar, around the settlements of Anstey and Rothley. These cover 2.2% of the catchment area, with four sites crossing into neighbouring catchments, as shown in Table 9-1. There are six sites within the upper and middle catchment located in neighbouring authorities.

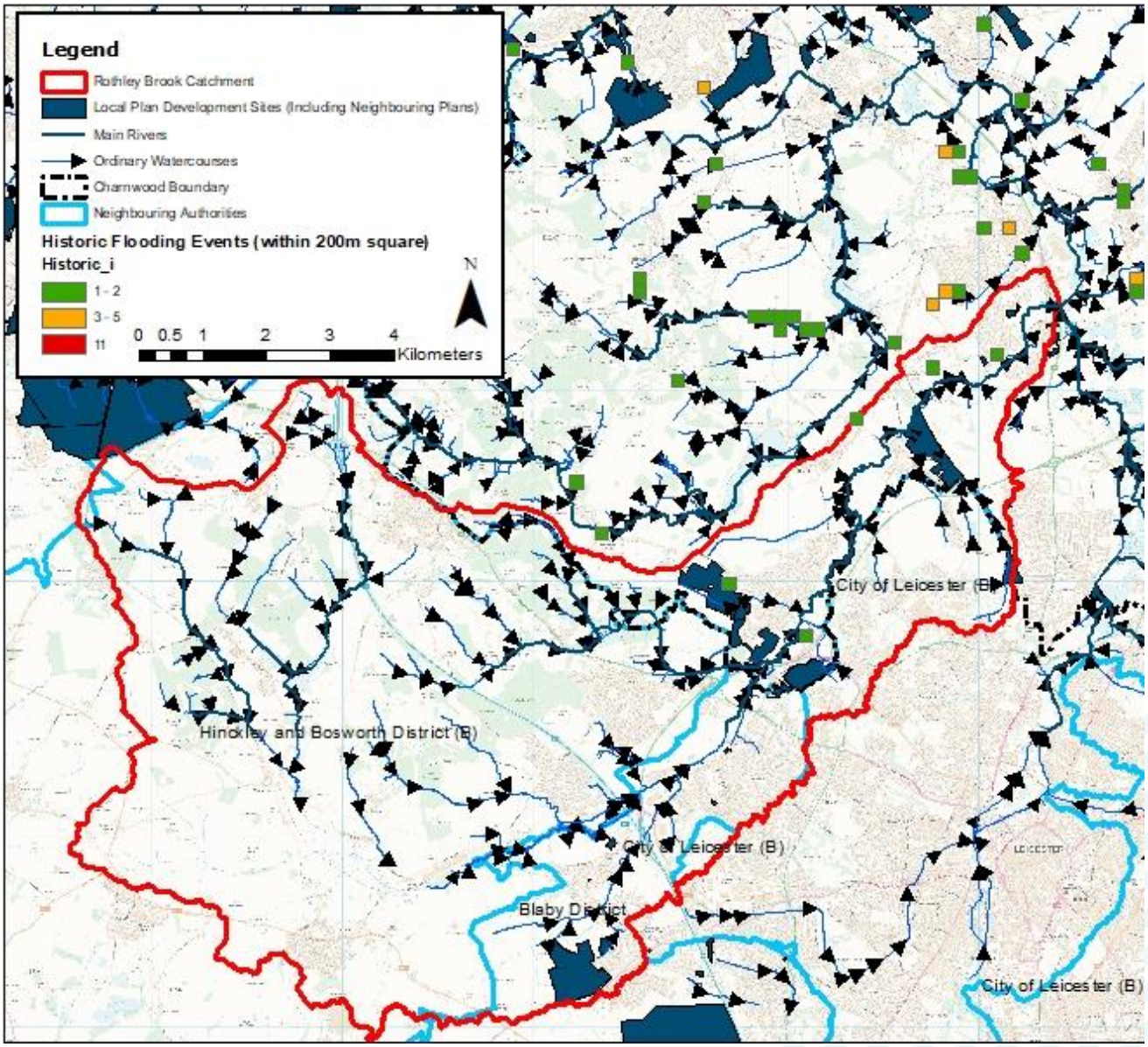


Figure 9-4 Proposed development and historic flooding in the Rothley Brook catchment

Figure 9-5 Pre- and post-development and SuDS hydrographs in the Rothley Brook catchment

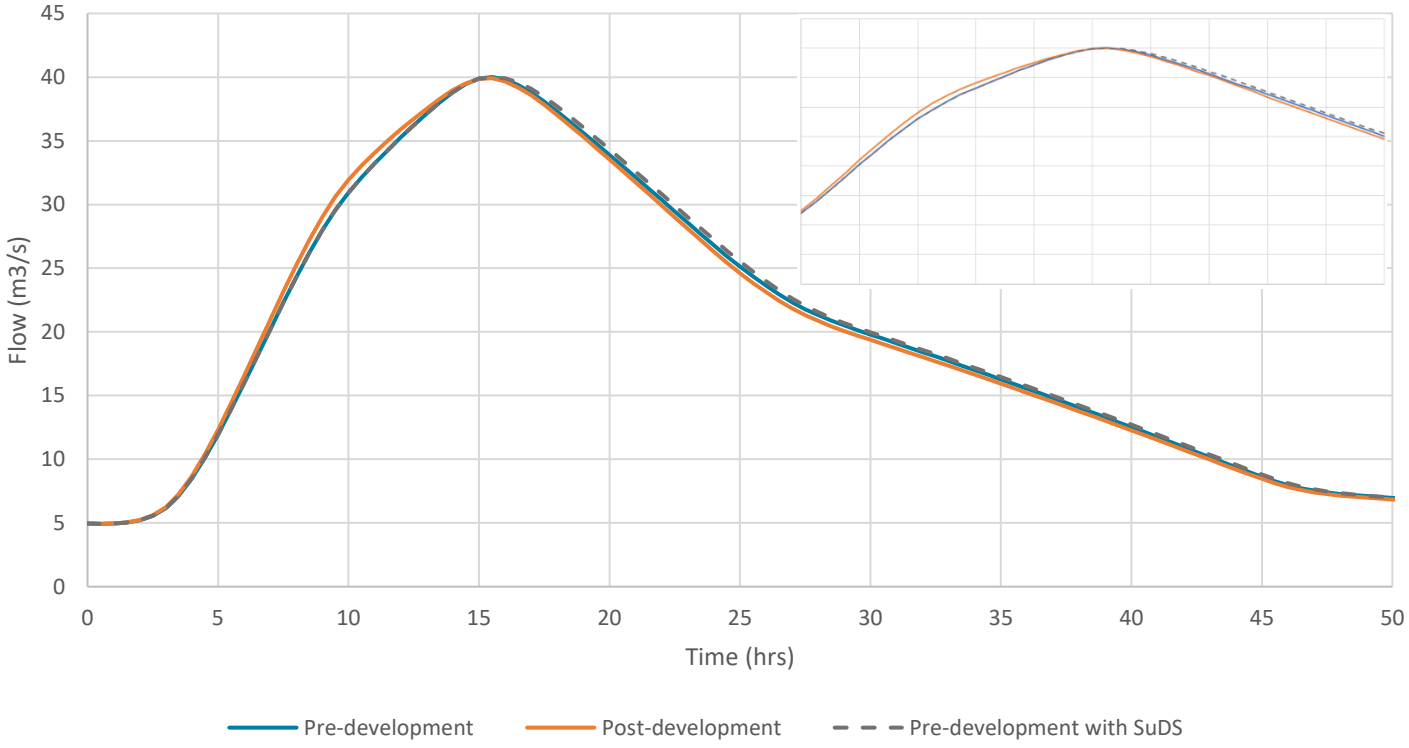


Table 9-3 suggests that at a site-specific scale a total of 9559m^3* is required in long-term storage in the Rothley Brook catchment in order to ensure that surface water runoff rates remain at the same level as current greenfield runoff rates. The catchment shows a flashier response post-development, however as the decrease in peak is minimal (0.1m3/s) there is no noticeable change in peak flows. Developers should therefore undertake a site-specific investigation at later stages to account for the exact amounts of impermeable surfaces within the developments.

**Volume assumes site areas within the Rothley Brook catchment only.*

Table 9-3 Estimated storage volumes required at sites in the Rothley Brook catchment, taken from the UK SUDS website

Settlement	Site	Attenuation Storage 1 in 100 years (m^3)	Long Term Storage 1 in 100 years (m^3)	Total Storage 1 in 100 years (m^3)
Anstey	PSH387	1861	383	2244
	PSH388	13265	2726	15991
	PSH389	4029	828	4857
Birstall	*PSH411*	64*	0*	64*
		0**	0**	0**
	PSH463	2436*	501*	2936*
		1508**	310**	1818**
Glenfield	PSH144	6522	1340	7863
	PSH460	346	0	346
Rothley	*PSH53*	661*	103*	764*
		0**	0**	0**

	PSH300	153	0	153
	PSH477	543	0	543
	PSH492	272*	0*	272*
		152**	0**	152**
Thurcaston	PSH120	12360	2540	14900
	PSH47	354	0	354

**Storage assuming entire site is discharged into the Rothley Brook catchment*

***Storage assuming only site area within the Rothley Brook catchment is being discharged to the catchment, with the remaining site area discharging to another catchment*

9.8.3 Wood Brook

The Wood Brook is the neighbouring catchment to the Black Brook and flows through Loughborough into the River Soar. There are 16 sites that lie within, or partially within the Wood Brook catchment, shown in Figure 9-5. Of these 16 sites, only two are located outside Loughborough. Nine of the sites within Loughborough are small sites within close proximity to each other. Collectively, the sites cover >2447ha (2.89% of the catchment area).

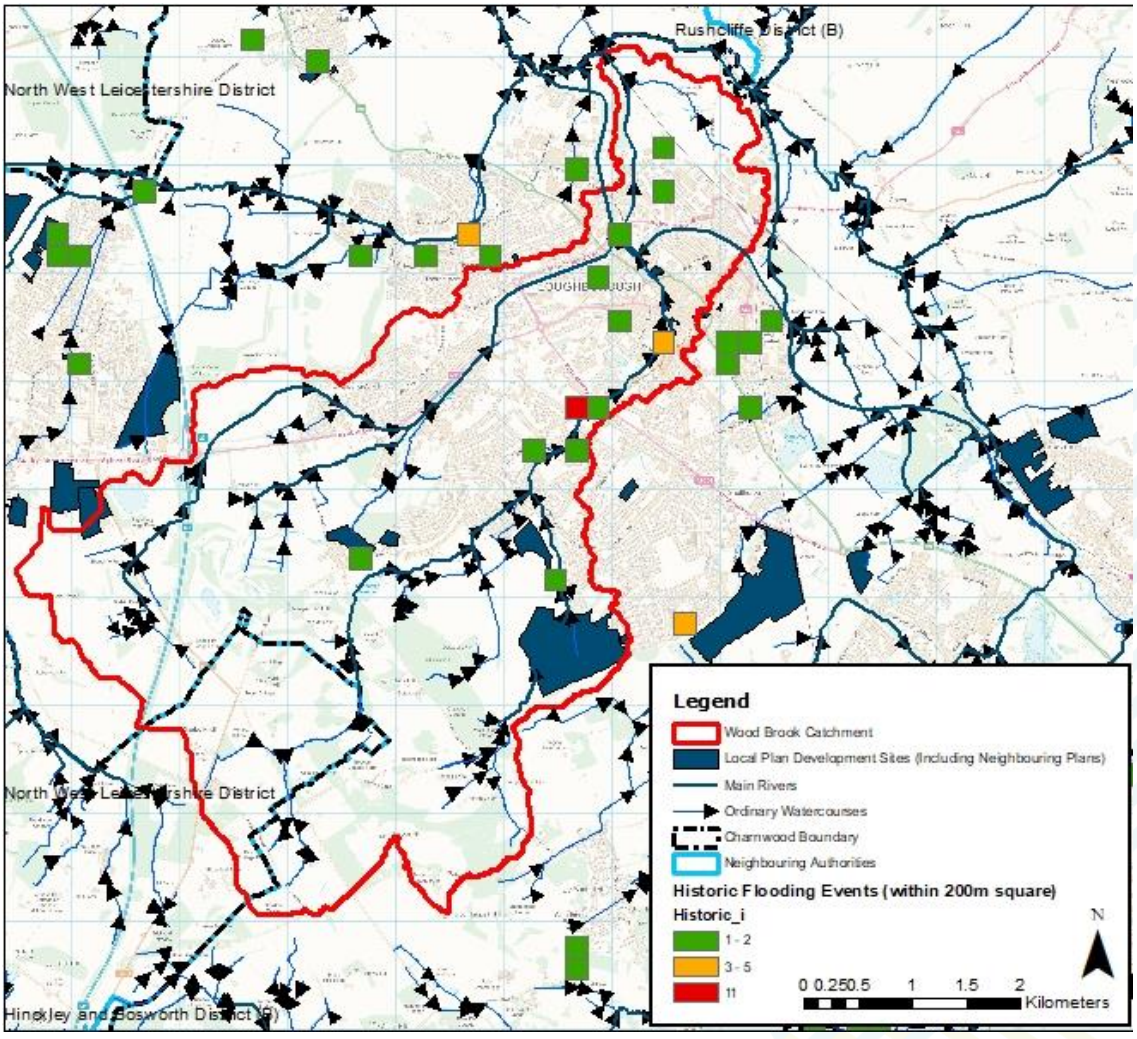


Figure 9-5 Proposed development and historic flooding in the Wood Brook catchment

Figure 9-7 Pre- and post-development and SuDS hydrographs in the Wood Brook catchment

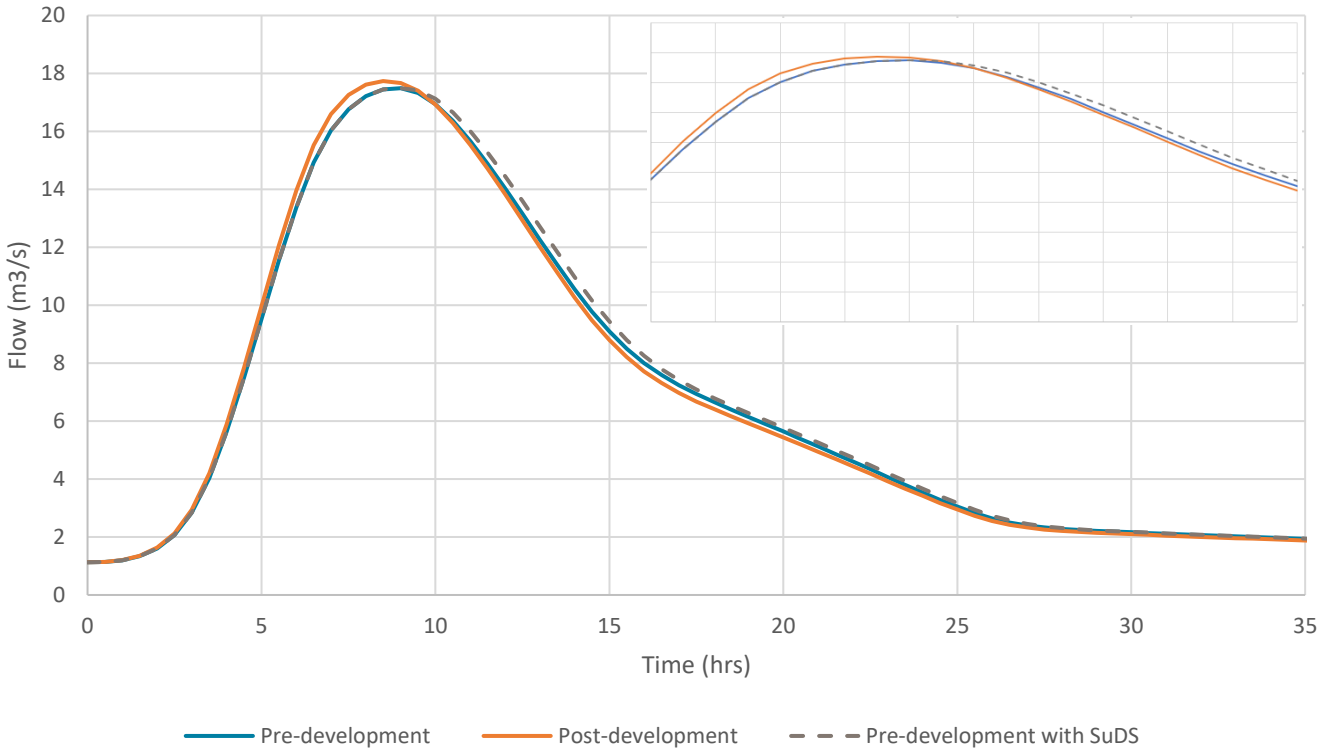


Table 9-4 suggests that at a site-specific scale a minimum of 8681m^3* is required in long-term storage in the Wood Brook catchment in order to ensure that surface water runoff rates remain at the same level as current greenfield runoff rates. The large number of '0' records in Table 9-4 indicates the small size of the individual sites, and SuDS are still required to store the minimum volumes.

**Volume assumes site areas within the Wood Brook catchment only.*

Table 9-4 Estimated storage volumes required at sites in the Wood Brook catchment, taken from the UK SUDS website

Settlement	Site	Attenuation Storage 1 in 100 years (m^3)	Long Term Storage 1 in 100 years (m^3)	Total Storage 1 in 100 years (m^3)
Loughborough	*SH102*	13*	0*	13*
		8**	0**	8**
	SH34	72*	0*	72*
		0**	0**	0**
	PSH171	48	0	48
	SH60	5*	0*	5*
		2**	0**	2**
	PSH313	123	0	123
	PSH405	2795	1054	3849
	PSH405	1093	412	1504
	PSH245	35	0	35

	SH84	209*	0*	209*
		39**	0**	39**
	PSH488	68	0	68
	SH48	212	0	212
	PSH487	34	0	34
	PSH21	15187	5722	20909
	PSH25	2059	776	2835
Nanpantan	PSH447	456	95	551
	PSH133	1651	622	2273

**Storage assuming entire site is discharged into the Wood Brook catchment*

***Storage assuming only site area within the Wood Brook catchment is being discharged to the catchment, with the remaining site area discharging to another catchment*

9.9 Neighbouring District Developments

Consideration should be taken to the cumulative impacts of developments proposed within these catchments by neighbouring authorities, particularly those in the upper Rothley Brook, as a significant number of sites are located in the lower urban part of the catchment within Charnwood, which could be impacted by larger developments upstream.

All three of the catchments assessed in this CIA cross the local authority boundary into neighbouring authorities' districts and it is recommended that the CBC liaise with neighbouring authorities at a site-specific development stage to ascertain whether any mitigation works are needed on sites.

Table 9-5 Neighbouring District and County Authorities for cross-boundary issues

Catchment	Neighbouring District Authority	Neighbouring County/ Unitary Authority
Black Brook	North West Leicestershire District	Leicestershire County
Rothley Brook	Blaby District Hinckley and Bosworth North West Leicestershire District	
	City of Leicester	City of Leicester
Wood Brook	North West Leicestershire District	Leicestershire County

9.10 General approached and policy recommendations for managing the excess storage needed to account for an increase in impervious area

The cumulative impact analysis has highlighted the importance of managing both the rate and volume of surface water runoff from new developments to mitigate the impact of flood risk along watercourses. Where reasonably practical, all new development should control both the rate and volume of runoff to greenfield characteristics. Where the developer can demonstrate it is not reasonably practical, runoff must be discharged at a rate that does not adversely affect flood risk. There are two general alternative approaches to meeting this requirement:

- Long Term Storage - the development should discharge surface water for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event at peak greenfield runoff rates for the same event and discharge the difference in runoff volume pre- and post-development for the 100-year six-hour event in long-term storage at a maximum rate of 2 l/s/ha.
- Restricted Discharge – the development shall discharge surface water at 2 l/s/ha or Qbar, whichever is greater, for all storms up to the critical 100-year event.

The size of development sites and their location within a catchment will impact the effect that it will have on catchment response to storm events. In line with national planning policy and the national requirements for SuDS, storage will always be required for the 100-year plus applicable climate change allowance event. Whether any additional storage would benefit downstream areas depends on where the site is located within the catchment and has been explored below.

9.11 Catchment-specific recommendations for storage and betterment

From analysing the results produced above, high-level recommendations for flood storage and betterment have been proposed for sites in each of the high-risk catchments. These recommendations should be considered by developers as part of a site-specific assessment, but it is recommended that more detailed modelling is undertaken by the developer to ascertain the true storage needs and potential at each site. This should refine the estimates of required storage taken from the UK SuDS Tool for each site.

9.11.1 Black Brook

There are thirteen sites within the Black Brook which are distributed across the middle catchment. There are no other proposed developments in the upstream catchment, although a small number are proposed for the headwaters of the Grace Dieu Brook which flows into the Black Brook near Shepshed.

Historic events in the Black Brook are centred around the urban areas of Shepshed and Loughborough. Two sites fall within 200m of recent flooding events, both in Shepshed: HS42 (PSH174, Land at Oakley Road) and PSH352 (Garendon Road). There is also an area near the Sandringham Road/Warwick Way, Dishley, that has 3 recorded historic events within a 200m area. Integrated SuDs systems at these sites should be designed to hold greater storage volumes than the minimum requirements stated in Table 9-2.

The opportunity should be taken to store additional water on development sites in this catchment to alleviate flooding in the wider area, in addition to long term storage requirements. Opportunities to complement and enhance any natural flood management schemes within the catchment should also be investigated.

9.11.2 Rothley Brook

Approximately 84% of the catchment is outside of Charnwood, with the majority located in neighbouring Hinckley and Bosworth Borough. Only 16% of the catchment area is within Charnwood in the lower catchment. There are opportunities in the upper catchment, located largely within Hinckley and Bosworth Borough, for natural flood management techniques to improve upstream storage in addition to those implemented within development sites.

Hinckley and Bosworth Borough have 19 development sites proposed in the upper catchment, these are discussed in the recent Level 2 SFRA for Hinckley and Bosworth Borough Council[3]. Communication with Hinckley and Bosworth Borough Council is recommended with regards to storage requirements across the catchment. This is especially important for those sites within Charnwood, as many are located in the lower catchment, downstream of neighbouring authorities' developments.

Recommendations from the Hinckley and Bosworth Borough Council Level 2 SFRA include increasing floodplain connectivity and high-flow storage to reduce the long-term dependence on engineered flood defences.

[3] Strategic Flood Risk Assessment for Hinckley and Bosworth Borough Council (2019) Available at: Strategic Flood Risk Assessment (SFRA) 2019 | Hinckley & Bosworth Borough Council (hinckley-bosworth.gov.uk)

There are 5 historic flooding events in the catchment within Charnwood, one of which is within 200m of a proposed development site, PSH388 (High Leys Farm/Manor Farm, Anstey II). Site PSH300 (Land of Wellsic Lane/Westfield Lane, Rothley) is also in close proximity to a historic flooding event, though >200m. These events are shown in Figure 9-4. Integrated SuDS systems at these sites should be designed to hold greater storage volumes than the minimum requirements stated in Table 9-3.

9.11.3 Wood Brook

The sixteen sites located within the Wood Brook are all located largely in the lower end of the catchment, and downstream of a large rural upstream catchment. There are a significant number of historic flooding events in the catchments, largely located in Loughborough. Sites HS34 (PSH133) and HS36 (PSH25) are within 200m of a historic flooding event, and site PSH487 is within 200m of 3 events. The only area to have historic flooding events in excess of 5 across Charnwood is located in Loughborough in the Wood Brook catchment. Figure 9-5 shows this in Red.

Integrated SuDS systems at these sites and in areas where significant historic flooding has occurred should be designed to hold greater storage volumes than the minimum requirements stated in Table 9-4.

The opportunity should be taken to store additional water on development sites in the Wood Brook to alleviate flooding in the wider area, in addition to long term storage requirements. Opportunities to complement and enhance the existing NFM scheme within the catchment should also be investigated. Such schemes may also improve the surface water risk in the catchment, by slowing the fluvial flows in the system allowing the surface water drainage to outfall to the channel.

Developers should enter into conversations with the Borough Council at pre-application stage to understand the latest position with regards to the Environment Agency led Wood Brook scheme. Betterment may be required:

- In the form of additional storage for surface water runoff from development sites on site,
- In the form of 'in kind' works, such as additional floodplain storage on site, and/ or
- In the form of a contribution towards wider community flood alleviation works within the catchment.

10 Summary of Level 2 assessment and recommendations

10.1 Assessment methods

As part of the Level 2 SFRA, 23 detailed site summary tables have been produced for the Level 2 sites assessed.

The summary tables set out the flood risk to each site, including Flood Zone coverage, maps of extent, depth and velocity of flooding as well as hazard mapping for the 100-year defended event, where available. Climate change mapping has also been produced (Level 1 SFRA) to indicate the impact which different climate change allowances may have on the site (where models are available) or using Flood Zone 2 as an indication of climate change. Each table also sets out the NPPF requirements for the site as well as guidance for site-specific FRAs. A broadscale assessment of suitable SuDS options has been provided giving an indication where there may be constraints to certain sets of SuDS techniques. This assessment is indicative and more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. It may be possible that those SuDS techniques highlighted as possibly not being suitable can be designed to overcome identified constraints. Where deemed required, culvert blockages were also presented to assess residual risk to sites.

Interactive mapping is shown in Appendix A and should be viewed alongside the detailed site summary tables. There are no detailed fluvial hydraulic models available, so the Environment Agency's Flood Zones and Risk of Flooding from Rivers and Sea datasets have been used. Also, where the watercourses are smaller and not represented in the Flood Zones, the Risk of Flooding from Surface Water mapping datasets have been used.

10.2 Summary of key site issues

- The majority of sites with a detailed Level 2 summary table are at fluvial flood risk. The degree of flood risk varies, with some sites being only marginally affected along their boundaries, and other sites being more significantly affected within the site, such as sites PSH343 and PSH260. These will require more detailed investigations on sequential site layouts, SuDS possibilities, safe access and egress and so on, as part of a site-specific Flood Risk Assessment at the planning application stage.
- Most sites at fluvial risk are also at risk from surface water flooding; however, there is not always a direct correlation between fluvial and surface water risk. For example, PSH260 has a higher fluvial risk than PSH483, but the latter is at a higher risk from surface water flooding, with more areas of ponding in the higher return period events. As a result, some sites not at fluvial risk were subject to a Level 2 assessment where surface water risk was deemed to be significant from professional judgement (surface water should also be considered when assessing safe access and egress to and from the site).
- Surface water tends to follow topographic flow routes, for example along the watercourses or isolated pockets of ponding where there are topographic depressions.
- Fluvial climate change mapping indicates that flood extents will increase. As a result, the depths, velocities and hazard of flooding may also increase. The significance of the increase tends to depend on the topography of site and the percentage allowance used; extents would be larger than Flood Zone 3, but maximum extents are likely to be similar to Flood Zone 2. The Council and the Environment Agency require the 100-year plus 20%, 30% and 50% climate change fluvial scenarios to be considered in future developments. The 1,000-year surface water flood extent can also be used as an indication of climate

change to surface water risk. Site-specific FRAs should confirm the impact of climate change using latest guidance.

- Additional climate change assessments were undertaken: the H++ allowance (100-year +65%) was run for the Wreake, Lower Upper Soar and Loughborough Tributaries models, where urban extensions are proposed to particular settlements. Also, the potential impacts of climate change on the functional floodplain were assessed by comparing the difference between the 20-year model extent and the nearest equivalent return period event, for example the 50-year/ 75-year extents. Where these assessments were relevant, these have been commented on in the site summary tables in Appendix A.
- The four sites considered in Loughborough town centre present unique challenges for developing the sites (PSH487, PSH488, PSH245 and SH48). The latest EA Wood Brook fluvial modelling shows the sites to only be at actual fluvial risk in the 100-year defended plus climate change events and higher, but it is the surface water extents which are more significant down the valley albeit in the 1,000-year event. This dataset does not account for culverts and hence there is a lower level of confidence in these extents in the absence of an integrated hydraulic model. When undertaking a site-specific FRA at these sites, developers will need to consider surface water flood risk in more detail.
- Three of the four sites are also located on top of/ adjacent to the Wood Brook where it is in culvert, presenting easement challenges. Any sites located where there is Main River (including culverted reaches of Main River) will require an easement of 8m either side. This will have constraints regarding what development will be possible on top of the culvert. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk.
- Residual risk was considered at the sites. Blockage locations were determined by visual inspection of the OS mapping and ground topography in the vicinity of the site, to determine whether a structure upstream, downstream, or within the site could have an impact on the site. These would need to be considered further as part of a site-specific assessment.
- A strategic assessment was conducted of SuDS options using regional datasets. A detailed site-specific assessment of suitable SuDS techniques would need to be undertaken at site-specific level to understand which SuDS option would be best.
- For some sites, there is the potential for safe access and egress to be impacted by fluvial or surface water flooding. Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to whether the risk forms a flow path or bisects the site where access from one side to another may be compromised.
- In respect of cumulative impact assessment, there are a number of development sites proposed that have the potential to provide a betterment to existing communities downstream within the catchment. However, all of these developments also have the potential to increase flood risk offsite if both National and Local SuDS Standards are not applied. They also offer a great potential to enhance the wider Green and Blue Infrastructure of the local area through integrated planning for flood risk, sustainable drainage, biodiversity, amenity and sustainable transport provision.
- Developers proposing windfall sites in the high-risk Cumulative Impact Assessment catchments should demonstrate through a site-specific FRA how SuDS and surface water mitigation techniques will ensure that development does

not increase flood risk elsewhere and seeks to reduce flood risk to existing communities. The catchment based Cumulative Impact Assessment used the latest available data for the Level 2 SFRA.

10.2.1 Considering the Exception Test for the proposed sites in Charnwood

In principle, it is possible for the majority of sites assessed in the Level 2 SFRA to pass the flood risk element of the Exception Test, for example by:

- siting development away from the highest areas of risk into Flood Zone 1 (in the majority of sites assessed, the risk is along a site boundary, so steering away from this is advised),
- considering safe access/ egress in the event of a flood (from all parts of the site, if say the site is severed by a flood flow path),
- using areas in Flood Zone 2 for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. Residential development should not be permitted in Flood Zone 3 and no development at all should be permitted in Flood Zone 3b (aside from essential infrastructure, such as a bridge crossing the lowest points of a site),
- testing flood mitigation measures if these are to be implemented, to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another),
- considering space for green infrastructure in the areas of highest flood risk where this is appropriate.

In some areas of Charnwood, more detailed fluvial modelling has been carried out in recent years, providing a more accurate representation of the Flood Zones within the Borough. The catchments modelled are the River Soar, Black Brook, River Wreake and the Wood Brook.

Consideration should be given to the surface water risk within Charnwood, particularly within Loughborough with regards to the Exception Test. For example, a site may pass the test based on fluvial flood risk alone, but greater risk may come from surface water at the four Loughborough sites assessed. However, the national surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.

If the strategic sites are split in future into smaller land parcels for development, and some of those parcels are in areas of flood risk, the Exception Test may need to be re-applied by the Developer at the planning application stage.

10.3 Planning Policy recommendations

The Planning Policy recommendations in Chapter 14 of the Level 1 SFRA still stand for the site allocations and any windfall development that comes forward. Recommendations in the L1 are made on:

- Developers should consider flood resilience measures for new development, including raised thresholds, self-sealing UPVC doors, non-return valves and air brick covers.
- Combine infiltration (e.g. permeable surfaces) and attenuation (e.g. balancing ponds and flood storage reservoirs) SuDS techniques to overcome constraints to the area of a site set aside for infiltration systems caused by development pressures.

- Where appropriate, opportunities for betterment should be sought where surface water flooding issues are present, which could be implemented through Supplementary Planning documents for individual settlements.
- Encourage the use of permeable surfacing in gardens and use measures to optimise drainage and reduce runoff.
- Consider opportunities for water conservation through rainwater harvesting and water butts where appropriate for new and existing development.
- Promote land management practices where appropriate to attenuate runoff and alleviate potential issues downstream.

Further site-specific recommendations have been made in the Level 2 regarding Cumulative Impact Assessment. These are made in Chapter 9.

10.4 Guidance for windfall sites and sites not assessed in the L2

- For sites not represented in the Environment Agency's Flood Zones, or where Flood Zones do exist, but no detailed hydraulic modelling is present, it is recommended that developers construct detailed hydraulic models at these sites as part of a site-specific FRA using channel, structure and topographic survey, to confirm flood risk.
- If a site's extents either include or borders with a Main River (including a culverted reach of Main River), an easement of 8m is required from either bank for access and maintenance. Any future development will require a flood risk permit from any activity within 8m of a Main River.
- If an ordinary watercourse is within or immediately adjacent to the site area, consultation with the Lead Local Flood Authority should be undertaken. If alterations or discharges are proposed to the watercourse, a land drainage consent will be required.
- Where necessary, blockages of nearby culverts may need to be simulated in a hydraulic model to confirm residual risk to the site.
- Surface water risk should be considered in terms of the proportion of the site at risk in the 30-year, 100-year or 1,000-year events, whether the risk is due to isolated minor ponding or deeper pooling of water, or whether the risk is due to a wider overland flow route.
- Surface water risk and mitigation should be considered as part of a detailed site-specific Flood Risk Assessment and Surface Water Drainage Strategy.
- Access and egress should be considered at the site, but also in the vicinity of the site, for example, a site may have low surface water risk, but in the immediate locality, access/ egress to and from the site could be restricted for vehicles and/ or people.
- Sites where there is a canal within or immediately adjacent to the site area, developers should consult the Canals and Rivers Trust. Any proposed alterations to the canal or discharges must be agreed with the Canals and Rivers Trust.
- If a site is located within 250m of a landfill site, there could be amenity, dirt and contamination issues. Sites could be sensitive from the perspective of controlled waters and therefore any redevelopment must ensure there is no pollution risk to the water environment.

10.5 Use of SFRA data and future updates

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

The SFRA should be a 'living document', and as a result should be updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by the Charnwood Borough Council, Leicestershire County Council, the Highways Authority, Canal and River Trust, Severn Trent Water and the Environment Agency. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a future flood event
- Policy/ legislation updates
- Environment Agency flood map updates
- New flood defence schemes, or alleviation schemes.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment. It is recommended that the SFRA is reviewed in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

10.5.1 Neighbourhood Plans

Flood risk should be fully addressed in the plan preparation and in bringing forward policies for the allocation of land and therefore the SFRA findings should be used in the production of Neighbourhood Plans.

Neighbourhood planners can use the information in the Level 1 and Level 2 SFRA on the sources of flood risk across Charnwood and the flood risk mapping, to assess the risk of flooding to sites within their community. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

The Level 1 SFRA highlights on a broad scale where flood risk from fluvial, surface water, groundwater and the effects of climate change are most likely. The 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 Charnwood are listed in the Level 1 SFRA and updated in Section 5.11 of this report and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by Charnwood Borough Council, Leicestershire County Council and the EA are outlined in Section 9.3 and Section 7.3 signposts to mitigations, resistance and resilience measures in the Level 1 report which can be applied to alleviate flood risk to an area. The Level 2 SFRA uses updated information since the 2018 Level 1 report to assess sites; this includes latest flood incident data from the LLFA and the latest Wood Brook modelling which is not yet publicly available. Please contact the Council to obtain further information.

Appendices

A Level 2 Assessment

A.1 Site summary tables

A.2 GeoPDF mapping

Offices at

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