

# **2018s1371 – Charnwood Borough Council Level 1 Strategic Flood Risk Assessment**

**Final Report**

**December 2018**

[www.jbaconsulting.com](http://www.jbaconsulting.com)

**Charnwood Borough Council**





This page is intentionally left blank

## JBA Project Manager

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

## Revision history

Revision Ref/Date	Amendments	Issued to
Draft Report v1.0/ December 2018	Draft Report	Liz Hopwell (Principal Planning Officer)
Final Report v1.0/ December 2018	Final Report	Liz Hopwell (Principal Planning Officer)
Final Report v2.0/ January 2019	Addition of change in Flood Zones to site screening	Liz Hopwell (Principal Planning Officer)

## Contract

This report describes work commissioned by Liz Hopwell, on behalf of Charnwood Borough Council, by an email dated 12<sup>th</sup> October 2018. Joanne Chillingworth, Lucy Finch and Joe Esgate of JBA Consulting carried out this work.

Prepared by ..... Lucy Finch BSc  
 Assistant Analyst

Joe Esgate BSc  
 Assistant Analyst

Reviewed by ..... Joanne Chillingworth BSc MSc MCIWEM C.WEM  
 Principal Analyst

Hannah Coogan BSc MCIWEM C.WEM  
 Technical Director

## Purpose

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

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

## Acknowledgements

We would like to acknowledge the assistance of:

- Charnwood Borough Council;
- Leicestershire County Council, including Highways;
- Environment Agency;
- Canals and River Trust;
- Severn Trent Water;
- Fire and Rescue; and
- Planners at the neighbouring authorities

## Copyright

© Jeremy Benn Associates Limited 2018.

## Carbon footprint

A printed copy of the main text in this document will result in a carbon footprint of 462g if 100% post-consumer recycled paper is used and 588g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

## Executive summary

### Introduction

The Level 1 Strategic Flood Risk Assessment (SFRA) 2018 document was created with the purpose of supporting the production of Charnwood Borough Council's Local Plan to 2036. This will provide an understanding of the risk from all types of flooding across Charnwood Borough and present clear and robust evidence. It will also provide useful information to inform future Infrastructure Planning and Neighbourhood Plans.

### Strategic Flood Risk Assessment Objectives

The key objectives of the Level 1 Strategic Flood Risk Assessment are:

- Inform Charnwood Borough Council's Local Plan by assessing flood risk from all sources, current and future.
- Critically review the Level 1 element of the 2014 SFRA to provide an update, taking into account latest flood risk information and updates to policy.
- Provide an assessment of the flood risk associated with each of the sites identified in the 2018 SHELAA (Strategic Housing and Economic Land Availability Assessment).
- Produce a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the Local Plan.
- Provide recommendations to inform the development of new policies to be included in the Local Plan, development control and technical issues.

### Strategic Flood Risk Assessment Outputs

The outputs of the Level 1 SFRA are as follows:

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Inclusion of new and/or amended data sources.
- Appraisal of all potential sources of flooding, including Main River, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Flood Risk Assessment guidance for developers.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

## Summary of Level 1 Assessment

### Sources of flood risk

Parts of Charnwood Borough are at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation and canal overtopping/breaches. This study has shown that the most significant sources of flood risk in Charnwood Borough are fluvial and surface water.

- *Fluvial flooding:* The primary fluvial flood risk is along the River Soar, the River Wreake and their tributaries. These present fluvial flood risk to rural communities as well as to the main urban centres including, but not exclusively, Loughborough, Syston, Thurmaston and Quorn. The floodplains are wide along the River Soar and River Wreake due to lower lying, flat topography.
- *Surface water:* The Risk of Flooding from Surface Water map shows a number of prominent overland flow routes. These predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas.
- *Sewer:* The sewers in Charnwood Borough are managed by Severn Trent Water. Severn Trent Water provided their Flood Risk Register which denotes 212 properties at risk from sewer flooding in the borough.
- *Groundwater:* The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of Charnwood Borough is within the <25% susceptible classification, due to the lower permeability of the bedrock.
- *Canals:* There is one canal in Charnwood Borough, the Grand Union Canal. The canal has the potential to interact with other watercourses and become a flow path during flood events or in a breach scenario. There have been two incidents of breach on the Grand Union Canal in Charnwood at Wanlip in 1962 and Barrow Weir in 1971. There has been one incident of overtopping in 2014 near Wanlip.
- *Reservoirs:* There is a potential risk of flooding from reservoirs both within the borough and those outside. There are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

### Defences

The risk of rapid inundation following defence overtopping or breach is limited to areas of Loughborough, Quorn, Thurmaston, Barrow upon Soar, Rothley, Sileby, East Goscote and other rural areas protected by minor defences. The condition of these defences varies from poor to good, with Standards of Protection up to 100 years.

### Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments have been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Flood Risk Management Authorities such as the Lead Local Flood Authority and the Environment Agency.

When necessary, development and redevelopment within Charnwood Borough will require a Flood Risk Assessment appropriate to the scale of the development and the scope as

agreed with the Lead Local Flood Authority and/or Environment Agency. Flood Risk Assessments should consider flood risk from all sources including residual risk, along with promotion of Sustainable Drainage Systems to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood. Latest climate change guidance (published in February 2016) should also be considered, for the lifetime of developments.

## **Recommendations**

The following recommendations are made for the Council to consider as part of their planning policy and flood risk management:

### **Sequential and Exception tests**

Areas of the borough are at high risk from river and/or surface water flooding. Charnwood Borough Council should use the information in this SFRA when deciding which development sites to take forward in their Local Plan by applying the Sequential Test. Developers should consult with Charnwood Borough Council and the Environment Agency (where relevant), at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

### **Site-specific Flood Risk Assessments**

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses 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. Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping, particularly with climate change increases on peak flows. Any improvements to defences should ensure they are in keeping with wider catchment policy.

The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk.

### **Windfall Sites**

The acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

### **Drainage assessments and promotion of Sustainable Drainage Systems**

Planners should refer to the guidance and standards set out on Leicestershire County Council's [website](#) when assessing planning applications. Developers should be able to submit the information outlined in the 'Planning Applications: Lead Local Flood Authority Statutory Consultation Checklist' document to demonstrate how local SuDS standards have been met.

### **Strategic solutions**

Developers should consult with Leicestershire County Council at pre-application stage to determine the latest progress with the programme of flood alleviation schemes and opportunities for Natural Flood Management (NFM), culvert day lighting and river restoration on/off site. Risk Management Authorities (RMAs) should work together through flood risk studies for high priority locations to determine where land should be safe guarded

for future flood alleviation works, such as flood storage, SuDS retrofit or NFM. The Environment Agency should also be consulted at pre-application stage if there are potential opportunities, particularly if there is land required to be safeguarded for potential schemes or where the development may incorporate flood risk measures to alleviate flood risk downstream. They encourage discussions in the early stages of development and offer both a preliminary free level response, and more detailed advice under a cost-recovery basis.

### **Cumulative Impact**

The following Planning Policy recommendations are made in the Loughborough SWMP for the Critical Drainage Areas and other high-risk areas. These could also be considered for other areas of significant surface water flood risk in Charnwood Borough and where cumulative impact is likely to have the greatest impact on flood risk:

- 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.

The NPPG states that a Flood Risk Assessment is required for all proposed development (regardless of size) in CDAs.

The following general recommendations should be considered for areas sensitive to the cumulative impact of development:

- For rural villages at low risk of flooding, Leicestershire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major developments. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- The LLFA and other RMAs should use the information in this SFRA to inform a long-term pipeline of flood alleviation studies and schemes to help inform where further contributions from developers on/off site would be beneficial.

### **Use of Strategic Flood Risk Assessment data**

It is important to recognise that Level 1 Strategic Flood Risk Assessments are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. The primary purpose of this Strategic Flood Risk Assessment data is to provide an evidence base to inform Charnwood Borough Council's Local Plan and any future flood risk policies. This Strategic Flood Risk Assessment is intended to help Charnwood Borough Council in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 Strategic Flood Risk Assessment. The Strategic Flood Risk Assessment can also be used by private developers, as a starting point, to help appraise the flood risk to their proposed development or re-development site.

This 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. At the time of writing, this report was developed using the best available information but should be updated when new information on flood risk, planning guidance or legislation becomes available.

It is recommended that the Strategic Flood Risk Assessment is reviewed internally on a quarterly basis, in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the Strategic Flood Risk Assessment, allowing a cycle of review and a review of any updated data by checking with Charnwood Borough Council, Leicestershire County Council, the Highways Authority, Severn Trent Water and the Environment Agency for any new information.



This page is intentionally left blank

## Contents

Executive summary .....	v
Introduction .....	v
Strategic Flood Risk Assessment Objectives .....	v
Strategic Flood Risk Assessment Outputs .....	v
Summary of Level 1 Assessment.....	vi
<b>1 Introduction .....</b>	<b>1</b>
1.1 Purpose of the Strategic Flood Risk Assessment.....	1
1.2 SFRA Objectives .....	1
1.3 SFRA outputs .....	1
1.4 SFRA Study Area .....	2
1.5 Consultation .....	4
1.6 Use of SFRA data .....	4
1.7 Future updates .....	6
<b>2 The Planning Framework and Flood Risk Policy .....</b>	<b>8</b>
2.1 Introduction .....	8
2.2 Roles and responsibilities for Flood Risk Management in Charnwood Borough .....	10
2.2.1 Leicestershire County Council as Lead Local Flood Authority .....	11
2.3 Relevant flood risk policy documents .....	11
2.3.1 Flood Risk Regulations (2009).....	11
2.4 Flood and Water Management Act (2010) .....	12
2.4.1 Leicestershire County Council Local Flood Risk Management Strategy (LFRMS) 2015 .....	12
2.4.2 LLFAs, surface water and SuDS .....	13
2.4.3 The National Flood and Coastal Erosion Risk Management Strategy for England (2011).....	13
2.5 Water Cycle Studies .....	14
2.6 Surface Water Management Plans .....	14
2.7 Catchment Flood Management Plans .....	15
2.8 The Water Framework Directive .....	15
2.8.1 River Basin Management Plans.....	16
2.9 National Planning Policy and Guidance .....	16
<b>3 The sequential, risk-based approach .....</b>	<b>20</b>
3.1 Applying the Sequential Test and Exception Test in the preparation of a Local Plan .....	21
3.2 Applying the Sequential Test and Exception Test to individual planning applications .....	23
3.2.1 Sequential Test .....	23
3.2.2 Exception Test .....	24
3.3 Actual and residual flood risk.....	25
3.3.1 Actual flood risk .....	25
3.3.2 Residual Flood Risk.....	25
3.4 Review of developer Flood Risk Assessments.....	25
<b>4 Assessment of flood risk to SHELAA sites.....</b>	<b>28</b>
<b>5 Impact of Climate Change .....</b>	<b>30</b>
5.1 Revised Climate Change Guidance.....	30
5.1.1 High ++ allowances.....	31
5.1.2 Which peak river flow allowance to use?.....	31

5.2	Peak rainfall intensity allowance.....	32
5.3	Using climate chance allowances.....	32
5.4	Impact of climate change in Charnwood Borough .....	32
6	Sources of information used in preparing the SFRA .....	34
6.1	Data used to inform the SFRA.....	34
6.1.1	Other relevant flood risk information.....	35
7	Understanding flood risk in Charnwood Borough .....	36
7.1	Historical flooding .....	36
7.2	Topography, geology, soils and hydrology .....	39
7.2.1	Topography .....	39
7.2.2	Geology and Soils.....	39
7.2.3	Hydrology .....	43
7.3	Fluvial flood risk.....	45
7.4	Surface water flooding.....	45
7.5	Groundwater flooding .....	45
7.6	Flooding from sewers .....	46
7.7	Flooding from canals .....	47
7.8	Flooding from reservoirs .....	48
7.9	Flood warning and emergency planning .....	50
7.9.1	Emergency planning .....	50
8	Flood defences and assets.....	58
8.1	Flood defences and standard of protection .....	58
8.1.1	Defence Conditions.....	58
8.2	Residual flood risk.....	61
8.3	Flood alleviation schemes.....	61
8.3.1	Swithland Brook.....	61
8.4	LLFA Asset Register.....	61
9	Cumulative impact of development and cross-boundary issues .....	63
9.1	Cumulative impact of development .....	63
9.2	Cross-boundary issues.....	64
9.2.1	Melton Borough Council.....	65
9.2.2	Blaby District Council .....	65
9.2.3	Leicester City Council.....	65
9.2.4	Harborough District Council .....	65
9.2.5	Rushcliffe Borough Council .....	65
9.2.6	North West Leicestershire District Council.....	65
9.2.7	Hinckley and Bosworth Borough Council .....	65
9.3	Water quality considerations .....	66
10	FRA requirements and guidance for developers .....	67
10.1	Over-arching principles.....	67
10.1.1	Planning consultees .....	67
10.2	Requirements for site-specific Flood Risk Assessments.....	67
10.2.1	What are site-specific FRAs? .....	67
10.2.2	When is a FRA required? .....	67

10.2.3	Objectives of site-specific FRAs .....	68
10.3	Flood risk management guidance - Mitigation measures.....	68
10.3.1	Site layout and design .....	68
10.3.2	Raised floor levels .....	69
10.3.3	Access and egress .....	70
10.3.4	Modification of ground levels.....	70
10.3.5	Development and raised defences .....	71
10.3.6	Developer contributions .....	71
10.4	Flood risk management guidance - Resistance measures .....	71
10.5	Flood risk management guidance - Resilience measures .....	72
10.6	Reducing flood risk from other sources .....	73
10.6.1	Groundwater .....	73
10.6.2	Surface water and sewer flooding.....	73
10.6.3	Sustainable Drainage Systems .....	73
<b>11</b>	<b>Surface water management and SuDS .....</b>	<b>75</b>
11.1	What is meant by Surface Water Flooding?.....	75
11.2	Role of the LLFA and Local Planning Authority in surface water management.....	75
11.3	Sources of SuDS guidance .....	76
11.3.1	Leicestershire County Council – guidance notes.....	76
11.3.2	C753 CIRIA SuDS Manual (2015) .....	76
11.3.3	Non-Statutory Technical Guidance, Defra (March 2015) .....	76
11.3.4	Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016).....	77
11.4	Other surface water considerations .....	77
11.4.1	Groundwater Vulnerability Zones.....	77
11.4.2	Groundwater Source Protection Zones (GSPZ) .....	77
11.5	Nitrate Vulnerable Zones.....	80
<b>12</b>	<b>Strategic flood risk solutions.....</b>	<b>82</b>
12.1	Introduction .....	82
12.2	Current programme of Flood Alleviation Schemes .....	82
12.3	Natural flood management.....	82
12.4	Flood storage .....	83
12.5	Catchment and floodplain restoration .....	83
12.6	Culverts.....	84
<b>13</b>	<b>Summary.....</b>	<b>86</b>
13.1	Sources of flood risk.....	86
13.2	Defences.....	86
13.3	Development and flood risk.....	86
13.4	Surface water and SuDS .....	87
13.5	Cross boundary and cumulative impacts .....	87
13.6	Status of the SFRA .....	87
<b>14</b>	<b>Recommendations.....</b>	<b>88</b>
14.1	Development Sequential and Exception tests.....	88
14.1.1	Site-specific Flood Risk Assessments.....	88
14.2	Windfall sites.....	88
14.3	Drainage assessments and promotion of SuDS .....	88
14.4	Strategic solutions .....	88

14.5	Cumulative Impacts .....	89
	Appendices.....	90
A	Charnwood Borough Council Level 1 SFRA Geo-PDFs.....	90
B	SHELAA Site Screening tables.....	90

## List of Figures

Figure 1-1 Study Area	3
Figure 2-1 Strategic planning links and key documents for flood risk	9
Figure 2-2 Flood Risk and the preparation of Local Plans†	18
Figure 3-1 Applying the Sequential Test in the preparation of a Local Plan	22
Figure 3-2 Applying the Exception Test in the preparation of a Local Plan	23
Figure 7-1 Historic flooding incidents by settlement in Charnwood Borough since 2011/38	
Figure 7-2 Topography of Charnwood Borough	40
Figure 7-3 Bedrock formations in Charnwood Borough	41
Figure 7-4 Superficial deposits in Charnwood Borough	42
Figure 7-5 Key watercourses in Charnwood Borough	44
Figure 8-1 Map of LLFA Asset Register within Charnwood Borough	62
Figure 11-1 Four pillars of SuDS design	76
Figure 11-2 Groundwater Source Protection Zones	79

## List of Tables

Table 1-1 SFRA report contents	5
Table 2-1 Roles and responsibilities for flood risk management in Charnwood Borough	10
Table 2-2 Roles and responsibilities as a Lead Local Flood Authority	11
Table 3-1 Flood Zone descriptions	20
Table 5-1 Peak river flow allowances by river basin district	31
Table 5-2 Peak rainfall intensity allowance in small and urban catchments	32
Table 6-1 Overview of supplied data for Charnwood Borough SFRA	34
Table 7-1 Documented Historic Flood Records in Charnwood Borough	36
Table 7-2 Properties at risk from sewer flooding (Severn Trent Water)	47
Table 7-3 Reservoirs that may potentially affect Charnwood Borough in the event of a breach	49
Table 7-4 Summary of Flood Risks in Charnwood Borough	52
Table 8-1 Defence asset condition rating	58
Table 8-2 Formal Flood Defences in Charnwood Borough	59

## 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.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan - A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	The cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second; also m <sup>3</sup> /s.
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
Design flood	This is a flood event of a given annual flood probability, which is generally taken as:  fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or;  tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
Exception Test	Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.
FCERM	Flood and Coastal Erosion Risk Management
FEH	Flood Estimation Handbook

Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
IDB	Internal Drainage Board
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
Jflow	2D generalised hydrodynamic modelling software.
LFRMS	Local Flood Risk Management Strategy
LIDAR	Light Detection and Ranging

LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.
PPS25	Planning Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG
RBMP	River Basin Management Plan
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	Operating authorities who's remit and responsibilities concern flood and/or coastal risk management.

RoFFSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessment
SMP	Shoreline Management Plan
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.



This page is intentionally left blank

## **1 Introduction**

### **1.1 Purpose of the Strategic Flood Risk Assessment**

JBA Consulting were commissioned by Charnwood Borough Council to prepare a Level 1 Strategic Flood Risk Assessment (SFRA). The purpose of this study is to provide a comprehensive and robust evidence base to inform the preparation of the Local Plan to 2036. This SFRA replaces the “Charnwood Strategic Flood Risk Assessment Update”, prepared by JBA in June 2014.

This study focusses on a Level 1 SFRA, which is identified by the Planning Practice Guidance as “Where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient details to enable the application of the Sequential Test.”

The 2018 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.

### **1.2 SFRA Objectives**

The key objectives of the Level 1 Strategic Flood Risk Assessment are:

- Inform Charnwood Borough Council’s Local Plan by assessing flood risk from all sources, current and future.
- Critically review the Level 1 element of the 2014 SFRA to provide an update, taking into account latest flood risk information and updates to policy.
- Provide an assessment of the flood risk associated with each of the sites identified in the 2018 SHELAA (Strategic Housing and Economic Land Availability Assessment).
- Produce a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the Local Plan.
- Provide recommendations to inform the development of new policies to be included in the Local Plan, development control and technical issues.

### **1.3 SFRA outputs**

To meet the objectives, the following outputs have been prepared:

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Inclusion of new and/or amended data sources.
- Appraisal of all potential sources of flooding, including Main River, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Flood Risk Assessment guidance for developers.

- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

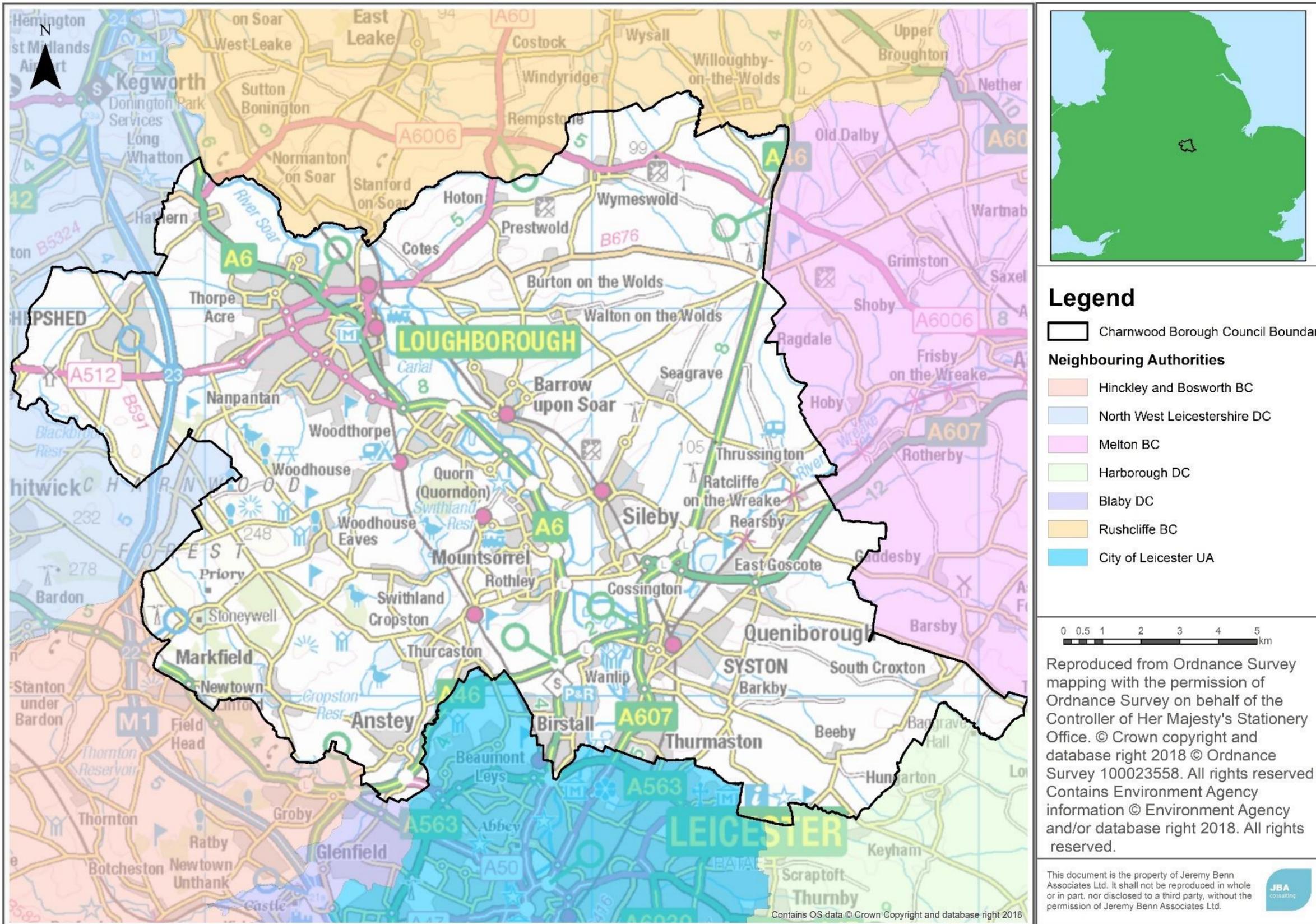
#### **1.4 SFRA Study Area**

Charnwood Borough covers an area of 279.06km<sup>2</sup> and has a population of approximately 181,000 (2011 census). The largest settlement in the borough is Loughborough, which has a population of approximately 59,317. The other main urban areas in Charnwood Borough include Shepshed, Syston, Sileby, Barrow upon Soar, Quorn, Mountsorrel, Anstey, Birstall, Thurmaston and Rothley. The population of Charnwood is expected to rise to 209,000 by 2036.

The main watercourses in Charnwood are the River Soar, River Wreake, Rothley Brook, Sileby Brook, Barkby Brook, Queniborough Brook, Burleigh Brook and Black Brook. The River Soar is the principal watercourse in the study area and the vast majority of watercourses in the borough drain into it.

An overview of the study area is shown in Figure 1-1.

Figure 1-1 Study Area



## 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 version of the SFRA:

- Environment Agency
- Leicestershire County Council
- Canal and River Trust
- Leicestershire Highways
- Leicestershire Fire and Rescue
- 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

## 1.6 Use of SFRA data

It is important to recognise that Level 1 SFRAs are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. 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 1.2. This SFRA is intended to aid Charnwood Borough Council in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 SFRA.

The data contained in this SFRA also has several other uses, in addition to that which is noted above. 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.

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

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

**Table 1-1 SFRA report contents**

Section	Contents	Use of data
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.	For users to understand the purpose, objectives and outputs of the study.
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.	There are other studies and policy/legislation that complement the SFRA and these may need to be referred to in the Local Plan and/or site-specific FRAs (where relevant).
3. The sequential, risk-based approach	Provides an overview of Flood Zones, application of the Sequential Approach and Sequential/Exception Test process.	Provides guidance for the Council on the application of the Sequential and Exception Test.
4. The impact of climate change	Outlines climate change guidance published by the Environment Agency in February 2016.	Updated climate change guidance must be considered in all new developments and planning applications.
5. Summary of SFRA mapping for all sources of flood risk and methodology	Outlines what information has been used in the preparation of the SFRA including any data gaps.	The methodology will provide users with an understanding of where broad-scale or detailed models have been used to identify the fluvial flood risk. Any data gaps identified may help to shape future strategic flood risk studies or indicate where studies need to be undertaken at a site-specific level.
6. Understanding flood risk in Charnwood Borough	Gives an introduction to the assessment of flood risk and provides an overview of the characteristics of flooding affecting Charnwood Borough including historical flooding incidents, flood risk from canals and reservoirs and flood warning arrangements.	The outputs (including mapping) will identify communities in the study area at flood risk and the potential sources. This will be used to help the Council apply the Sequential Test and if necessary, the Exception Test to site allocations proposed in the Local Plan. Private developers should consider the findings of this SFRA, particularly in relation to site-specific FRAs, the application of the Sequential and Exception Test, and/or drainage strategies. The Council should also review the findings in relation to any strategic flood emergency plans.
7. Flood defences and assets, residual risk	Assessment of residual risk from flood defences, including future protection from climate change and on-going flood defence schemes.	The residual risk must be considered in relation to new development, alongside how the residual risk is to be mitigated.
8. Cumulative impact of development and cross boundary issues	Broadscale assessment of areas where the cumulative impact of development may be detrimental to flood risk. An assessment of potential cross boundary flood risk issues as a result of future large-scale developments.	The Council and neighbouring authorities should consider the policy recommendations in this section.
9. Flood Risk Assessment and Surface Water Drainage Strategy requirements and guidance for	Outlines requirements for Flood Risk Assessments (FRAs) and Surface Water Drainage Strategies as well as providing guidance for developers	This section is intended to offer guidance for developers in preparation of site-specific FRAs and/or drainage strategies. It links to advice from the Environment Agency and

developers		Charnwood Borough Council.
10. Surface water management and SuDS	Advice on managing surface water run-off, and how SuDS play an important role.	This section is intended to offer guidance for developers and the Council in the use of SuDS and the management of surface water at development sites. This complements, but does not replace national or local SuDS/surface water guidance/requirements.
11. Strategic Flood Risk Solutions	Summary of Strategic Flood Risk Solutions.	The potential strategic flood risk solutions that could be considered by the Council and other flood management authority partners.
12. Summary	Summary of SFRA assessment and key findings	
13. Recommendations	Outlines key recommendations	Key recommendations should be considered by the Council.
Appendix A: Level 1 SFRA mapping - GeoPDFs		The appendices are intended to map the sources of flood risk in Charnwood Borough and to help users identify whether a site is at flood risk and from what source. The appendices are intended to complement EA datasets and do not seek to replace these. Developers should refer to both the SFRA and EA datasets (where relevant). The SFRA outputs do not remove requirements for site-specific FRAs, drainage strategies or further detailed modelling at a site-specific level.

### 1.7 Future updates

This SFRA provides an overview of the flood risk to Charnwood Borough and draws together all sources of flooding including fluvial, surface water, reservoir, canal, sewer and groundwater. 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 Charnwood Borough Council, Leicestershire County Council, the Highways Authority, Canal and River Trust, Severn Trent Water, neighbouring authorities 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 etc.

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 internally on a quarterly basis, 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.

## 2 The Planning Framework and Flood Risk Policy

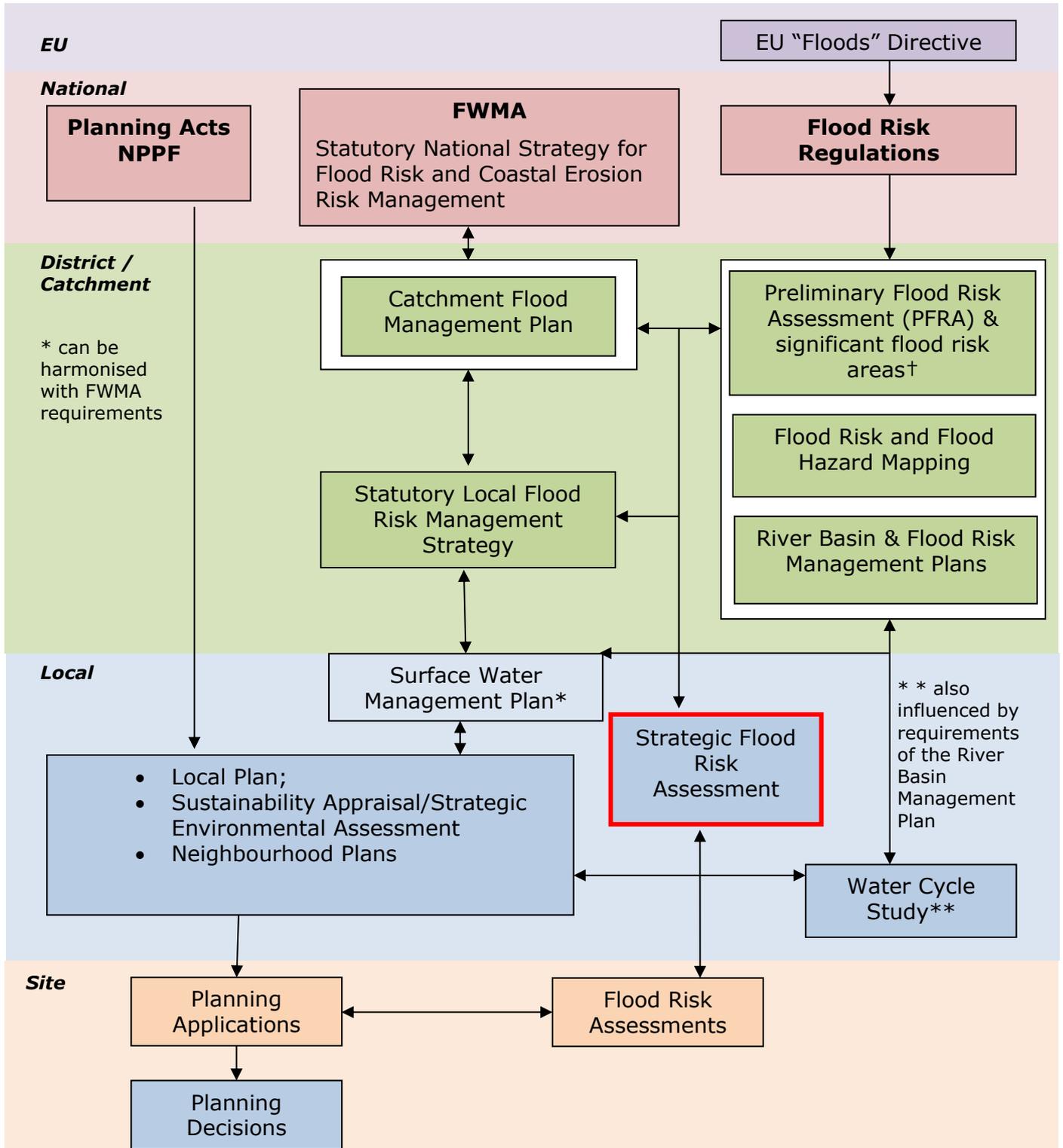
### 2.1 Introduction

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 SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities. 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 Studies (WCSs).

Figure 2-1 outlines the key strategic planning links for flood risk management and associated documents. It shows how the Flood Risk Regulations and Flood and Water Management Act, in conjunction with the Localism Act's "duty to cooperate", introduce a wider requirement for the mutual exchange of information and the preparation of strategies and management plans.

**Figure 2-1 Strategic planning links and key documents for flood risk**



**Legend: Responsibilities are indicated using colour coding as follows**

European Union	National Government	Local Planning Authority	EA/LLFA/Local Authorities	Developer
----------------	---------------------	--------------------------	---------------------------	-----------

## 2.2 Roles and responsibilities for Flood Risk Management in Charnwood Borough

There are a number of different organisations in and around Charnwood Borough Council that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown in Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding. 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 LLFAs 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 in Charnwood Borough**

Risk Management Authority	Strategic Level	Operational Level
Environment Agency	<ul style="list-style-type: none"> <li>Strategic overview for all sources of flooding</li> <li>National Strategy</li> <li>Reporting and general supervision</li> </ul>	<ul style="list-style-type: none"> <li>Main rivers</li> <li>Reservoirs</li> </ul>
Leicestershire County Council as Lead Local Flood Authority (LLFA)	<ul style="list-style-type: none"> <li>Preliminary Flood Risk Assessment</li> <li>Local Flood Risk Management Strategy</li> </ul>	<ul style="list-style-type: none"> <li>Surface Water</li> <li>Groundwater</li> <li>Ordinary Watercourses (consenting and enforcement)</li> <li>Ordinary watercourses (works)</li> </ul>
Charnwood Borough Council as Local Planning Authority	<ul style="list-style-type: none"> <li>Local Plans as Local Planning Authorities</li> </ul>	<ul style="list-style-type: none"> <li>Determination of Planning Applications as Local Planning Authorities</li> </ul>
Water Companies <i>Severn Trent Water</i>	<ul style="list-style-type: none"> <li>Asset Management Plans supported by Periodic Reviews (business cases)</li> </ul>	<ul style="list-style-type: none"> <li>Public sewers</li> </ul>
Highways Authorities <i>Highways Agency (motorways and trunk roads)</i> <i>Charnwood Borough Council (other adopted roads)</i>	<ul style="list-style-type: none"> <li>Highway drainage policy and planning</li> </ul>	<ul style="list-style-type: none"> <li>Highway drainage</li> </ul>

### 2.2.1 Leicestershire County Council as Lead Local Flood Authority

There are both strategic and operational elements to the role of Lead Local Flood Authority and these are set out in Table 2-2.

**Table 2-2 Roles and responsibilities as a Lead Local Flood Authority**

Strategic	Operational
<ul style="list-style-type: none"> <li>• Develop, maintain, apply and monitor a Local Flood Risk Management Strategy.</li> <li>• Co-ordinate partnership working between relevant organisations.</li> <li>• Represent Leicestershire on the Trent Regional Flood and Coastal Committee.</li> <li>• To comply with the European Floods Directive, produce a Preliminary Flood Risk Assessment and for nationally significant Flood Risk Areas, surface water mapping and a Flood Risk Management Plan (on a six-year cycle).</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate flooding incidents and set out who has responsibilities and what actions can be taken.</li> <li>• Hold a register of significant drainage/flood alleviation assets.</li> <li>• Power to designate third party assets acting as flood defences so they cannot be altered or removed.</li> <li>• Powers to enforce land drainage legislation to ensure ordinary watercourses flow properly and a duty to consent to certain works on these watercourses.</li> <li>• Powers to build new flood alleviation schemes for local sources of flooding.</li> <li>• Statutory Consultee for Planning Applications for surface water drainage on major developments</li> </ul>

### 2.3 Relevant flood risk policy documents

This section summarises relevant national and local flood risk and water management documents and policies. Some of these are required by EU legislation. The UK is due to leave the EU in March 2019; however, both the Floods Directive and Water Framework Directive have been applied into English law using secondary legislation. Until this secondary legislation is reviewed, these requirements will remain.

#### 2.3.1 Flood Risk Regulations (2009)

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

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

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 are currently undertaking a PFRA for river, sea and reservoir flooding and identifying nationally significant Flood Risk Areas for these sources. This will be published by December 2019.

## 2.4 Flood and Water Management Act (2010)

**The Flood and Water Management Act (2010)** (FWMA) aims to create a simpler and more effective means of managing flood risk and implements Sir Michael Pitt's recommendations following his review of the 2007 floods. The responsibilities for Leicestershire County Council as LLFA are covered in Table 2-2. Below is a summary of some of the work Leicestershire County Council has undertaken to date as a LLFA.

- Leicestershire County Council's **Local Flood Risk Management Strategy** was published in August 2015.
- Guidance Notes providing advice to residents, landowners and developers on flooding and flood risk management available on Leicestershire County Council's **website**.
- A formal flood investigation has been undertaken for Cothlestone Avenue, Loughborough (final report June 2014). This can be requested from Leicestershire County Council.
- Leicestershire County Council is currently undertaking modelling in Charnwood Borough, for example in Swithland.
- **Leicestershire Preliminary Flood Risk Assessment**
- **Loughborough Surface Water Management Plan**
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion are likely to have a significant effect on flood risk in the LLFA area. A Flood Asset Register has been prepared for Leicestershire (see Section 8.4).

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

Leicestershire County Council 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.

#### 2.4.2 LLFAs, surface water and SuDS

The revised 2018 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

At the time of preparing the SFRA, Leicestershire County Council were currently in the process of producing a SuDS guidance document for developers. 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 Local Plan: Adopted Core Strategy. Policy CS16: Sustainable Construction and Energy

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

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

The Strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. It describes how risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment. The Strategy is currently being updated and will be published in 2019.

## 2.5 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 Borough. The report highlighted the following that are relevant to Charnwood Borough Council:

- Water resources: Charnwood Borough 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 Borough 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 Borough which are predicted to receive additional waste water 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 which will be published in 2019.

## 2.6 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 a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

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

## 2.7 Catchment Flood Management Plans

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

The CFMP most relevant to Charnwood is the **River Trent Catchment Flood Management Plan**. Charnwood is located within two of the River Trent CFMP’s sub areas; Rural Leicestershire and Upper Soar and Upper Anker.

The Policy Option in the Rural Leicestershire sub area is defined as “Area of low to moderate flood risk where we will take actions with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits”.

The Policy Option in the Upper Soar and Upper Anker sub area is defined as “Area of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change”.

## 2.8 The Water Framework Directive

The EU Water Framework Directive (WFD) seeks to integrate and enhance the way in which water bodies are managed throughout Europe by the preservation, restoration and improvement of the water environment. On 23 October 2000 the European Commission established the WFD Directive (WFD) requiring each Member State of the European Union to satisfy the environmental objectives set by the Directive and implement the legislation. This was transposed into law in England and Wales in 2003. In England, the Environment Agency is responsible for the delivery of the WFD objectives.

The Directive requires that Environmental Objectives be set for all surface and ground waters in England and Wales to enable them to achieve Good Ecological Status (or Good Ecological Potential for Heavily Modified and Artificial Water Bodies) by a defined date.

Charnwood Borough is made up of two catchments: River Soar and the River Wreake. Of these catchments, there are several waterbodies which are not achieving “good status” for the Water Framework Directive, including parts of both the River Soar and River Wreake. Issues include but are not limited to livestock, abandoned mines, land drainage, poor nutrient management, private sewage treatment, sewage discharge and trade and/or industry discharge. The Environment Agency is working with its partners, businesses and the community to investigate improvements to the ecological status of these water bodies and techniques.

Further information on the ecological status of waterbodies in Charnwood Borough Council is available on the Environment Agency's [Catchment Data Explorer](#).

It is important that developments aim to take positive measures to conform to the WFD, which can be impacted as a result of development, for example in terms of 'deterioration' in ecological status or potential.

### 2.8.1 River Basin Management Plans

The WFD requires the production of Management Plans for each River Basin District. River Basin Management Plans (RBMPs) aim to ensure that all aquatic ecosystems, riparian ecosystems and wetlands reach 'good status'. To achieve 'good status', a waterbody must be observed to be at a level of ecological and chemical quality.

Charnwood Borough falls within the Humber River Basin District. The River Basin District Management Plans highlight a number of actions to a number of issues raised either within the borough as a whole or in sub districts. Further information can be found in the [Humber RBMP](#) and the [Catchment Based Approach \(CaBA\) website](#).

## 2.9 National Planning Policy and Guidance

The [National Planning Policy Framework](#) (NPPF) was published in July 2018, replacing the previous version published in March 2012. The NPPF sets out Government's planning policies for England and how these are expected to be applied. The Framework is based on core principles of sustainability and forms the national policy framework in England. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions.

The NPPF sets out the Government's requirements for the planning system and provides a framework within which local people and councils can produce distinctive local and neighbourhood plans to reflect the needs and properties of their communities. The NPPF must be taken into account by local planning authorities when preparing Local Plans and for applicants preparing planning submissions.

The key changes in the revised 2018 NPPF compared to the 2012 NPPF include:

- Strategic policies should also now consider the 'cumulative impacts in, or affecting, local areas susceptible to flooding' (para 156), rather than just to or from individual development sites;
- Future risk from climate change. The 'sequential approach should be used in areas known to be at risk now or in the future from any form of flooding' (para 158);
- Natural Flood Management. 'Using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques)' (para 157c);
- SuDS. 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165); and
- Emergency planning. Emergency plans are required as part of an FRA that includes the inclusion of safe access and egress routes (para 163e).

[National Planning Practice Guidance](#) (NPPG) was published in 2014 and sets out how the NPPF should be implemented. This will be updated in due course to reflect the changes to the NPPF. [NPPG: Flood Risk and Coastal Change](#) advises

on how planning can account for the risks associated with flooding and coastal change in plan making and the application process. It sets out Flood Zones, the appropriate land uses for each Zone, flood risk assessment requirements, including the Sequential and Exception Tests and the policy aims for developers and authorities regarding each Flood Zone. Further details on Flood Zones and associated policy is provided in Chapter 3 and throughout this report. The Sequential and Exception Tests are covered in greater detail in Sections 3.1 and 3.2.

### **The Sequential Test**

*"The Sequential Test ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The Flood Zones, as refined in the Strategic Flood Risk Assessment for the area, provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required."*

(National Planning Practice Guidance, paragraph 019)

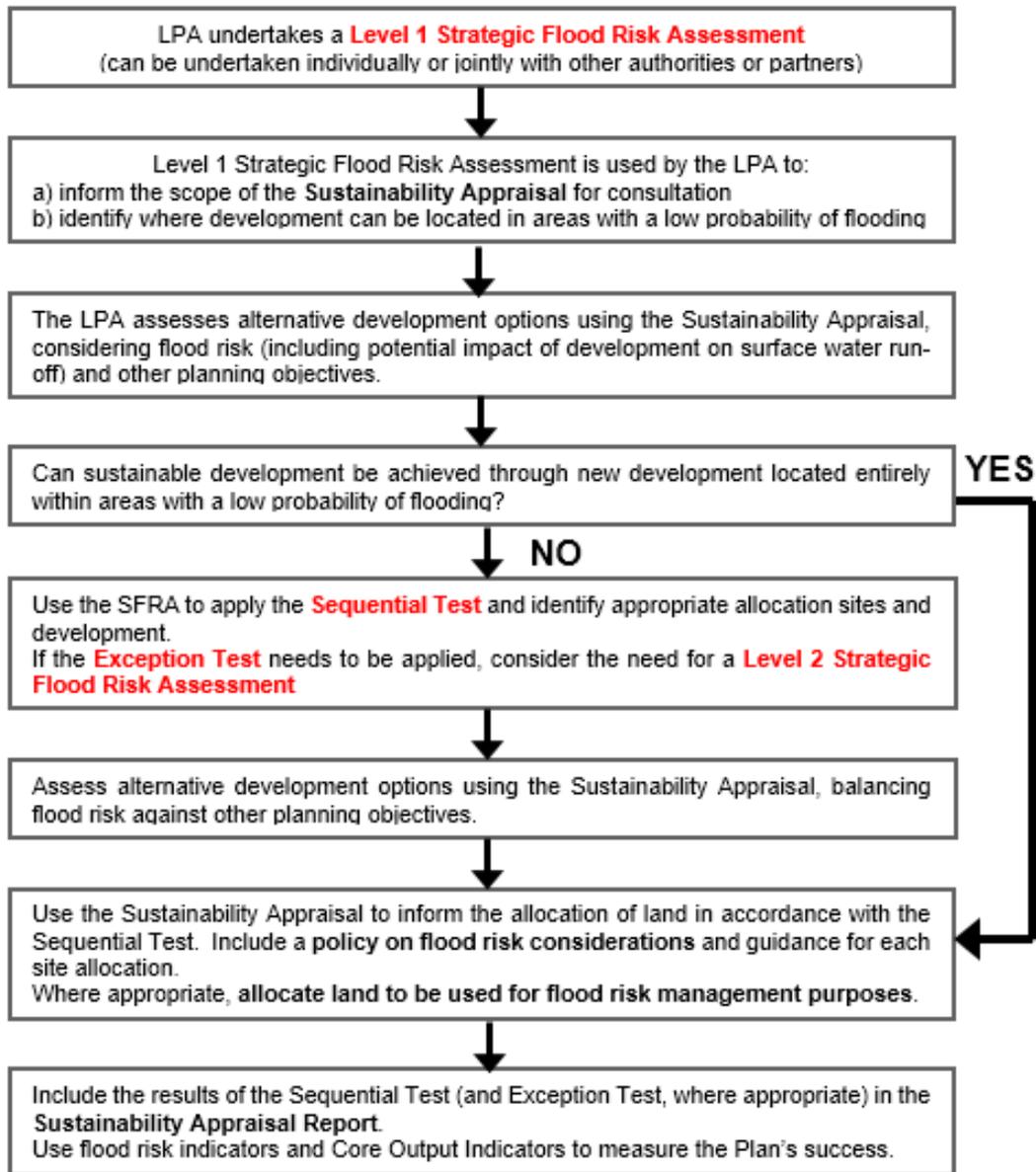
### **The Exception Test**

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

*Essentially, the two parts to the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall."*

(National Planning Practice Guidance, paragraph 023)

**Figure 2-2 Flood Risk and the preparation of Local Plan†**



† Diagram 1 of NPPG: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-005-20140306) March 2014

This page is intentionally left blank

### 3 The sequential, risk-based approach

The NPPF advocates a sequential approach to development allocation via the Sequential Test. This approach is designed to ensure areas with little or no risk of flooding (from any source) are developed in preference to areas at higher risk, with the aim of keeping development outside of medium and high flood risk areas (Flood Zones 2 and 3) and other sources of flooding, where possible. The sequential approach can be applied both between and within Flood Zones. Table 3-1 describes the Flood Zones from the Flood Map for Planning.

The preference when allocating land is, whenever possible, to place all new development on land in Zone 1. Since the Flood Zones identify locations that are not reliant on flood defences, placing development on Zone 1 land means there is no future commitment to spending money on flood banks or flood alleviation measures. It also does not commit future generations to costly long-term expenditure that would become increasingly unsustainable as the effects of climate change increase.

However, it is often the case that it is not possible for all new development to be allocated on land that is not at risk from flooding. In these circumstances the Flood Zone maps (that show the extent of inundation assuming that there are no defences) are too simplistic and a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

**Table 3-1 Flood Zone descriptions**

Zone	Probability	Description
Zone 1	Low	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
		All land uses are appropriate in this zone.
		For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment.
Zone 2	Medium	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1% - 1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1% - 0.5%) in any year.
		Essential infrastructure, water compatible infrastructure, less vulnerable and more vulnerable land uses (as set out by NPPF) as appropriate in this zone. Highly vulnerable land uses are allowed as long as they pass the Exception Test.
		All developments in this zone require an FRA.
Zone 3a	High	This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year

		<p>Developers and the local authorities should seek to reduce the overall level flood risk, relocating development sequentially to areas of lower flood risk and attempting to restore the floodplain and make open space available for flood storage.</p> <p>Water compatible and less vulnerable land uses are permitted in this zone. Highly vulnerable land uses are not permitted. More vulnerable and essential infrastructure are only permitted if they pass the Exception Test.</p> <p>All developments in this zone require an FRA.</p>
Zone 3b	Functional Floodplain	<p>This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain should take account of local circumstances.</p> <p>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. Infrastructure must also not increase flood risk elsewhere.</p> <p>All developments in this zone require an FRA.</p>

**Important note on Flood Zone information in this SFRA**

The Flood Zones presented in Appendix A Geo-PDFs are the same as those shown on the Environment Agency’s ‘Flood Map for Planning’.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses. 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.

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

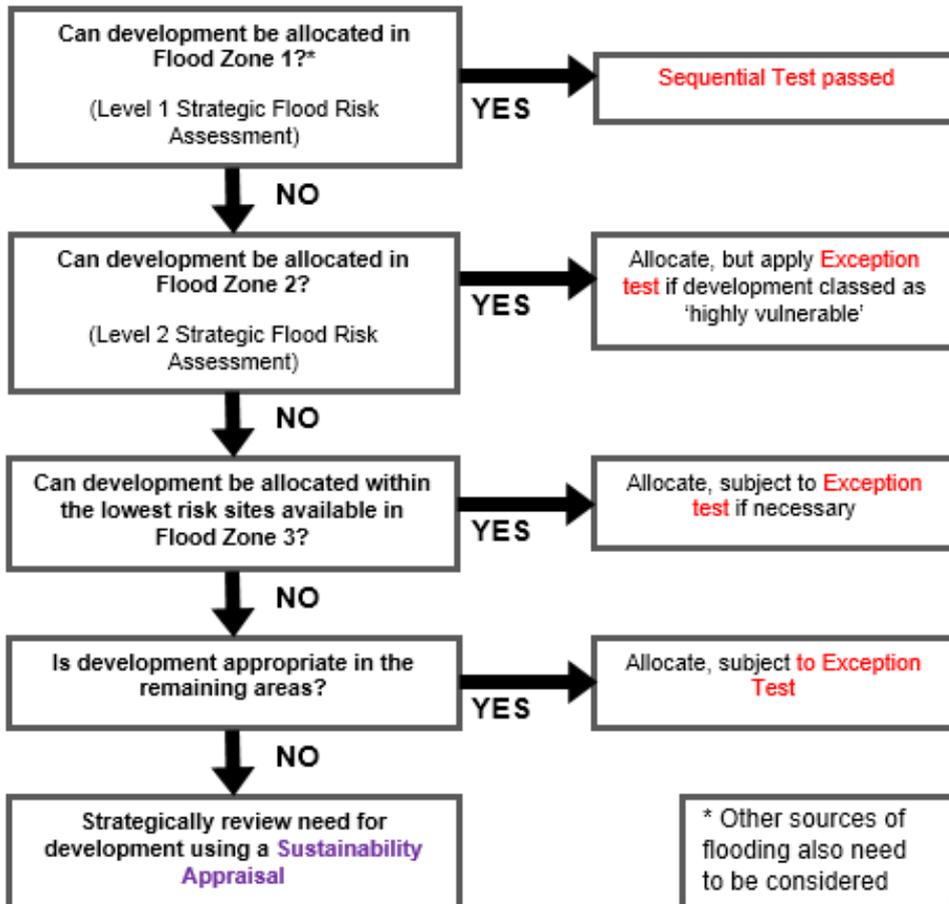
**3.1 Applying the Sequential Test and Exception Test in the preparation of a Local Plan**

When preparing a Local Plan, the Local Planning Authority should demonstrate it has considered a range of site allocations, using SFRAs to apply the Sequential and Exception Tests where necessary.

The Sequential Test should be applied to the whole Local Planning Authority area to increase the likelihood of allocating development in areas not at risk of flooding. The Sequential Test can be undertaken as part of a Local Plan Sustainability

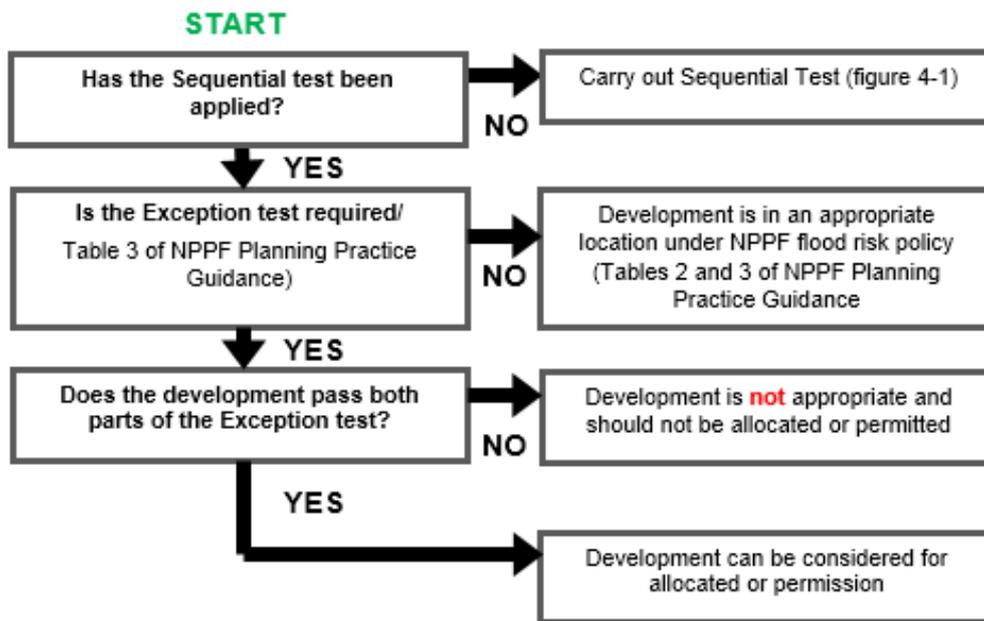
Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPF Planning Practice Guidance for Flood Risk and Coastal Change describes how the Sequential Test should be applied in the preparation of a Local Plan.

**Figure 3-1 Applying the Sequential Test in the preparation of a Local Plan**



The Exception Test should only be applied following the application of the Sequential Test and as set out in Table 3 of the NPPF Planning Practice Guidance: Flood Risk and Coastal Change. The NPPF PPG describes how the Exception Test should be applied in the preparation of a Local Plan (Figure 3-2).

**Figure 3-2 Applying the Exception Test in the preparation of a Local Plan**



### 3.2 Applying the Sequential Test and Exception Test to individual planning applications

#### 3.2.1 Sequential Test

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, in other cases it may be identified by other Local Plan policies. A pragmatic approach should be taken when applying the Sequential Test.

Charnwood Borough Council are responsible for considering the extent to which Sequential Test considerations have been satisfied and will need to be satisfied that the proposed development would be safe and not lead to increased flood risk elsewhere. The Environment Agency may provide advice to the Council regarding the most appropriate flood risk mapping to use to support the Sequential Test should the SFRA be out of date.

The Sequential Test does not need to be applied for individual developments under the following circumstances:

- The site has been identified in development plans through the Sequential Test.
- Applications for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).

It is normally reasonable to presume and state that individual sites that lie in Zone 1 (subject to appropriate assessment, noting the 'Advice to User' on page 21) satisfy the requirements of the Sequential Test; however, consideration should be given to risks from all sources, areas with critical drainage problems and critical drainage areas and the increasing risk of flooding in the future.

The NPPG provides further detailed guidance on the **Sequential Test for applicants**.

### 3.2.2 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 deemed appropriate. The aim of the Exception Test is to ensure that more vulnerable property types, such as residential development can be implemented safely and are not located in areas where the hazards and consequences of flooding are inappropriate. For the Test to be satisfied, both of the following elements have to be accepted for development to be allocated or permitted:

1. *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<sup>1</sup>.

2. *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 can be used to inform the Exception Test at planning allocation stage.

At Planning Permission stage, a 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 following should be considered<sup>2</sup>:

- 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.
- Any funding arrangements required for implementing measures.

The NPPF and NPPG provide detailed information on how the Test can be applied.

---

<sup>1</sup> NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 037, Reference ID: 7-056-20140306) March 2014

<sup>2</sup> NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 038, Reference ID: 7-056-20140306) March 2014  
2018s1371 - Charnwood BC - Level 1 Final Report v2.0.docx

### 3.3 Actual and residual flood risk

#### 3.3.1 Actual flood risk

If it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Zones 2 or 3. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are that residential development should be protected against flooding to the 1 in 100-year with climate change river flooding event.

The assessment of the actual risk should take the following issues into account:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time, the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences, if the present-day levels of protection are to be maintained, and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures.
- The assessment of actual risk can include consideration of the magnitude of the hazard posed by flooding. By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources. This assessment will be needed in circumstances where consideration is given to the mitigation of the consequences of flooding or where it is proposed to place lower vulnerability development in areas that are at risk from inundation.

#### 3.3.2 Residual Flood Risk

Residual risk refers to the risks that remain in circumstances after measures have been taken to alleviate flooding (such as flood defences). It is important that these risks are quantified to confirm that the consequences can be safely managed. Chapter 7 considers this risk in more detail.

### 3.4 Review of developer Flood Risk Assessments

The Council should consult the Environment Agency's **Flood Risk Standing Advice (FRSA) for Local Planning Authorities**, last updated 28 February 2017, when reviewing planning applications for proposed developments at risk of flooding. When considering planning permission for developments, planners may wish to consider the following:

- Will the natural watercourse system which provides drainage of land be adversely affected;

- Will a minimum 8m width access strip be provided adjacent to the top of both banks of any Main River (5m for Ordinary Watercourses), for maintenance purposes and is appropriately landscaped for open space and biodiversity benefits;
- Will the development ensure no loss of open water features through draining, culverting or enclosure by other means and will any culverts be opened up;
- Sustainable drainage systems are given priority to manage surface water flood risk;
- Will there be a betterment in the surface water runoff regime; with any residual risk of flooding, from drainage features either on or off site not placing people and property at unacceptable risk;
- Is the application compliant with the conditions set out by the LLFA? and
- Flood risk reduction opportunities should be sought/improved in the fluvial flood risk regime

This page is intentionally left blank

#### 4 Assessment of flood risk to SHELAA sites

The NPPF requires all local authorities to prepare a Strategic Housing and Economic Land Availability Assessment (SHELAA) (paragraph 67). The purpose of the SHELAA is to identify sites in Charnwood Borough with the potential for housing and employment, to assess that potential and to consider whether these sites are likely to be developed. The SHELAA does not determine whether a site should be allocated or granted planning permission, it simply determines which sites are suitable, available and achievable for housing and employment development.

Appendix B provides an assessment of the flood risk associated with each of the sites in the 2018 SHELAA, by illustrating the percentage of a site area within the Flood Zones, surface water flood extents and historic flood map and provides a comparison against the 2014 Flood Zones to determine if there has been any change in flood risk since the 2014 SFRA.

In total there are 325 sites in the 2018 SHELAA, 70 of which already have planning permission or are allocations in the Core Strategy. These sites have therefore been excluded from the assessment as their flood risk has already been assessed through the planning process, leaving a total 255 sites for assessment.

##### **Note on Flood Zone and Surface Water percentages**

The values quoted in the screening tables in Appendix B shows 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 zone.

For example, 50% of a site is in the Flood Zones. Taking each Flood Zone individually, 50% is in Flood Zone 2 but only 30% is in Flood Zone 3a and only 10% is in Flood Zone 3b. In the screening tables this will be displayed as stated above, i.e. the total % of that particular Flood Zone in that site.

If you would like to know how much of the site is in say Flood Zone 2 'only' (i.e. less the overlapping Flood Zone 3), then these percentages can be subtracted, e.g. 50% of the site is in Flood Zone 2, but as 30% of the site is in Flood Zone 3 (which overlaps Flood Zone 2), this leaves 20% of the site in Flood Zone 2 'only'.

Note that the Flood Zone 3b used in the screening is derived from the 20-year model outlines supplied by the Environment Agency where available. Where no modelled data was available, Flood Zone 3a was used to give an "Indicative 3b". Therefore, it is common for the percentage of a site located in Flood Zone 3a to be the same as the percentage of the site located in Flood Zone 3b, as they will only differ where modelled data is available.

##### **Note on changes to Flood Zones since the 2014 SFRA**

The changes in the percentage of a site located in Flood Zones 1, 2 and 3a since 2014 have been stated in the site screening tables in Appendix B. The cells are colour-coded: blue denotes there has been no change in fluvial flood risk since the 2014 SFRA, green denotes a decrease in fluvial flood risk and red denotes an increase in fluvial flood risk. This is defined for each of the Flood Zones 1, 2 and 3a. The percentage change is given by subtracting the percentage of the site in each Flood Zone in 2018 from the percentage of the site in each Flood Zone in 2014.

This page is intentionally left blank

## 5 Impact of Climate Change

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.

### 5.1 Revised Climate Change Guidance

The Environment Agency published **updated climate change guidance** on 19 February 2016, which must now be considered in all new developments and planning applications.

These allowances are based on UK Climate Impacts predictions from 2009. The UK Climate Impacts Programme published new predictions for climate change in November 2018. The Environment Agency will, in due course, use this information to update their climate change guidance for planners.

The peak river flow allowances show the anticipated changes to peak flow by river basin district which the subject watercourse resides. Once this is determined, guidance on uplift in peak flows are assigned for three allowance categories, Central, Higher Central and Upper End which are based on the 50<sup>th</sup>, 70<sup>th</sup> and 90<sup>th</sup> percentiles respectively. The allowance category to be used is based on the vulnerability classification of the development and the Flood Zones within which it resides.

These allowances (increases) are provided for three climate change 'epochs':

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

One or two of the percentiles are provided for each combination of vulnerability and Flood Zone, which in the latter case provides a 'range' of allowances. The peak river flow allowances show the anticipated changes to peak flow by river basin district, for three future epochs and percentiles, as shown in Table 5-1. Charnwood Borough lies within the Humber river basin district.

**Table 5-1 Peak river flow allowances by river basin district**

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%

**5.1.1 High ++ allowances**

High++ 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**.

**5.1.2 Which peak river flow allowance to use?**

The Flood Zone and flood risk vulnerability classification should be considered when deciding which allowances apply to the development or the plan. The guidance states the information in the tables below. Note that developments should consider the range of allowances identified for each vulnerability classification.

Flood Zone 2

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure		✓	✓
Highly vulnerable		✓	✓
More vulnerable	✓	✓	
Less vulnerable	✓		
Water compatible	None		

Flood Zone 3a

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure			✓
Highly vulnerable	Development not permitted		
More vulnerable		✓	✓
Less vulnerable	✓	✓	
Water compatible	✓		

Flood Zone 3b

Vulnerability classification	Central	Higher Central	Upper end
Essential infrastructure			✓
Highly vulnerable	Development not permitted		
More vulnerable			
Less vulnerable			
Water compatible	✓		

**5.2 Peak rainfall intensity allowance**

Increased rainfall affects river levels and land and urban drainage systems. The table below shows anticipated changes in extreme rainfall intensity in small and urban catchments.

For Flood Risk Assessments, both the central and upper end allowances should be assessed to understand the range of impact.

**Table 5-2 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%

**5.3 Using climate chance allowances**

To help decide which allowances to use to inform the flood levels that the flood risk management strategy will be based on for a development or development plan allocation, the following should be considered:

- 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)
- vulnerability of the proposed development types or land use allocations to flooding
- 'built in' resilience measures used, for example, raised floor levels
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

**5.4 Impact of climate change in Charnwood Borough**

The types of climate change impact relevant to Charnwood Borough are:

- Milder wetter winters
- Hotter drier summers
- Increased rainfall intensity in summer months
- Flashier catchment/site responses and surcharging of piped systems and flooding as a result of poor capacity of structures is expected to increase

- Pressure on existing sewer systems effectively reducing their design standard, leading to more frequent flooding
- The prospect of droughts may increase

It is important to remember that even where flood extents may not significantly increase, flooding is likely to become more frequent under a climate change scenario. For example, what is currently an event with a 2% probability of occurring in any one year, may increase to say a 5% probability under climate change.

The impact of an event with a given probability is also likely to become more severe. For example, as water depths, velocities and flood hazard increase, so will the risk to people and property. Although qualitative statements can be made as to whether extreme events are likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of the localised impact of these changes.

The effect of climate change on groundwater flooding, and those watercourses where groundwater has a large influence on winter flood flows, is more uncertain. 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.

#### **Important note on Climate Change mapping this SFRA**

For this SFRA update, the following hydraulic models were provided by the Environment Agency: Black Brook, Lower Wreake and tributaries, Lower Soar and tributaries and Leicester Climate Change.

Only the Leicester Climate Change model had already been run for the three climate change allowances for the '2080s' timeframe in the Humber River Basin District, the 100-year plus 20%, 30% and 50% defended scenarios.

Where hydraulic models had not already been run for the latest climate change allowances, Flood Zone 2 has been used as a proxy. More detailed hydraulic modelling in these areas will be required at site-specific Flood Risk Assessment stage to confirm flood risk and climate change impacts.

This information was provided to assist the Council with the preparation of their Local Plan. Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs.

Climate change mapping has been provided in Appendix A: Geo-PDFs. The Indicative Flood Zone 2 layer provided under the climate change sub-heading should be viewed in conjunction with the modelled climate change outlines. The Indicative FZ2 extent has been provided where latest climate change models are not available, to serve as an indication of possible extents.

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.

## 6 Sources of information used in preparing the SFRA

### 6.1 Data used to inform the SFRA

Table 6-1 provides an overview of the supplied data, used to inform the appraisal of flood risk for Charnwood Borough.

**Table 6-1 Overview of supplied data for Charnwood Borough SFRA**

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines Hydraulic Modelling Reports	Environment Agency
	2014 SFRA	Charnwood Borough Council
	Historic flood incidents/records	Environment Agency Leicestershire County Council Canal and River Trust Fire and Rescue
	Flood Risk Register – observed and verified reports of rainfall induce sewer flooding	Severn Trent Water
Fluvial (including climate change)	Black Brook (2006, Capita Symonds) Lower Soar and tributaries (2012, JBA) Lower Wreake and tributaries (2015, CH2M) Leicester Climate Change (2017, Arcadis) *Soar flood risk mapping (2002, Mott Macdonald) *Lower Soar (1996)	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 datasets	Environment Agency
Sewer	Flood Risk Register	Severn Trent Water
Reservoir	National Inundation Reservoir Mapping	Environment Agency
Canal	Description of flood incidences	Canal and River Trust

\*Models were provided but not used to inform the study as they were outdated by other models.

Mapping of surface water flood risk in Charnwood Borough 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 1 in 30 (3.3%) each year.
- **Low:** An area has a chance of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%) each year.
- **Very Low:** An area has a chance of flooding of less than 1 in 1,000 (0.1%) each year.

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.

Properties at risk from sewer flooding provided by Severn Trent Water are detailed in Table 7-2. For confidentiality reasons this data has been supplied on a postcode basis.

#### **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<sup>2</sup>. 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. Where the Flood Map for Planning is based on generalised modelling, developers should undertake a more detailed analysis and assessment of the flood risk at the planning application stage.

All of the mapping can be found in the appendices to this SFRA. More details of the mapping structure can be found in Table 1-1.

#### **6.1.1 Other relevant flood risk information**

Users of this SFRA should also refer to other relevant information on flood risk where available and appropriate. The Planning Framework and Flood Risk Policy chapter includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to this study.

## 7 Understanding flood risk in Charnwood Borough

### 7.1 Historical flooding

Charnwood Borough has a history of documented flood events with the main source being from fluvial and surface water sources. Significant historic flood events are highlighted in Table 7-1.

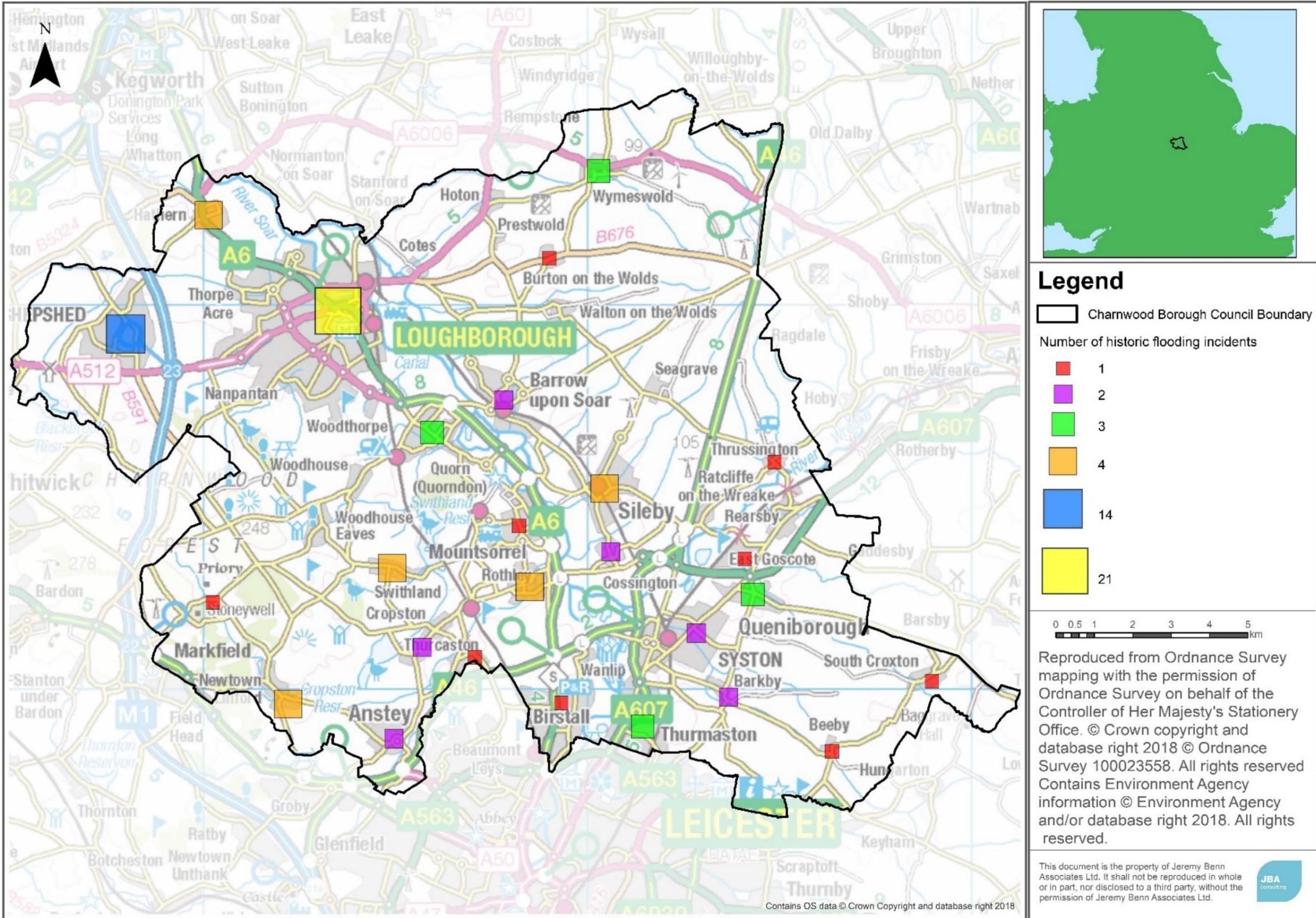
**Table 7-1 Documented Historic Flood Records in Charnwood Borough**

Location	Date	Record Source	Additional Information
Hathern	1912	Historic flood map	
Queniborough	1947	Historic flood map	Fluvial flooding from the Queniborough Brook
Loughborough to Hathern	December 1960	Historic flood map	Fluvial flooding from the River Soar
Borough wide	February 1977	Historic flood map	Fluvial flooding from the Black Brook, Quorn Brook, Rothley Brook, Wood Brook, River Wreake
Hathern	May 1983	Historic flood map	Fluvial flooding from the River Soar
Syston	September 1992	Historic flood map	Fluvial flooding from the Barkby Brook
Rearsby	1998-2000	Historic flood map	Fluvial flooding from the Rearsby Brook
Loughborough	1998	PFRA	Surface water flooding
Borough wide	April 1998	Historic flood map	Fluvial flooding from the River Soar and River Wreake
Borough wide	October 2000	Historic flood map	Fluvial flooding from the River Soar and River Wreake
Charnwood Forest	Summer 2007	PFRA	Surface water flooding due to overland flow affecting Swithland, Woodhouse Eaves, Rothley, Nanpantan and Newtown Linford
Loughborough	June and November 2012	Historic flood map and <b>itv News</b>	Culvert blockage of the Burleigh Brook causing flooding on Lisle Street, further flooding in the town
Alan Moss Road – Loughborough	November 2012	Historic flood map	Fluvial flooding from the Burleigh Brook
Borough wide	November 2012	Historic flood map, LLFA flood incidents and <b>BBC News</b>	Fluvial flooding from the Wood Brook and the River Soar
Mountsorrel and Loughborough	27 <sup>th</sup> January 2013	Fire and rescue flood records and LLFA flood incidents	Flood water present on Slash Lane/Mountsorrel Lane in Mountsorrel, property flooded on Bottleacre Lane in Loughborough
Borough wide	17 <sup>th</sup> /18 <sup>th</sup> March 2013	Fire and rescue flood records	Flooding requiring Fire and Rescue services in Loughborough, Cossington, Syston, Sileby and Ratcliffe on Wreake
Mountsorrel	24 <sup>th</sup> December 2013	Fire and rescue flood records	Approximately 11 inches of water on Slash Lane

Sileby	6 <sup>th</sup> January 2014	Fire and rescue flood records	Evacuation required by Fire Service on Mountsorrel Lane in Sileby
Thurmaston	13 <sup>th</sup> June 2016	Fire and rescue flood records	Flooding on Church Hill Road in Thurmaston requiring Fire Service
Mountsorrel	9 <sup>th</sup> February 2016	Fire and rescue flood records	Flooding on Sileby Road in Mountsorrel requiring Fire Service
Borough wide	9 <sup>th</sup> March 2016	LLFA flood incidents	Flooding affecting highways and properties in Anstey, Barkby, East Goscote, Loughborough, Ulverscroft, Newtown Linford, Queniborough, Rothley, Sileby, Swithland, Syston and Thurcaston
Loughborough	25 <sup>th</sup> February 2016	Fire and rescue flood records	Pumping out required for a flooded cellar on Queens Road
Borough wide	15 <sup>th</sup> June 2016	Fire and rescue flood records, LLFA flood incidents, <b>Loughborough Echo</b>	Heavy rain in the area causing widespread localised flooding

Flooding records relating to flooding incidents from all sources since 2011, provided by Leicestershire County Council are shown in Figure 7-1. Flooding incidents were grouped by settlement and are widespread throughout the borough. There are notable clusters of flooding history in the two largest towns in the borough, Loughborough with 21 historic flooding incidents and Shepshed with 14. The other settlements in the borough have had 4 or less historic flooding incidents according to Leicestershire County Council's records. Dates were not provided for all flooding incidents, however there are notable dates which have a high frequency of recorded incidents; 21<sup>st</sup> November 2012 (4 incidents), 9<sup>th</sup> March 2016 (16 incidents) and 15<sup>th</sup> and 16<sup>th</sup> June 2016 (15 incidents).

Figure 7-1 Historic flooding incidents by settlement in Charnwood Borough since 2011



## 7.2 Topography, geology, soils and hydrology

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

### 7.2.1 Topography

There are three distinct topographic regions within Charnwood Borough; raised elevations of Charnwood Forest in the west, the central low-lying south to north floodplain of the River Soar and the raised area of the Wolds to the east. Elevations range from 245m AOD in the west to 44m AOD in the River Soar floodplain, to 150m AOD in the Wolds to the east. The topography of the study area is shown in Figure 7-2.

### 7.2.2 Geology and Soils

The geology of the catchment can be an important influencing factor on the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

Figure 7-3 shows the bedrock (solid permeable) formations in Charnwood Borough and Figure 7-4 shows the superficial (permeable, unconsolidated (loose) deposits. These are classified as the following:

- *Principal*: layers of rock or drift deposits with high permeability which, therefore, provide a high level of water storage
- *Secondary A*: rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers
- *Secondary B*: lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater
- *Secondary undifferentiated*: rock types where it is not possible to attribute either category A or B
- *Unproductive Strata*: rock layers and drift deposits with low permeability and therefore have negligible significance for water supply or river base flow.

The majority of the borough is comprised of Secondary B bedrock. The south-eastern corner of the borough is made up of Secondary Undifferentiated bedrock and the north-eastern corner of Unproductive Strata. Small, isolated areas of higher permeability Principal bedrock can be found in the west of the borough surrounding Shepshed and also Secondary A formations primarily around Barrow upon Soar. The majority of the borough is therefore underlain by lower permeability bedrock. Lower permeability bedrock means that flooding from groundwater sources is unlikely, however the risk of surface water runoff is increased.

The majority of the study area is overlain by Undifferentiated superficial deposits, with higher permeability Secondary A deposits found in the river valleys.

The British Geological Survey provides further information on the nature of groundwater flooding on their [website](#).

Figure 7-2 Topography of Charnwood Borough

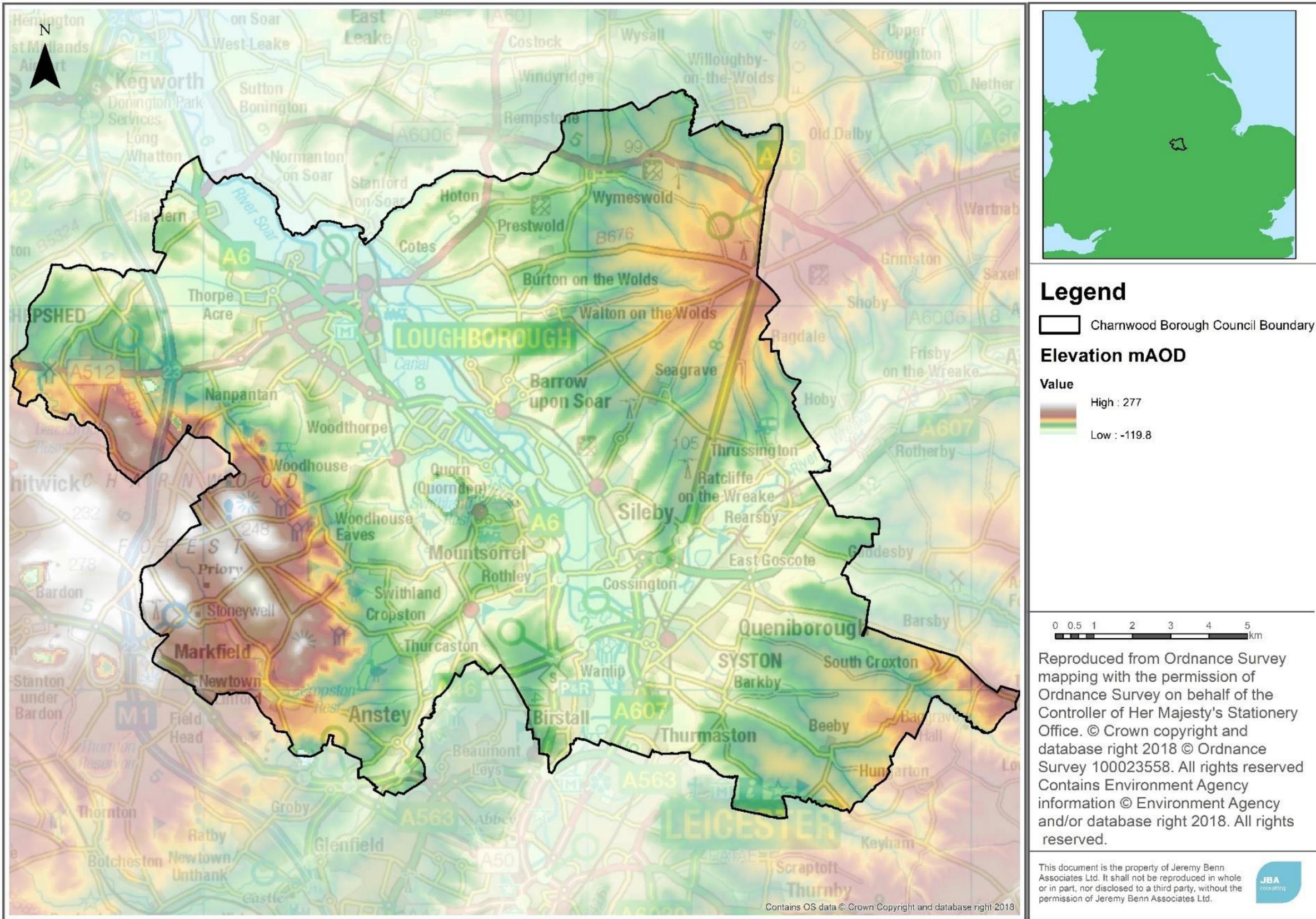


Figure 7-3 Bedrock formations in Charnwood Borough

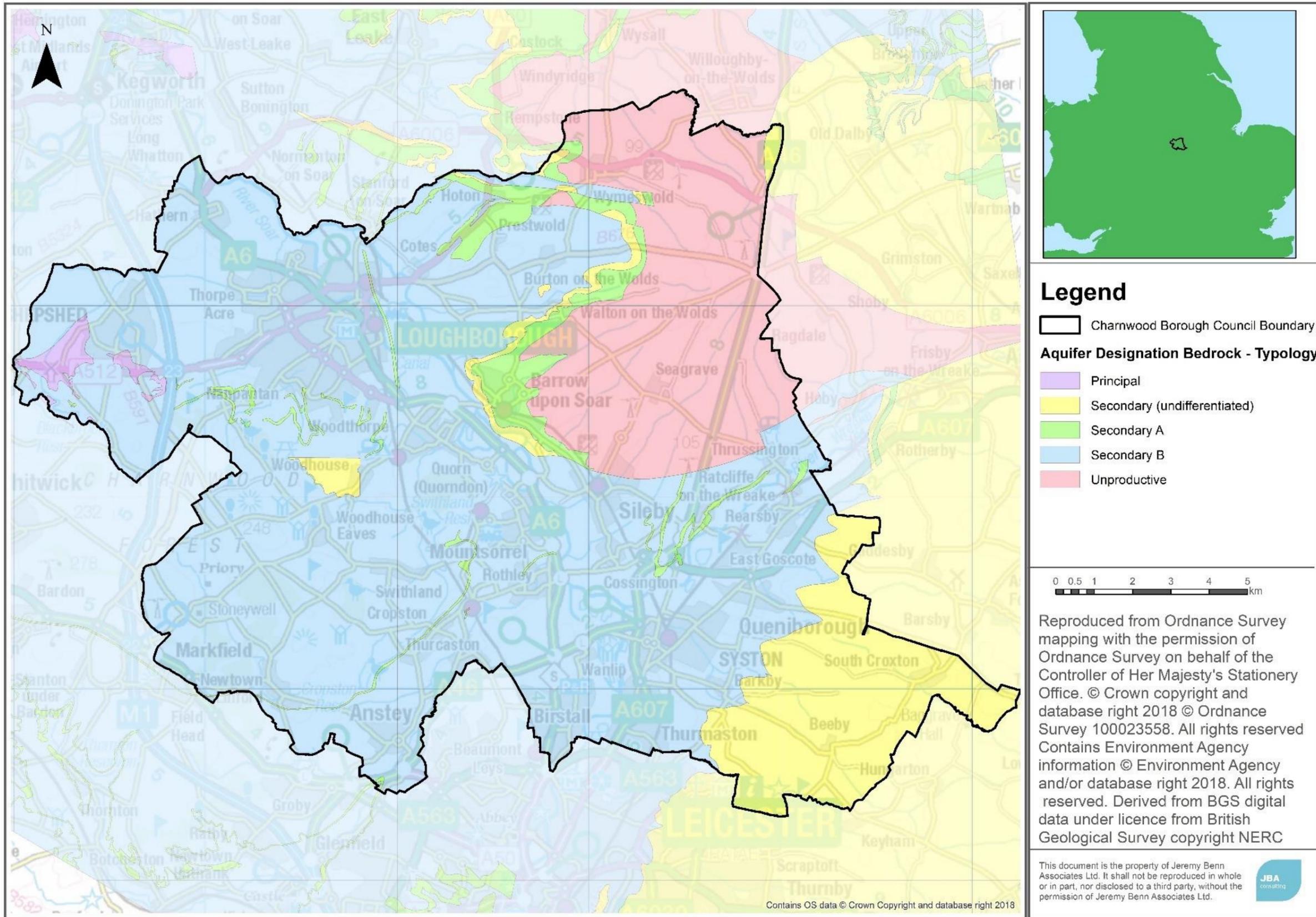
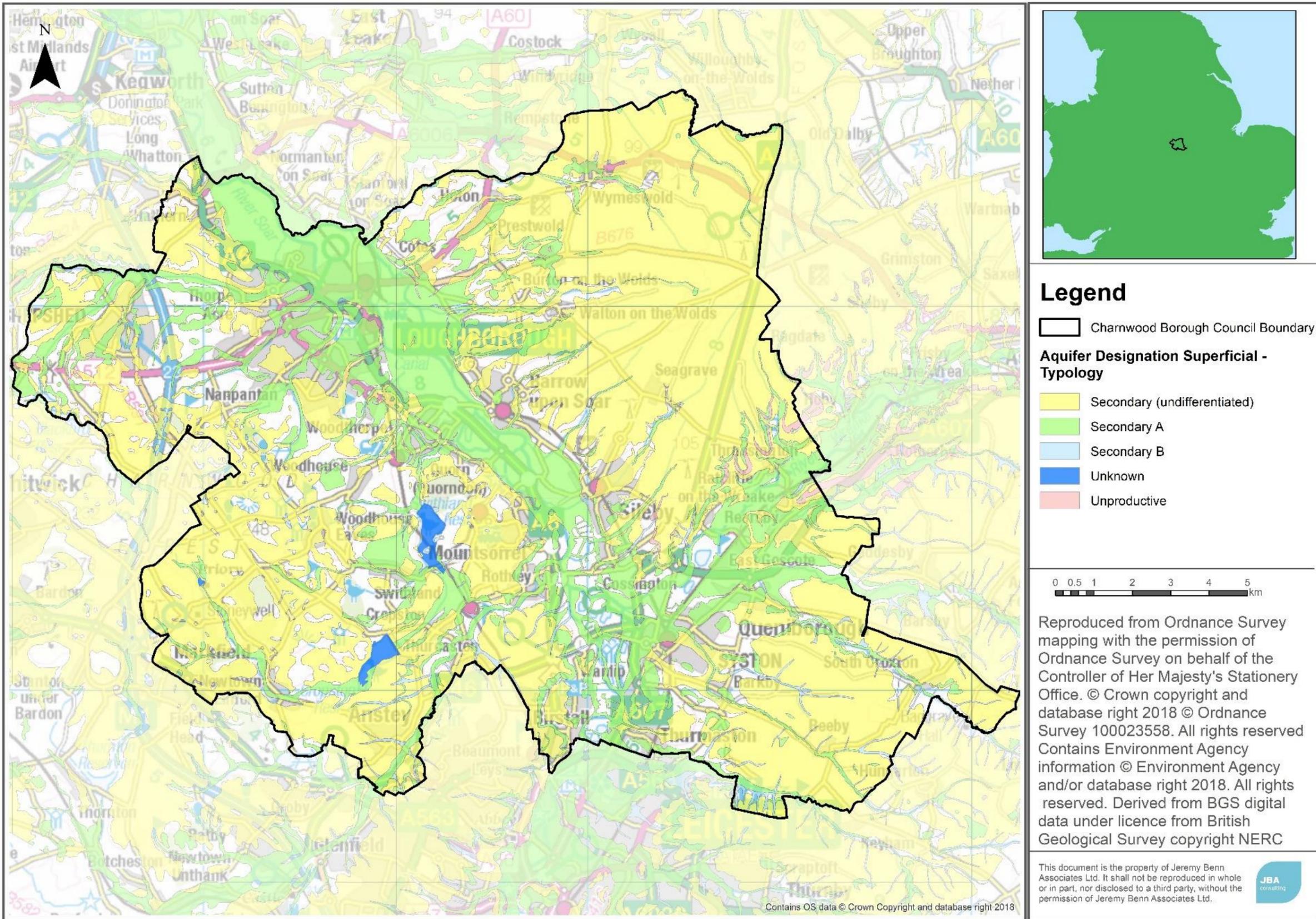


Figure 7-4 Superficial deposits in Charnwood Borough



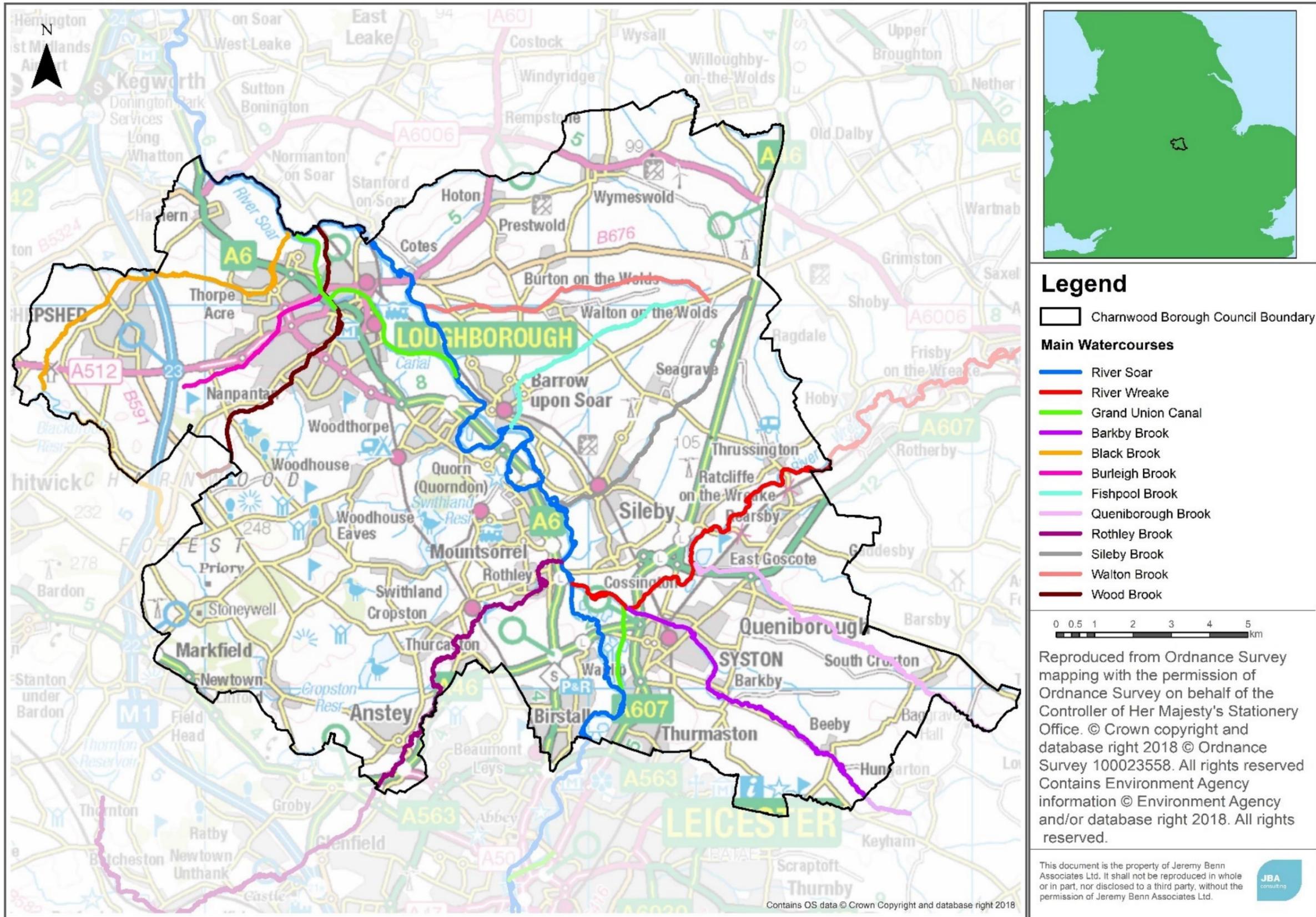
### 7.2.3 Hydrology

The principal watercourses flowing through the SFRA study area are:

- River Soar
- River Wreake
- Barkby Brook
- Black Brook
- Burleigh Brook
- Fishpool Brook
- Queniborough Brook
- Rothley Brook
- Sileby Brook
- Walton Brook
- Wood Brook

Tributaries of these watercourses include smaller ordinary watercourses and numerous unnamed drains. There are also a number of ponds and lakes within the study area. A summary of the key watercourses in the SFRA are provided in Figure 7-5. Detailed mapping indicating the location of the watercourses can be found in Appendix A.

Figure 7-5 Key watercourses in Charnwood Borough



**Legend**

- Charnwood Borough Council Boundary
- Main Watercourses**
- River Soar
- River Wreake
- Grand Union Canal
- Barkby Brook
- Black Brook
- Burleigh Brook
- Fishpool Brook
- Queniborough Brook
- Rothley Brook
- Sileby Brook
- Walton Brook
- Wood Brook



Reproduced from Ordnance Survey mapping with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown copyright and database right 2018 © Ordnance Survey 100023558. All rights reserved. Contains Environment Agency information © Environment Agency and/or database right 2018. All rights reserved.

This document is the property of Jeremy Benn Associates Ltd. It shall not be reproduced in whole or in part, nor disclosed to a third party, without the permission of Jeremy Benn Associates Ltd.

### 7.3 Fluvial flood risk

The primary fluvial flood risk in the borough is along the River Soar, the River Wreake and their tributaries. These present fluvial flood risk to rural communities as well as some of the main urban centres including, but not exclusively, Loughborough, Syston, Thurmaston and Quorn. The fluvial flood extents are wide along the River Soar and River Wreake due to lower lying, flat topography. Flooding in the borough may not be from one watercourse alone; there are a number of interactions, particularly between the River Soar, Grand Union Canal and the Wood Brook in Loughborough.

The Flood Zone maps for Charnwood Borough are provided in Appendix A: Geo-PDFs, split into Flood Zones 2, 3a and 3b (including an 'indicative 3b' where FZ3a acts as FZ3b in the absence of detailed model data). The locations with the highest fluvial flood risk in Charnwood Borough are detailed in Table 7-4. Please note that this table does not cover all locations at risk and the reader should refer to the mapping for further information on other locations.

### 7.4 Surface water flooding

Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours and usually occurs in lower lying areas, often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems can be inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding. This can be made worse by local insufficient drainage capacity. Where discharge is directly to a watercourse, locally high water levels can cause back-up and prevent drainage taking place.

The Risk of Flooding from Surface Water mapping (RoFfSW) provided by the Environment Agency via Charnwood Borough Council shows that a number of communities are at risk of surface water flooding, as discussed in Table 7-4. In general, the RoFfSW shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, e.g. properties situated at the foot of surrounding hills. The RoFfSW mapping for Charnwood Borough can be found in Appendix A.

### 7.5 Groundwater flooding

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.

Groundwater susceptibility mapping of Charnwood Borough 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. As discussed in section 7.2.2, 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.

## 7.6 Flooding from sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system. Infiltration or entry of soil or groundwater into the sewer system via faults within the fabric of the sewerage system, is another cause of sewer flooding. Infiltration is often related to shallow groundwater and may cause high flows for prolonged periods of time.

Since 1980, the Sewers for Adoption guidelines have meant that the newest surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that, even where sewers are built to current specification, they are likely to be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100 chance of occurring in a given year). Existing sewers can also become overloaded as new development adds to the discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Further, sewer flooding is more likely to occur along the routes of main trunk sewers and in particular, if these sewers interact with fluvial systems.

The sewers in Charnwood Borough are managed by Severn Trent Water.

Severn Trent's Flood Risk Register identifies properties and areas at which have had observed and verified reports of internal and external sewer flooding due to hydraulic overloading or where flow exceeds the capacity of the system. The register does not identify properties and areas at risk of sewer flooding caused by operational issues such as blockages and does not contain properties that could be at model predicted risk of flooding. Properties defined as at risk on Severn Trent's Flood Risk Register are set out in Table 7-2.

For confidentiality reasons this data has been supplied on a postcode basis. The register is continually being updated, therefore the dataset provided will eventually become outdated. The Flood Risk Register data in Table 7-2 was supplied on the 28/11/2018.

**Table 7-2 Properties at risk from sewer flooding (Severn Trent Water)**

Post code	Locality associated with post code	Number of properties at risk
LE11 1	Loughborough	17
LE11 2	Loughborough	34
LE11 3	Loughborough	14
LE11 4	Loughborough	4
LE11 5	Loughborough	1
LE12 5	Hathern	2
LE12 5	Hoton	1
LE12 6	Wymeswold	1
LE12 7	Mountsorrel	5
LE12 8	Barrow upon Soar	14
LE12 8	Quorn	3
LE12 8	Swithland	2
LE12 8	Woodhouse	1
LE12 9	Shepshed	34
LE4 3	Birstall	5
LE4 4	Birstall	8
LE4 8	Thurmaston	8
LE6 0	Newtown Linford	4
LE7 1	Syston	24
LE7 3	East Goscote	1
LE7 3	Queniborough	1
LE7 4	Wanlip	4
LE7 4	Ratcliffe on the Wreake	2
LE7 4	Cossington	8
LE7 4	Rearsby	5
LE7 7	Anstey	1
LE7 7	Thurcaston	2
LE7 7	Rothley	6
		<b>Total=212</b>

A total of 212 properties are at risk from sewer flooding within the borough. The localities at the highest risk include Loughborough, Shepshed, Syston and Barrow upon Soar.

### 7.7 Flooding from canals

Canals do not generally pose a direct flood risk as they are a regulated waterbody. 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).

Breaches or embankment failure may be caused by a number of factors including:

- Culvert collapse
- Overtopping
- Animal burrowing

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is

dependent on the upstream pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

The only canal in Charnwood Borough is the Grand Union Canal. The Canal and River Trust were consulted to identify any instances of breaches and overtopping of the canal.

The Grand Union Canal enters the borough in the south at Thurmaston, it travels north where it joins the River Wreake north-west of Syston. The River Wreake then joins the River Soar which continues north through Charnwood to Barrow-upon-Soar where the Grand Union Canal splits from the Soar for approximately 800m. The Grand Union Canal and the River Soar meet again and travel north for approximately 1000m where they diverge again. The canal then travels through Loughborough and joins the Soar again to the north of the town. There have been 2 incidents of breach on the Grand Union Canal at Wanlip in 1962 and Barrow Weir in 1971. There has been one incident of overtopping in January 2014 when the River Soar overtopped and flowed into the Canal near Wanlip.

The Grand Union Canal has the potential to interact with other watercourses in the study area, including the River Wreake, River Soar, Grammar School Brook, Wood Brook and the Hermitage Brook. These have the potential to become flow paths if these canals were overtopped or breached. Any development proposed adjacent to the canal should include a detailed assessment of how a canal breach would impact the site, as part of a site-specific Flood Risk Assessment. Guidance on development near canals is available from the [Canal and River Trust](#).

## 7.8 Flooding from reservoirs

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

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

The risk of inundation to Charnwood Borough as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Mapping (NIRIM) study. There are 16 reservoirs shown to affect Charnwood Borough; this includes reservoirs located within the borough and a number of reservoirs outside of the area whose inundation mapping is shown to affect Charnwood Borough. The reservoirs inundation extents provided by the Environment Agency can be found on the Environment Agency's [Long term flood risk map for England](#).

The Environment Agency maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

**Table 7-3 Reservoirs that may potentially affect Charnwood Borough in the event of a breach**

<b>Reservoir</b>	<b>Is the reservoir located within the study area?</b>	<b>Local Authority Area</b>
Nanpantan	Yes	Leicestershire
Groby Pool	No – Hinckley and Bosworth District	
Scalford Brook Reservoir	No – Melton District	
Central East Area Balancing Pool	No – North West Leicestershire District	
Hallgates No. 4	Yes	
Frisby Lake	No – Melton District	
Swithland	Yes	
Thornton	No – Hinckley and Bosworth District	
Blackbrook	Partially – also North West Leicestershire District	
EMA Gimbro Ponds	No – North West Leicestershire District	
Brentingby Flood Storage Reservoir	No – Melton District	
Cropston	Yes	
Ragdale	No – Melton District	
Knighton Park FSR	No – City of Leicester	
Dakyn Road FSR	No – City of Leicester	
Braunstone Park Storage Reservoir	No – City of Leicester	

As above, 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 seek to contact the reservoir owner to obtain information which may include:
  - reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
  - operation: discharge rates/maximum discharge;
  - discharge during emergency drawdown; and
  - inspection/maintenance regime.
- Developers should apply the sequential approach to locating development within the site.
- Consult with relevant authorities regarding emergency plans in case of reservoir breach.

- The reservoir owners are contacted to confirm the Reservoir Risk Designation (if determined) and the inspection and maintenance regime of the reservoir.
- 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.
- 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). For proposed sites located within the extents, consideration should be given to the extent, depths and velocities shown in these online maps.
- In addition to the risk of inundation, those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

## 7.9 Flood warning and emergency planning

### 7.9.1 Emergency planning

Emergency planning enables Emergency Responders to respond effectively before, during and after a flood. Emergency Planners also work with local businesses to increase their resilience to flooding through business continuity and local communities on Community Emergency Plans.

The **Leicester, Leicestershire and Rutland Local Resilience Forum** brings Emergency Responders together in Leicestershire to plan for flooding. A Multi Agency Flood Plan has previously been produced for Leicestershire by the Leicestershire Local Resilience Forum. It is recommended that the information in this SFRA is used to inform any further reviews to the document.

Safety is a key consideration for any new development and this includes the residual risk of flooding i.e. behind flood defences, the availability of flood warnings, safe access and egress routes and evacuation procedures. There are currently 5 Flood Alert Areas (FAA) and 19 Flood Warning Areas (FWAs) covering significant parts of Charnwood Borough. These are shown in Appendix A. Flood Warnings are supplied by the Environment Agency for river flooding via the Flood Warning System service, to homes and businesses within Flood Zones 2 and 3.

The revised 2018 NPPF requires that LPAs assess Planning Applications to ensure that:

- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

There are circumstances where a flood warning and evacuation plan is required and/or advised:

- Camping and caravan sites, holiday accommodation and where there are transient occupants e.g. hostels
- Buildings that will be occupied below a design flood level i.e. basements

In addition to the flood warning and evacuation plan considerations in the NPPG, developers should also consider:

- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a flood defence breach or failure.
- That proposed new development that places additional burden on the existing response capacity of the Council will not normally be considered to be appropriate.
- Developers should encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.
- The vulnerability of site occupants.
- Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain “in-situ” and/or move to a higher floor or safe refuge area (e.g. developments located immediately behind a defence and at risk of a breach).

**Table 7-4 Summary of Flood Risks in Charnwood Borough**

Settlement	Fluvial flood risk	Existing or proposed defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
Anstey	Rothley Brook runs along the east side of the settlement of Anstey. Properties located in Flood Zone 3 include those east of the river off Leicester Road and the buildings on Sheepwash Lane. The most eastern properties on Melody Avenue and Ned Ludd Close are located within Flood Zone 2. The majority of the settlement is not within either Flood Zone 2 or 3 due to the topography rising away from the watercourse.	None	During both the 30 and 100-year events, surface water flooding is largely confined to watercourses and green spaces, with a flow path from Cropston Road and onto adjacent roads including Albion Street. An additional topographic flow path leading to the Rothley Brook flows via Ellis Street, Staddon Road, Paper Mill Close and The Nook. A flow path from the high ground to the west of Bradgate Road leads across Forest Gate and Hollow Road to join the aforementioned flow path at Staddon Road. Within the 1,000-year extent there are more flow paths from higher up in the catchment.	✓	✓	✓	✓	Anstey is partially located within the reservoir inundation extents of Groby Pool and Thornton reservoirs.	Rothley Brook – 1977  2 incidents since 2011 from multiple sources (LCC records)
Barrow upon Soar	The River Soar is located to the south and west of the village and its floodplain meets the first properties on the southside of Barrow upon Soar around Welland Road and Bridge Street. Only a couple of properties on Mill Lane and Bridge Street are within Flood Zones 2 and 3 as the majority of the town is elevated above the floodplain. The Fishpool Brook flows through the east side of the settlement, with only a couple of properties located in Flood Zone 2 at the bottom of Newton Close and Fishpool Way. The Flood Zones are predominantly confined to the channel along this watercourse.	Flood gates and embankment along left bank of River Soar to the west of Barrow upon Soar	During both the 30 and 100-year events, surface water flooding is largely confined to watercourses and overland flow paths on Melton Road and some scattered areas in the south of the settlement. A further overland flow is within the north of the settlement which includes Nursery Grove, Nottingham Road, Elms Avenue, Ennerdale Road, Derwent Road and Coniston Road, which flows towards the Fishpool Brook floodplain. Residential properties are affected in the 30-year event on Heron Road and Derwent Road. Some additional areas are affected in the 1,000-year event. These include backing up at the rail embankment by Breachfield Road, roads north of Roman Close as well as Blake Close, Marianne Close Sibley Road and onto the railway track adjacent to Sibley Road between Huston Close and Slash Lane.	✓	✓			Barrow upon Soar is partially located within the reservoir inundation extents of Groby Pool, Dakyn Road FSR, Scaford Brookm Brentingby, Swithland, Thornton and Cropston reservoirs.	River Soar – 1998, October 2000  2 incidents since 2011 from multiple sources (LCC records)
Birstall	The River Soar flows to the east of Birstall. None of Birstall is located in either Flood Zone 2 or 3.	None	In the 30-year event, scattered spots of surface water flooding exist, mostly in green space. Flow paths exist on the following roads: Meadow Lane, Lambourne Road, Wanlip Lane, Wanlip Avenue, Paget Avenue, Ambergate Drive, Castlegate Avenue and Saltersgate Drive, where a large area of ponding occurs. Overland flow paths then follow Sibson Road east along Wanlip Avenue to Meadow Lane. The 1,000-year event further links isolated areas of surface water risk, north-east from Loughborough Road towards Acacia Avenue and Wanlip Road. On the west side of the settlement, the surface water risk reaches the residential properties on Queensgate Drive in the 1,000-year event.	✓	✓	✓	✓	Birstall is partially located within the reservoir inundation extents of Knighton Park, Dakyn Road and Braunstone Park reservoirs	River Wreake – April 1998  1 incident since 2011 from unknown source (LCC records)
East Goscote	The River Wreake flows to the north of the settlement and the Queniborough Brook to the south.	Embankment along left bank of River Wreak adjacent to Broome Lane	The risk of surface water flooding within this settlement adjacent to the Queniborough Brook is negligible.			✓	✓	None	Queniborough Brook – 1947  1 incident since 2011 from unknown source (LCC records)

	No properties are within Flood Zone 3. The floodplain of the Queniborough Brook is confined on the right bank (the settlement side) with water filling the left-hand floodplain up to the A607. There is a Flood Zone 2 flow path across the settlement from Long Furrow, Woodman's Chase, Cooper's Nook, Fletchers' Way, Saddlers' Close, Thatcher's Corner, Farriers' Way, Ploughman's Lea, Keepers' Croft, Broomfield, The Burrows and Watergate. This flow path leads towards the River Wreake channel beyond the rail embankment.		Scattered isolated pockets of surface water flooding occur on residential roads within both the 30 and 100-year events but does not affect residential properties. Residential properties are shown to be affected in the 1,000-year event on Long Furrow and Keepers' Croft. Within the 1,000-year event the following streets are affected: Broome Avenue, Greensward and The Meadows, although no residential properties are affected.						
Hathern	Considerable floodplain exists north-east of Hathern from the River Soar, although the majority of the settlement is not within either Flood Zone 2 or 3. Flood Zone 3 extends to the edge of Hathern, only reaching Pasture Lane and the most northern buildings of Hathern CE Primary School. Flood Zone 2 extends marginally further but only affects residential properties on Green Hill and the majority of Hathern CE Primary School. An unnamed watercourse flows south-east to north-west across Derby Road to the Zouch Road, but this is not included in the Flood Zones due to its small catchment size.	None	Within the 30-year event surface water flooding affects properties along both Nightingale Avenue and The Green. In the 100-year this expands into further properties along these roads and down the roads of Wide Lane, Church Street, Narrow Lane, Cross Street, Dovecote Street, Wide Street, Swallow Walk, Derby Road and Loughborough Road. Further residential properties flood in the 1,000-year event on both Nightingale Avenue and The Green, as well as Matthew Trige Close. The flow paths originate from the high ground around Golden Square/ Loughborough Road and follow the topographic routes of the roads to the east, down towards the floodplain.	✓	✓	✓		Hathern is partially located within the reservoir inundation extents of Blackbrook, Swithland, Cropston, East Midlands Airport Gimbro Ponds and Central East Area Balancing Pond reservoirs	River Soar – 1912, 1960, 1983 4 incidents since 2011 from multiple sources (LCC records)
Loughborough	The Black Brook, Shortcliff Brook, Burleigh Brook, Oxley Gutter, Wood Brook and Hermitage Brook flow through or along the boundary of Loughborough to join the River Soar north of the town. Roads adjacent to the Black Brook through Thorpe Acre and Dishley, predominantly on the left bank of the brook, are within Flood Zone 3. These include Maxwell Drive, Herriot Way, Gavin Drive, Murdoch Rise, Raymond Avenue, Cordell Road, Braddon Road and Barsby Drive. Flood Zone 2 extends further along the left bank of the Black Brook and significantly further along the right bank affecting Thorpe Acre. Roads and properties adjacent to both the Burleigh Brook and the Wood Brook are included within Flood Zones 2 or 3, with the extents widening downstream into the centre of Loughborough. Areas most notably affected are the roads and properties off Holywell Way, between Watermead Lane and Bradgate Road, Brookfield Avenue, Forest Road, Forest Road, Alan Moss Road and large areas of the University site off Epinal Way. A large number of the properties along between the Grand Union Canal and the River Soar and on the left bank of the	Embankment, flood gates and flood walls present throughout the town, including along the Black Brook, Burleigh Brook, Hermitage Brook and River Soar	The extent of flooding from surface water in the 30-year and 100-year events are similar - scattered pockets mostly following roads and watercourses flowing from higher ground in the west south west. The most notable areas of surface water flooding are the roads adjacent to the Wood Brook through the town. A number of roads become overland flow routes in the 1,000-year surface water event, most notably Alan Moss Road, the A512 and Forest Road.	✓	✓	✓	✓	Loughborough is partially located within the reservoir inundation extents of Nanpantan, Blackbrook, Groby Pool, Cropston, Swithland and Thornton reservoirs	River Soar – 1960, 1983, 1998, 2000, June 2016 Black Brook – 1997 Wood Brook – 1977, 2012 Burleigh Brook – 2012 Pluvial flooding – 1998 Unknown source – March 2013, February 2016  21 incidents since 2011 from multiple sources (LCC records)

	Grand Union Canal up to the A6 are located within the Flood Zones.								
Mountsorrel	<p>The majority of the village is located at higher elevations and is therefore unlikely to flood from fluvial sources.</p> <p>A section of the River Soar flows along the northern edge of the village posing a fluvial flood risk to properties along Waterside Drive, Wishbone Lane, The Quay, Sibley Road, Barons Way which lie at lower elevations.</p> <p>There is an ordinary watercourse flowing in a north-easterly direction from the south-west of the village towards the River Soar which is not included in the Flood Zones due to its small catchment size. There may be risk from this watercourse, particularly as it is culverted in places and therefore blockages could occur.</p>	None	<p>No extensive surface water flooding is shown to occur in the 30 or 100-year events outside of rural areas, with small isolated pockets of flooding on some roads in the village.</p> <p>A small number of properties are located within the 100-year surface water extent, including along Meadow Road, Walton Way, The Crescent, Kirby Close, Cross Lane, Otter Lane and Foxglove Close.</p> <p>Due to the topography of the village, a number of roads become overland flow routes in the 1,000-year event, flowing from higher ground in the west to the east. Notable areas flooded in the 1,000-year event include between Bier Way, Linkfield Road, Mountsorrel Lane and Loughborough Road and between Highfields Road and Halstead Road.</p>		✓	✓	✓	Mountsorrel is partially located within the reservoir inundation extents of Groby Pool, Dakyn Road, Thornton, Brentingby and Scalford Brook reservoirs	<p>River Soar – 1998, 2000</p> <p>Unknown – January and December 2013, February 2016</p> <p>1 incident since 2011, a property flooded from a culvert beneath the house (LCC records)</p>
Queniborough	<p>Queniborough Brook flows to the east of the settlement of Queniborough in a north-westerly direction.</p> <p>No properties are located within Flood Zone 3. The majority of the overtopping of the bank of Queniborough Brook occurs north of the settlement.</p> <p>Contained within Flood Zone 2 are the most northern properties within the gated community off east side of Main Street, as well as the northern side of Coppice Lane and those most eastern on The Ringway and Rupert Crescent.</p> <p>An ordinary watercourse flows through the western half of the settlement from Campion Avenue to Syston Road, Melton Road and parallel with the Queniborough Brook to the south of the into the A507. This catchment is not represented in the Flood Zones.</p>	None	<p>The surface water flooding located adjacent to the Queniborough Brook affects residential properties in the 100-year event on Croxton Road, an unnamed road off Main Street and Coppice Lane.</p> <p>The surface water risk which follows the ordinary watercourse's topography is situated through Boonton Meadows Way, Glebe Road, Barkby Road, Gascoigne Avenue and Syston Road, further adding Wetherby Close in the 1,000-year event. Residential properties are affected in the 30-year event on Barkby Road and Syston Road.</p> <p>In the 30 and 100-year events, Melton Road, Marsden Avenue, Chestnut Close and an industrial estate off Melton Road are affected between Marsden Avenue and New Zealand Lane.</p> <p>In the 1,000-year event this extends along the previously stated roads and into Link Road, Avenue Road, New Zealand Lane and Dobney Avenue.</p>				✓	None	<p>Queniborough Brook – 1947</p> <p>3 incidents since 2011 from multiple sources (LCC records)</p>
Quorn	<p>Multiple unnamed watercourses flow through the settlement of Quorn and meet the River Soar beyond the eastern boundary of the settlement of Quorn. Included in Flood Zone 3 within the village are properties where the High Street meets both Station Road and Leicester Road, as well as where Leicester Road meets School Lane. To the east of School Lane, properties on Stoop Lane, Soar Road, Freehold Street, Victoria Street, Swinfield Road, Thomas Firr Close are also included. The majority of the north-west side of the village is within Flood Zone 3, on Farley Way from Pepper Drive eastwards until the roundabout, as well as properties on and on the adjacent roads of Pepper Drive, Alexander Road, Deeming Drive and Barrow Road.</p>	Embankment, flood gate and flood walls along the Quorn Brook and River Soar	<p>Scattered surface water flooding occurs across the settlement with increasing density where multiple rivers merge to meet the River Soar, affecting predominantly only green space and small sections on Meeting Street, High Street, Leicester Road and Soar Road in both the 30 and 100-year events.</p> <p>In the 1,000-year event the scattered ponding across the settlement starts to affect residential properties and expands further on Leicester Road and Meeting Street, Whall Close, Armston Road and the properties around Barrow Road.</p>			✓	✓	Quorn is partially located within the reservoir inundation extents of Groby Pool, Dakyn Road, Cropston, Thornton, Swithland, Scalford Brook and Brentingby reservoirs	<p>Quorn Brook – 1977</p> <p>River Soar – 1998, 2000</p> <p>3 incidents since 2011 from multiple sources (LCC records)</p>

	Flood Zone 2 includes the majority of properties on Hutton Close, Wykes Close, Russ Close, Thompson Close, Fenny Copse Lane, Netherhall Drive, Swinfield Road, Mansfield Street and Disraeli Street, as well as properties on the west side of School Lane.								
Rearsby	The Rearsby Brook flows through Rearsby and joins with River Wreake to the north-west of the village. Properties along Brookside and part of Church Lane are located within Flood Zone 3. Flood Zone 2 extends to also affect properties along Mill Road, William Everard Close, and Brook Street.	None	Mill Road and Brookside are flow routes in the 30-year surface water event, with Melton Road, Station Road and Brook Street also becoming flow routes in the 100-year event as water flows from higher ground towards the Rearsby Brook. Properties are affected along Brookside, Church Lane and Mill Road in the 100-year event. The 1,000-year event extends further to Brook House Close, William Everard Close, Gaddesby Lane and Grange Avenue.			✓	✓	None	Rearsby Brook – 1998, 1999 River Wreake – 1977, 1998
Rothley	Rothley Brook flows through the village, posing a fluvial flood risk. The north-west and south of the village are located at higher elevations however parts of the village are located within the valley of the brook and are therefore at higher risk of fluvial flooding.  A small number of properties are located within Flood Zone 3 on Hallfields Lane, Walkers Lane and Town Green Street. Roads located in Flood Zone 3 include Anthony Street and Homefield Lane adjacent to the Rothley Brook. Properties within Flood Zone 2 also include Homefield Lane, Anthony Street, North Street and Forge End.	Embankment and flood wall along the Rothley Brook	The 30-year surface water flood extent is predominantly within field areas with small isolated areas of ponding on Anthony Street, Wellsic Lane, Hallfields Lane and Town Green Street. In the 1,000-year event the notable flow routes are Mountsorrel Lane, Homefield Lane, Babington Road, Garland, Wellsic Lane and Hallfields Lane.	✓	✓	✓		Rothley is partially located within the reservoir inundation extents of Groby Pool, Thornton, Scalford Brook and Brentingby reservoirs	Rothley Brook – 1977 Pluvial flooding – 2007  4 incidents since 2011 from multiple sources (LCC records)
Shepshed	The Black Brook Runs parallel to north-west side of the settlement. No properties are included within Flood Zone 3 in this settlement. The most northern properties on Field Avenue are included in Flood Zone 2. There are several topographic depressions and ordinary watercourses shown on the drainage network which are not included in the Flood Zones due to their small catchment sizes. There may be risk from these, particularly as some are culverted where blockages could occur.	None	Four surface water flow paths exist through Shepshed, following the topography of the Black Brook and Oxley Gutter and the 2 unnamed watercourses in central Shepshed. Central Shepshed is also affected by surface water following the topographic flow paths from the A512, Charnwood Road, Old Station Close and Cambridge Street continuing north to Field Street. The second topographic flow path exists from the southern end of Anson Road and Griffin Close down The Meadows, Field Street, Britannia Street and Brook Street. Surface water backs up behind the western side of the M1 causing large areas of ponding on fields and along Coach Road and Butthole Lane.	✓	✓	✓		Shepshed is partially located within the reservoir inundation extent of Blackbrook reservoir	Black Brook – 1977 Pluvial flooding – June 2016  14 incidents since 2011 from multiple sources (LCC records)
Sileby	Sileby Brook runs through the middle of the catchment of Sileby, flowing north-east to south-west into the River Soar. Properties on Cossington Road that are not adjacent to the road on the west side are within Flood Zone 3 as well as Preston Close and those on the west side of Barrow Road between Wrights Acre and Hayhill. Properties adjacent to Sileby Brook on Brook Street, High Street, Back	74m of embankment along left bank of Sileby Brook	Where the Sileby Brook runs alongside or under the roads, these are affected by surface water flooding including High Street, Brook Street, Back Lane, Burton Road, Swan Street and The Banks. Residential properties are affected in the 30-year and include along High Street, The Banks and Swan Street. During the 100-year event, the water extends further down Ratcliffe Road, Swan	✓	✓			Sileby is partially located within the reservoir inundation extents of Frisby Lake, Scalford Brook, Brentingby, Thornton, Groby Pool and Dakyn Road reservoirs	River Soar – 1998, 2000, June 2016 Unknown source – March 2013, January 2014  4 incidents since 2011 from multiple sources (LCC records)

	Lane, The Banks, Swan Street, Burton Road and Heathcote Drive are also with Flood Zone 3. Within Flood Zone 2 are the streets on the north side of Cossington Road.		Street and Seagrave Road; but does not affect further residential properties. During the 1,000-year event, surface water extends further north into residential streets with isolated residential property flooding on St Mary's Road, Springfield Road, Gibson Road and Collingwood Drive, as well as affecting the majority of properties on Moir Close, Burton Road, Swan Street, Simons Walk and Willet Close.						
Syston	The Barkby Brook runs through the middle of the town of Syston. Properties within The Half Croft, Fosse Way and those north of Glebe Way, east of A46 and west of railway line that cuts through the High Street are all included in Flood Zone 3, as well as those on West Street, North Street and those adjacent to the Barkby Brook on Brook Street, Brookside, Melton Road, Victoria Street, Cross Street, Trinity Close and College Road. Properties south of Glebe Way to the northern edge of Wanlip Road and the western edge of the railway line into Syston Station are included in Flood Zone 2, with the exception of eastern Sedgefield Drive, south of Heath Avenue, Gorse Lane, south Willow Walk, south Wolsey Way, south Hardwick Crescent, Haddon Close and Old Station Road. The farming sites north of Wreake Valley Academy, properties on the High Street between Turn Street and The Half Croft as well as some properties on Dalley Close, Southfield Avenue, Plumtree Way, College Road, Trinity Close, University Close, Victoria Street, Brookfield Street, Brookfield Avenue, Halford Street and Necton Street are included in Flood Zone 2.	None	Surface water extends within both the 30 and 100-year events are similar, in both events only scattered areas of ponding exist across the settlement with no flow paths activated. In the 1,000-year event, those scattered pockets have developed and combine themselves with other smaller areas across the majority of the settlement. Within the 1,000-year event, roads and residential properties adjacent to the Barkby Brook are shown to be affected. Most prominently the residential properties on Southfield Avenue, Montague Avenue, College Road, Brookfield Avenue, Brookfield Street, Brookside, North Street and West Street. Backing up and ponding occurs adjacent to the rail line embankments.			✓	✓	Syston is partially located within the reservoir inundation extents of Frisby Lake, Scalford Brook and Brentingby reservoirs	River Wreake – 1977, 1998 Barkby Brook – 1992 Unknown source – March 2013  2 incidents since 2011 from multiple sources (LCC records)
Thurmaston	The River Soar runs along the west side of the settlement of Thurmaston. Properties on the west side of Mill Lane, those on Melton Road between Church Lane and Dorothy Avenue, Assured Drive and the most western properties on Brook Street and Lea Close located within Flood Zone 3. Properties on the unnamed road off Unicorn Street, select buildings on Melton Road between Church Lane and Dorothy Avenue, eastern properties of those in Flood Zone 3 on both Lea Close and Brook Street, those on the north and or west side of Dorothy Avenue, Bridge Park Road, Pinfold Road and the west side of Manor Road are located within Flood Zone 2.	Embankment and flood wall along the right bank of the River Soar parallel to Melton Road	Surface water flood extents are similar for both the 30 and 100-year flood extents. Scattered ponding occurs across the settlement as well as an overland flow path from Mill Lane, Hadrian Road, Alexandra Street and the A607. Another flow path is present from Spencer Avenue, Dovedale Road, Ferndale Road, Ivydale Road, Manor Road, Maple Road, Rosedene Avenue towards Southdown Drive, with residential properties affected in the 30-year event on Spencer Avenue. Within the 1,000-year event, notable additions include the majority of Melton Road, Garden Street and residential properties in Kiln Avenue, Ridgeway Drive, Lodge Close, Elliott Drive and Orchard Gardens. A large area of ponding occurs east of Colby Drive in a topographic depression in all surface water events.	✓	✓	✓	✓	Thurmaston is partially located within the reservoir inundation extents of Knighton Park, Braunstone Park and Dakyn Road reservoirs	River Wreake – 1998 Unknown source – June 2016  3 incidents since 2011 from multiple sources (LCC records)

This page is intentionally left blank

## 8 Flood defences and assets

### 8.1 Flood defences and standard of protection

The residual risk of flooding in an extreme flood event or from failure of defences should be carefully considered. The condition of existing flood defences and whether they will continue to be maintained and/or improved in the future is a factor that needs to be considered as part of the risk-based sequential approach and, in light of this, whether proposed land allocations are appropriate and sustainable.

Developers should also consider the Standard of Protection (SoP) provided by defences and residual risk as part of a site-specific FRA. Site-specific FRAs will need to thoroughly explore the condition of defences, especially where these defences are informal and demonstrate a wide variation of condition grades. It is important that all of these assets are maintained to a good condition and their function remains unimpaired.

#### **Standard of Protection**

Flood defences are designed to give a specific standard of protection, reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP standard of protection means that the flood risk in the defended area is reduced to a 1% chance of flooding in any given year.

Although flood defences are designed to a standard or protection it should be noted that, over time, the actual standard of protection provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change.

#### 8.1.1 Defence Conditions

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 8-1.

A broadscale overview of formal flood defences in Charnwood Borough is provided using AIMS data from the Environment Agency, shown in Table 8-2.

**Table 8-1 Defence asset condition rating**

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

*Source: Condition Assessment Manual – Environment Agency 2006*

**Table 8-2 Formal Flood Defences in Charnwood Borough**

Watercourse	Location	NGR	Type	Design SoP	Approximate Length (m)	Condition rating	Comments
Black Brook	Thorpe Acre and Dishley (Loughborough)	451518, 320332	Embankment	Up to 100	3889m	Poor to good	Both banks
Burleigh Brook	Loughborough	451177, 318659	Embankment	Unknown	120m	Fair	Surface water storage area embankment on left bank
Burleigh Brook	Edward Street, Loughborough	452989, 320251	Flood wall	Unknown	81m	Fair	Both banks
Hermitage Brook	Loughborough	454554, 320551	Embankment	10-100	1196m	Fair to good	Left bank adjacent to Falcon Street, right bank from railway line to River Soar
River Soar	Thurmaston	460890, 309307	Embankment/ flood wall	100	366m	Fair to good	Right bank
River Soar	Between Sileby and Mountsorrel	459307, 314748	Embankment	10	147m	Fair	Right bank adjacent to Mill Lane
River Soar	Quorn to Barrow upon Soar	457015, 317236	Embankment/ flood wall/ flood gate	Up to 100	2307m	Fair to good	Left bank
River Soar	Downstream of Barrow upon Soar to north-east Loughborough	455735, 319831	Embankment/ flood wall	Up to 10	6148m	Fair to good	Both banks to Cotes, left bank only Cotes to Hermitage Brook
River Soar/ Grand Union Canal	Loughborough	452583, 321685	Embankment/ flood wall	1	847m	Fair	Left bank, around north and west of industrial estate of Soarbank Way
River Soar	Loughborough, Normanton on Soar and Zouch	452006, 322313	Embankment/ flood wall/ flood gate	Up to 100	8623m	Fair to good	Both banks Loughborough to the A6006, right bank only downstream of A6006

Rothley Brook	Rothley	458366, 312414	Embankment/ flood wall	100	667m	Fair to good	Left bank Town Green Street to Hallfields Lane, both banks Hallfields Lane to Church Street
River Wreake	Broome Lane, East Goscote	463561, 314108	Embankment	5	214m	Fair	Left bank
Sileby Brook	Sileby	461022, 315611	Embankment	Unknown	74m	Fair	Left bank, Heathcote Drive
Wood Brook	Loughborough	452571, 318369	Embankment	Unknown	50m	Good	Right bank, behind Oakley Drive
Quorn Brook	Quorn	456275, 316505	Embankment/ flood wall/ flood gate	Up to 100	1523m	Fair to good	Predominantly both banks

*Source: AIMS dataset, Environment Agency*

## 8.2 Residual flood risk

The risk of rapid inundation following defence overtopping or breach is limited to areas of Loughborough, Quorn, Thurmaston, Barrow upon Soar, Rothley, Sileby, East Goscote and other rural areas protected by minor defences.

## 8.3 Flood alleviation schemes

The following flood alleviation schemes in the borough have been published by Charnwood Borough Council:

- **Anstey (2003)**
- **Barkby Brook - Syston (2004)**
- **Queniborough (2004)**

### 8.3.1 Swithland Brook

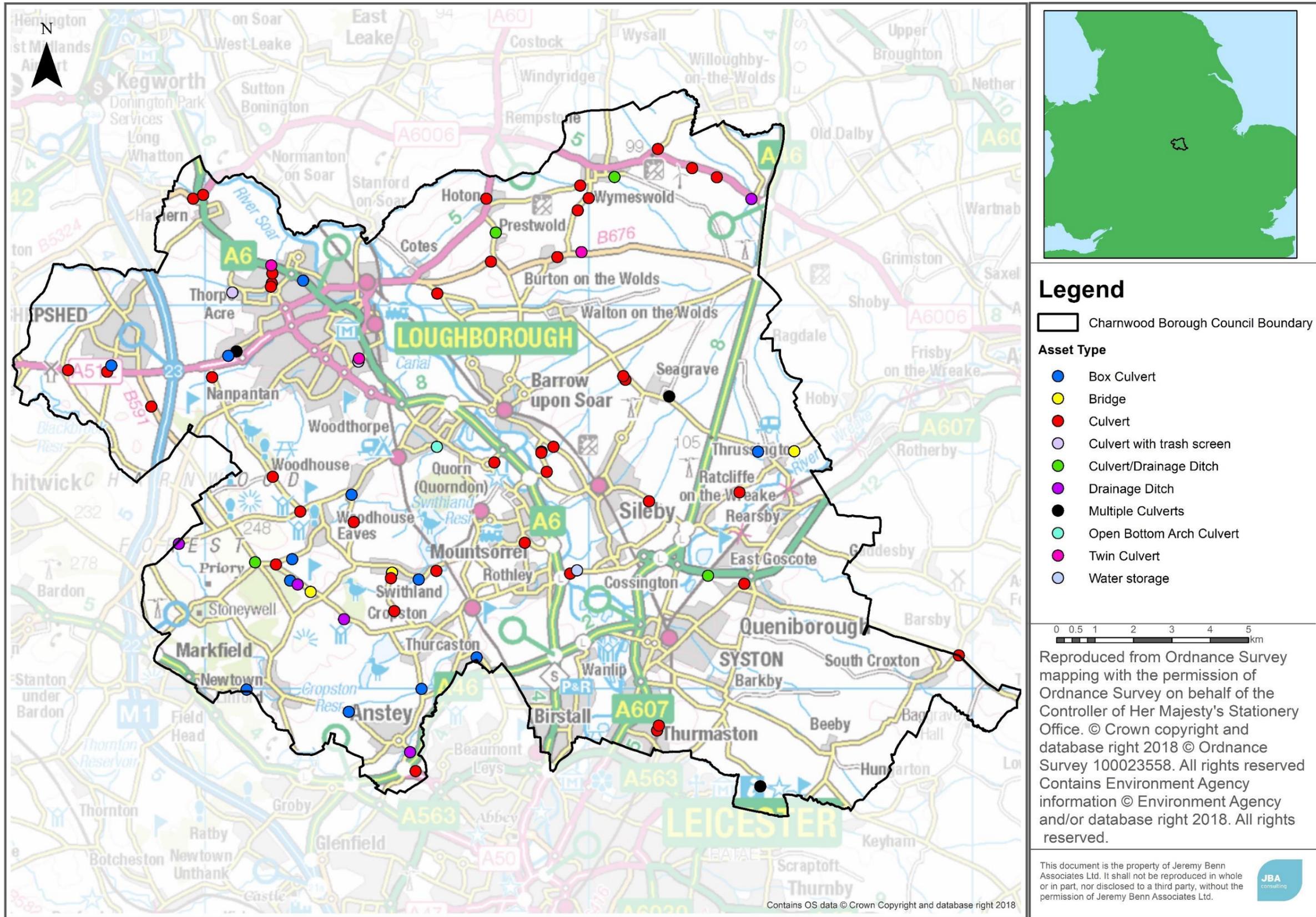
In the **March 2018 Flood and Coastal Erosion Risk Management Capital Investment (FCERM) programme**, the Swithland Brook flood alleviation scheme is proposed to better protect 18 homes, to be completed by 2021. This scheme is set out in Leicestershire County Council's LFRMS **Action Plan** and aims to improve the channel capacity of the Swithland Brook and replace an existing highway culvert.

## 8.4 LLFA Asset Register

Leicestershire County Council has compiled a Flood Risk Asset Register for the County under Section 21 of the Flood and Water Management Act (2010).

Figure 8-1 shows the locations of the assets listed on the Leicestershire County Council Asset Register located within Charnwood Borough. The LLFA are currently reviewing the asset register, therefore the current functionality level of the assets may be different to the data provided in the asset register.

Figure 8-1 Map of LLFA Asset Register within Charnwood Borough



## 9 Cumulative impact of development and cross-boundary issues

### 9.1 Cumulative impact of development

Under the revised 2018 NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to '*consider cumulative impacts in, or affecting, local areas susceptible to flooding*' (para. 156), rather than just to or from individual development sites.

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

Conditions imposed by Charnwood 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 area.

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 improve flood risk.

The **Loughborough SWMP** identifies four Critical Drainage Areas (CDAs) in the study; the Willow Brook, Burleigh Brook, Grammar School Brook and Wood Brook. These areas of significant flood risk, characterised by the amount of surface water runoff that drains into the area, the pathway (sewer, river system etc.) and the receptors (people, property and infrastructure), and are shown in Figure 14-1 of the SWMP.

The following Planning Policy recommendations are made in the SWMP for the CDAs and other high-risk areas. These could also be considered for other areas of significant surface water flood risk in Charnwood Borough and where cumulative impact is likely to have the greatest impact on flood risk:

- 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.

The NPPG states that a Flood Risk Assessment is required for all proposed development (regardless of size) in CDAs.

The following general recommendations should be considered for areas sensitive to the cumulative impact of development:

- For rural villages at low risk of flooding, Leicestershire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major developments. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- The LLFA and other RMAs should use the information in this SFRA to inform a long-term pipeline of flood alleviation studies and schemes to help inform where further contributions from developers on/off site would be beneficial.

## 9.2 Cross-boundary issues

Future large-scale development, both within and outside of Charnwood Borough can have the potential to affect flood risk to existing development and surrounding areas. Charnwood Borough has boundaries with the following Local Authorities:

- 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

The topography of the study area and direction of watercourse flow means that neighbouring authorities with the potential to affect flood risk in Charnwood are predominantly Hinckley and Bosworth Borough Council, Melton Borough Council, Blaby District Council, Leicester City Council and Harborough District Council. The authorities that may potentially be affected by Charnwood Borough are Rushcliffe Borough Council and North West Leicestershire District Council.

Neighbouring authorities were contacted and where possible, Local Plans were reviewed to assess whether there are any proposed large-scale developments that may affect flood risk in the study area.

A high-level overview of potential cross-boundary flood risk issues is provided in Sections 9.2.1 to 9.2.6 for the 6 neighbouring authorities which have supplied information on their Strategic Site Allocations within their Local Plans. A broader overview is supplied for Hinckley and Bosworth Borough Council where information on Strategic Site Allocations in Section 9.2.7. In the vast majority of cases, if appropriate drainage and SuDS are adopted, development in these neighbouring authorities is unlikely to affect flood risk in Charnwood. For the 7 neighbouring authorities, their respective Local Plans are being updated alongside the evidence base (i.e. SFRAs, Sustainability Appraisals etc.) and therefore, their flood risk and drainage policies are not yet formalised. However, it is very likely that to ensure compliance with the NPPF, appropriate sustainable drainage and flood risk policies will be proposed. It is recommended that Charnwood Borough Council consults neighbouring authorities, particularly during the consultation phases of their respective Local Plans, to identify and review potential cross-boundary issues.

### **9.2.1 Melton Borough Council**

A number of sites outlined in Melton Borough's Local Plan are located in and around Melton Mowbray along the River Eye which flows into the River Wreake, and in and around Asfordby along the River Wreake which flows into Charnwood. Given the distance of the proposed sites from the border with Charnwood (between 3-9km), development at these sites is unlikely to affect flood risk in Charnwood.

### **9.2.2 Blaby District Council**

Blaby shares a very short border with Charnwood where the Rothley Brook enters the borough. Two housing allocations are along the Rothley Brook, one at Ratby Lane and the other north of the A47, approximately 3.5 and 5km away from the border with Charnwood respectively. Given the distance of the proposed site allocations from Charnwood Borough, development at these sites is unlikely to affect Charnwood.

### **9.2.3 Leicester City Council**

The Leicester City Council Core Strategy was adopted in July 2014. All sites set out in the Core Strategy have been developed, with the exception of Ashton Green which lies on the border of Leicester City and Charnwood, near Birstall and Thurcaston, where up to 3,500 new homes and other facilities are proposed. Development here would drain into the Rothley Brook in Charnwood which could have an impact on flood risk in the borough if appropriate SuDs and drainage are not adopted. Leicester City have no further strategic development sites that have been allocated or consulted on at this stage.

### **9.2.4 Harborough District Council**

The majority of sites outlined in Harborough District's Local Plan are located in and around Market Harborough and Lutterworth which are located a significant distance away from Charnwood Borough and therefore very unlikely to affect flood risk in Charnwood. The Scraftoft North Strategic Development Area with an estimated 1200 dwellings to be built to 2031 is located on the border with Charnwood. The majority of the site drains into the Scraftoft Brook in Harborough District, however some of the site would drain into the Melton Brook, which could affect flood risk in Charnwood; however, if appropriate drainage is adopted at the development the impact on Charnwood Borough would be low.

### **9.2.5 Rushcliffe Borough Council**

Watercourses in Rushcliffe Borough flow away from Charnwood. Given this and the topography of the boroughs, development in Rushcliffe Borough is unlikely to affect flood risk in Charnwood. Housing development at Park Lane in Sutton Bonington is located near the border with Charnwood near to the River Soar. Therefore, there is the possibility of a localised effect in increasing flood risk upstream of this site with Charnwood Borough.

### **9.2.6 North West Leicestershire District Council**

The sites outlined in North West Leicestershire District's Local Plan are located away from the border with Charnwood Borough on watercourses which flow away from the study area, therefore proposed development in North West Leicestershire is unlikely to impact flood risk in Charnwood Borough.

### **9.2.7 Hinckley and Bosworth Borough Council**

No information on sites were provided by Hinckley and Bosworth Borough Council, however development on the border between Charnwood and Hinckley and

Bosworth could affect flood risk in Charnwood Borough as the Rothley Brook and Slate Brook drain from Hinckley and Bosworth into the study area.

### 9.3 Water quality considerations

In addition to cross-boundary issues regarding flood risk, there are also cross-boundary issues relating to water quality. Development or changes to land management practices in the upper catchments of watercourses that flow across boundaries into Charnwood Borough can potentially impact on the quality of watercourses within the study area. Development should consider the quality of the water that is released from sites and the impact it may have on the water quality on any receiving waterbodies. Future development should ensure there is no adverse impact on the quality of watercourses within the borough. Any impacts identified should then be considered in relation to the WFD Ecological, Hydromorphological and Chemical Status of the waterbody and the status objectives. Opportunities to improve the status of watercourses should also be considered. This is particularly important for Charnwood Borough as there are several watercourses within the area which have not achieved a good status. It is recommended that the LPA consults with the Environment Agency on ways to approach this and to discuss any measures that can be undertaken during development to improve water quality.

## 10 FRA requirements and guidance for developers

### 10.1 Over-arching principles

This SFRA focuses on delivering a strategic assessment of flood risk within Charnwood Borough. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk at a site are fully addressed. It should be acknowledged that a detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. Where the FRA shows that a site is not appropriate for a particular usage, a lower vulnerability classification may be appropriate.

#### 10.1.1 Planning consultees

There are a number of statutory consultees for planning matters; key stakeholders are listed below (note, this list is not exhaustive):

- Charnwood Borough Council decides all planning matters, including those related to flood risk, in their decision whether or not to grant planning permission.
- Leicestershire County Council are a statutory consultee on surface water drainage proposals for all major development. As the Lead Local Flood Authority, they provide technical advice on surface water drainage strategies and designs put forward for 'major' developments. Statutory planning consultation guidance can be found on their [website](#).
- The Environment Agency is a statutory consultee for applications in Flood Zones 2 and 3 and development within 20m of a Main River.

### 10.2 Requirements for site-specific Flood Risk Assessments

#### 10.2.1 What are site-specific FRAs?

Site-specific FRAs are carried out by (or on behalf of) developers to assess all sources of 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, taking into account climate change and vulnerability of users.

#### 10.2.2 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 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.

A FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1).
- Where the site is intended to discharge to the catchment or assets of a water management authority which requires a site-specific FRA.

- Where the site's drainage system may have an impact on an IDB's system.
- Where evidence of historical or recent flood events have been passed to the LPA.
- In an area of significant surface water flood risk.

### 10.2.3 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, Charnwood Borough Council 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);
- **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.**

## 10.3 Flood risk management guidance - Mitigation measures

Mitigation measures should be seen as a last resort to address flood risk issues. 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.

### 10.3.1 Site layout and design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones, to higher ground, while more flood-compatible development (e.g. recreational space) can be located in higher risk areas. The Sequential approach is followed to steer development into

areas with the lowest probability of flooding and any assessment should take into account the flood risk vulnerability of land uses.

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

### **Making space for water**

All new development close to rivers should consider the opportunity presented to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

The provision of a buffer strip can 'make space for water', allow additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

### **10.3.2 Raised floor levels**

The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood. If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable, the floor levels should be raised to a minimum of 300mm above the maximum water level caused by a 1 in 100-year fluvial flood event including an appropriate allowance for climate change. The additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Should development not be possible in Flood Zone 1 and development in Flood Zone 3 is required, it is advised by the Environment Agency that the finished floor levels should be set to 300mm above the 1 in 1000-year/1 in 100-year plus 50% climate change levels in the absence of updated modelling.

If raised floor levels are proposed, these should be agreed with Charnwood Borough Council and the Environment Agency. The minimum Finished Floor Level (FFL) may change depended on the vulnerability and flood risk of the development.

Reference to the latest climate change guidance will be made when considering the FFL. Many areas currently situated within Flood Zone 2 may become part of Flood Zone 3a in the future because of climate change, therefore it is essential that the potential risk of flooding in the future is considered when planning development.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This

risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress would still be an issue, particularly when flood duration covers many days. All sleeping accommodation in Flood Zone 2 and 3a must be located above the recommended flood level. No sleeping accommodation should be located in Flood Zone 3b, as is in line with the **NPPF Table 3** vulnerability classifications, stating that no more or less vulnerable infrastructure should be permitted in Flood Zone 3b.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test.

### 10.3.3 Access and egress

Safe access and egress will need to be demonstrated at all development sites. For residential developments, a minimum dry pedestrian access should be provided to and from the development without crossing through the 1 in 100-year plus climate change floodplain. Vehicular access to the site should be achievable, taking into account extreme events.

If safe access and egress cannot be achieved, the Defra/EA Technical Report: **FD2320: Flood Risk Assessment Guidance for New Development** should be referred to, to determine the hazard to people posed along the access route. This can also be used to inform a Flood Warning and Evacuation Plan for the site in consultation with Emergency Planners.

Emergency vehicular access should be possible during times of flood.

### 10.3.4 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property; in most areas of fluvial flood risk, raising land above the floodplain would reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should be provided to ensure that the total volume of the floodplain storage is not reduced.

For compensatory flood storage to be effective and not require hydraulic modelling, it must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership/control and linked to the site. Floodplain compensation should be considered in the context of the 1% annual probability (1 in 100 year) flood level including an allowance for climate change. When designing a scheme, flood water must be able to flow in and out unaided. An FRA should demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624.

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

### 10.3.5 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain. It would be preferable for schemes to involve an integrated flood risk management solution.

Temporary or demountable defences are not considered acceptable for new developments. Any new development must ensure that flood risk is managed and mitigated as part of the development and will not increase flood risk elsewhere.

Where development is located behind, or in an area benefitting from, defences, consideration should be given to the potential safety of the development, finished floor levels and the potential for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

### 10.3.6 Developer contributions

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

Developers cannot contribute towards schemes which will enable development on land which they otherwise could not develop on. Any new development must ensure that flood risk is managed and mitigated as part of the development and will not increase flood risk elsewhere. The Environment Agency recommend early conversations between themselves and developers in close proximity to potential future schemes to work together. Contributions may be required from developers where the development is located near to future schemes to ensure flood risk is not increased.

DEFRA's **Flood and Coastal Risk Management Grant in Aid (FCRMGiA)** can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCRMGiA and therefore any shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

For new development in locations without existing defences, or where the development is the only beneficiary, the full costs of appropriate risk management measures for the life of the assets proposed must be funded by the developer.

Information on current and future flood alleviation schemes can be obtained from the Environment Agency and Leicestershire County Council as LLFA.

## 10.4 Flood risk management guidance - Resistance measures

There may be instances where flood risk to a development remains despite implementation of such planning measures as those outlined above. For example, where the use is water compatible, where an existing building is being changed,

where residual risk remains behind defences, or where floor levels have been raised but there is still a risk at the 1 in 1,000-year scenario. In these cases, (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery.

These measures should not normally be relied on for new development as a mitigation method. Most of the measures should be regarded as reducing the rate at which flood water can enter a property during an event and considered an improvement on what could be achieved with sand bags. They are often deployed with small-scale pumping equipment to control the flood water that does seep through these systems. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system to user the measures are deployed in advance of an event. The following measures are often deployed:

#### **Permanent barriers**

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

#### **Temporary barriers**

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

#### **Community resistance measures**

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

#### **Non-return valves**

Non-return valves can be installed to prevent waste water from being forced up appliances e.g. lavatories, washing machines, sinks etc.

### **10.5 Flood risk management guidance - Resilience measures**

Flood-resilient buildings are designed and constructed to reduce the impact of flood water entering the building. These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding include:

- electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level;
- water-resistant materials for floors, walls and fixtures.

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

## 10.6 Reducing flood risk from other sources

### 10.6.1 Groundwater

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

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off of the site. Developers should provide evidence and ensure that this will not be a significant risk. When redeveloping existing buildings, it may be acceptable to install pumps in basements as a resilience measure. However, for new development this is not considered an acceptable solution.

### 10.6.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. The development must improve the on-site drainage infrastructure to reduce flood risk on the site and the wider area. It is important that a drainage impact assessment shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

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

Developers should refer to the County Council's [website](#) for guidance on how new developments should be designed to take surface water flood risk into account.

### 10.6.3 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by encouraging water to flow along natural flow routes and thereby reduce runoff rates and volumes during storm events while providing some water treatment benefits. SuDS also have the advantage of provided effective Blue and Green infrastructure and ecological and public amenity benefits when designed and maintained properly.

Leicestershire County Council are currently in the process of producing a SuDS guidance document for developers. Developers should refer to the County Council's [website](#) for updates and guidance notes on new developments.

This page is intentionally left blank

## 11 Surface water management and SuDS

### 11.1 What is meant by Surface Water Flooding?

Surface water flooding describes flooding from sewers, drains, and ditches that occurs during heavy rainfall.

Surface water flooding includes:

- **pluvial flooding:** flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (overland surface runoff) before it either enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity;
- **sewer flooding:** flooding that occurs when the capacity of underground water conveyance systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters which may cause water to back up and flood around buildings or in built up areas. Sewer flooding can also arise from operational issues such as blockages or collapses of parts of the sewer network; and
- **overland flows entering the built-up area from the rural/urban fringe:** includes overland flows originating from groundwater springs.

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

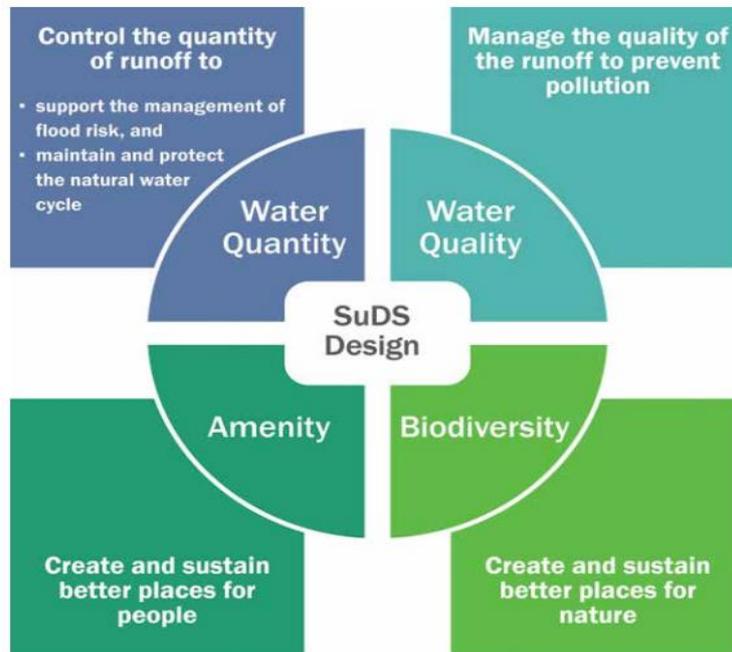
In April 2015, Leicestershire County Council was made a statutory consultee on the management of surface water and, as a result, provides technical advice on surface water drainage strategies and designs put forward for major development proposals.

When considering planning applications, Charnwood Borough Council should seek advice from the relevant flood risk management authorities, principally Leicestershire County Council on the management of surface water (including what sort of SuDs they would consider to be reasonably practicable), satisfy themselves that the development's proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.

Judgement on what SuDS system would be reasonably practicable is through reference to **Defra's Non-Statutory Technical Standards for SuDS** and the Local SuDS Standards from Leicestershire County Council.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These four principles are shown in Figure 11-1.

**Figure 11-1 Four pillars of SuDS design**



Source: The SuDS Manual (C753)

### 11.3 Sources of SuDS guidance

#### 11.3.1 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.**

#### 11.3.2 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.

#### 11.3.3 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.

In March 2015, the latest guidance was released providing amendments as to what is expected by the LPA to meet the National Standards. The guidance provides a

valuable resource for developers and designers outlining peak flow control, volume control, structural integrity of the SuDS, and flood considerations both within and outside the development as well as maintenance and construction considerations. It considers the following: flood risk inside and outside the development, peak flow, volume control, structural integrity, designing for maintenance considerations and construction.

The LPA will make reference to these standards when determining whether proposed SuDS are considered reasonably practicable.

#### **11.3.4 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.

### **11.4 Other surface water considerations**

#### **11.4.1 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.

Two maps are available:

- **Basic groundwater vulnerability map:** this shows the likelihood of a pollutant discharged at ground level (above the soil zone) reaching groundwater for superficial and bedrock aquifers and is expressed as high, medium and low vulnerability
- **Combined groundwater vulnerability map:** this map displays both the vulnerability and aquifer designation status (principal or secondary). The aquifer designation status is an indication of the importance of the aquifer for drinking water supply.

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 type of SuDS appropriate to certain areas.

#### **11.4.2 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 SPZ requires attenuated storage of runoff to prevent infiltration and contamination. The definition of each zone is shown below:

- **Zone 1 (Inner Protection Zone)** – Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- **Zone 1c (Inner Protection Zone)** – Same as Zone 1 but subsurface activity only.

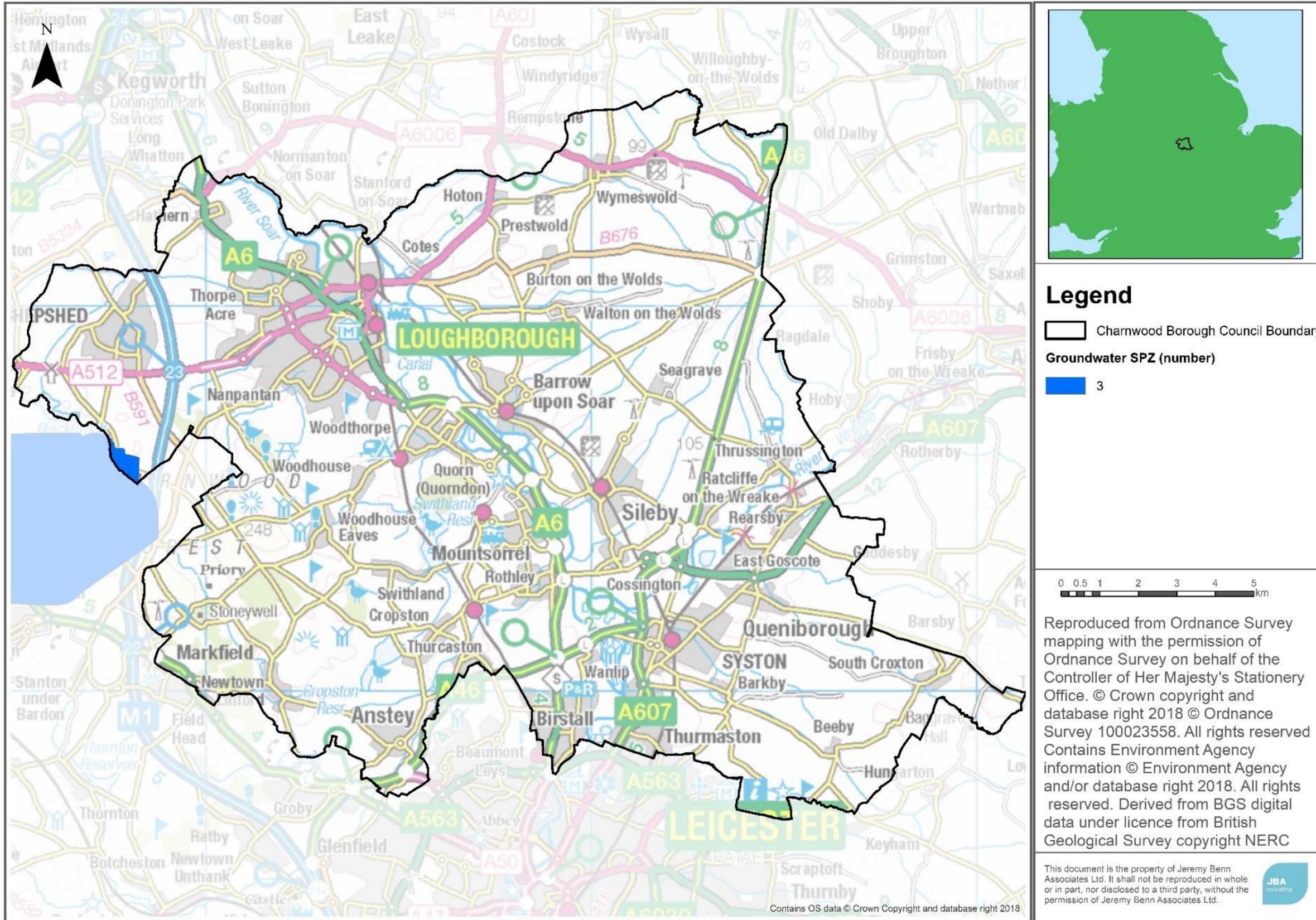
- **Zone 2 (Outer Protection Zone)** – Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction
- **Zone 2c (Outer Protection Zone)** – Same as Zone 2 but subsurface activity only.
- **Zone 3 (Total Catchment)** – Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is  $>0.75$ . Individual source protection areas will still be assigned to assist operators in catchment management
- **Zone 4 (Zone of special interest)** – A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone

The location of the Groundwater SPZs in relation to Charnwood Borough are shown in Figure 11-2.

The vast majority of Charnwood Borough is not located within a Groundwater SPZ. There is a small area covered by a SPZ in the borough to the south of Shephed 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.

Figure 11-2 Groundwater Source Protection Zones



### 11.5 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 Borough 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](#).

This page is intentionally left blank

## 12 Strategic flood risk solutions

### 12.1 Introduction

Strategic flood risk solutions offer the opportunity to reduce flood risk in Charnwood Borough. Leicestershire County Council's **Local FRM Strategy**, the **Humber Flood Risk Management Plan** and **River Trent Catchment Flood Management Plan** set out specific actions for Leicestershire. New development has the potential to contribute towards such solutions, either by the provision of on-site measures that contribute towards a wider strategic approach or by financially contributing to offsite measures that can reduce flood risk to developments and/or help to offset the cumulative impact of development.

### 12.2 Current programme of Flood Alleviation Schemes

The Swithland Brook flood alleviation scheme is the only current scheme in the borough. The scheme aims to better protect 18 homes from flooding by 2021 by improving the channel capacity of the brook and replacing an existing highway culvert. See section 8.3 for more information.

### 12.3 Natural flood management

Natural Flood Management (NFM) is used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). NFM involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts. Techniques and measures, which could be applied in Charnwood Borough include:

- Peatland and moorland restoration in upland catchments
- Offline storage areas
- Re-meandering streams
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS

In 2017, the Environment Agency published an **online evidence base** to support the implementation of NFM and maps showing locations with the potential for NFM measures. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps; however, it is a useful tool to help start dialogue with key partners.

There are areas within Charnwood Borough whereby removing existing defences and reconnecting the floodplain could create areas for potential without causing risk to properties. These areas are spread throughout Charnwood, notably along the Black Brook around Shepshed, along the River Wreake and isolated areas along the River Soar and Rothley Brook. Reconnecting the river with its floodplain and

naturalising the river itself should lead to reduced peak flood levels which will protect properties and infrastructure in settlements downstream.

NFM measures are designed to reduce the flow of floodwater to minimise the risk of flooding to areas downstream. Tree planting can play a vital role in reducing flood risk within an area. Increased rainfall interception and infiltration may reduce surface water runoff and therefore increase the potential of NFM in the area. There are many areas within Charnwood Borough where planting of floodplain woodland could be implemented, most notably along the River Wreake, River Soar, Black Brook and Rothley Brook.

#### **12.4 Flood storage**

Flood storage schemes aim to reduce the flows passed downriver to mitigate downstream flooding and detain additional runoff from increased impermeable areas in the catchment due to development by releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include:

- enlarging the river channel;
- raising the riverbanks; and/or
- constructing flood banks set back from the river.

Flood storage schemes have the advantage that they generally benefit areas downstream, not just the local area. The construction of new upstream storage schemes as part of upstream catchment-based approaches on watercourses could provide one potential strategic solution to flood risk. Watercourses which are rural in their upper reaches but have high levels of flood risk to urban areas in the downstream reaches are potential candidates, as the open land in the upper reaches can potentially provide the space for an attenuation area, providing benefit to the urban area downstream.

#### **12.5 Catchment and floodplain restoration**

Floodplain and river restoration represent the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state. The following measures could be adopted:

- return existing and future brownfield sites that are adjacent to watercourses back to floodplain, rather than allowing new development;
- restoring watercourses and allowing them to act as green corridors/infrastructure;
- removal of redundant structures to reconnect the river and the floodplain; and
- apply the Sequential Approach to avoid new development within currently undefended floodplain.

There is potential to re-naturalise a watercourse by re-profiling the channel, removing hard defences, re-connecting the channel with its floodplain and introducing a more natural morphology (particularly in instances where a watercourse has historically been modified through hard bed modification). Detailed assessments and planning would need to be undertaken to gain a greater understanding of the response to any proposed channel modification.

By using the Sequential Approach and by locating development away from these watercourses it will ensure the watercourse retains connectivity to its floodplain. Loss of floodplain connectivity in the upper reaches of watercourses could

potentially increase flooding downstream. This could help to negate any need to build flood defences for proposed development downstream.

## 12.6 Culverts

Culverted watercourses were often constructed to enable the efficient drainage of an area and allow land to become developable. However, culverted watercourses require regular maintenance to ensure that they function correctly. In most cases they also require trash screens at their entrance to ensure they do not become blocked by large debris, further adding to the maintenance requirements.

Where practical, the de-culverting and re-naturalisation of watercourses restoring to open channel should be encouraged. De-culverting can bring many benefits including reducing the need for regular maintenance and trash screens, reducing blockages and enhancing the river environment by providing a more varied habitat. In some cases, small sections of open channel can be beneficial for flood risk management allowing for flood water to disperse naturally and thus slowing the movement of flood water downstream.

Further information is provided in the '**Trash and Security Screen Guide 2009**', published by the Environment Agency/Defra, which should be used as evidence for any culvert assessment, improvement or structure retention. The reader should refer to the CIRIA website, as this document is currently being updated.

This page is intentionally left blank

## 13 Summary

### 13.1 Sources of flood risk

Parts of Charnwood Borough are at risk from the following sources; fluvial, surface water, groundwater, sewers, reservoir inundation, canal overtopping/breaches. This study has shown that the most significant sources of flood risk in Charnwood Borough are fluvial and surface water.

- *Fluvial flooding:* The primary fluvial flood risk is along the River Soar, the River Wreake and their tributaries. These present fluvial flood risk to rural communities as well as to the main urban centres including, but not exclusively Loughborough, Syston, Thurmaston and Quorn. The floodplains are wide along the River Soar and River Wreake due to lower lying, flat topography.
- *Surface water:* The Risk of Flooding from Surface Water map shows a number of prominent overland flow routes; these predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas.
- *Sewer:* The sewers in Charnwood Borough are managed by Severn Trent Water. Severn Trent Water provided their Flood Risk Register which denotes 212 properties at risk from sewer flooding in the borough.
- *Groundwater:* The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of Charnwood Borough is within the <25% susceptible classification, due to the lower permeability of the bedrock.
- *Canals:* There is one canal in Charnwood Borough, the Grand Union Canal. The canal has the potential to interact with other watercourses and become a flow path during flood events or in a breach scenario. There have been two incidents of breach on the Grand Union Canal in Charnwood at Wanlip in 1962 and Barrow Weir in 1971. There has been one incident of overtopping in 2014 near Wanlip.
- *Reservoirs:* There is a potential risk of flooding from reservoirs both within the borough and those outside. There are no records of flooding from reservoirs in the study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant).

### 13.2 Defences

The risk of rapid inundation following defence overtopping or breach is limited to areas of Loughborough, Quorn, Thurmaston, Barrow upon Soar, Rothley, Sileby, East Goscote and other rural areas protected by minor defences. The condition of these defences varies from poor to good, with Standards of Protection up to 100 years.

### 13.3 Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments have been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Flood Risk Management Authorities such as the Lead Local Flood Authority and the Environment Agency.

When necessary, development and redevelopment within Charnwood will require a Flood Risk Assessment appropriate to the scale of the development and to the scope as agreed with the Lead Local Flood Authority and/or Environment Agency. Flood Risk Assessments should consider flood risk from all sources including residual risk, along with promotion of Sustainable Drainage Systems to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood. Latest climate change guidance (published in February 2016) should also be taken into account, for the lifetime of developments.

#### **13.4 Surface water and SuDS**

All new major development proposals should ensure that sustainable drainage systems for management of run-off are put in place. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined and that the SuDS system is designed in accordance with national and local SuDS Standards.

#### **13.5 Cross boundary and cumulative impacts**

The cumulative impact of development has been considered by outlining planning policy recommendations as set out in the **Loughborough SWMP**, for the Critical Drainage Areas and other high-risk areas in Charnwood Borough and for areas where the cumulative impact of development is likely to have the most impact on flood risk.

Consideration should be given to sites which are located around the borough boundary for cross-boundary impacts. There are 7 authorities neighbouring Charnwood Borough. The topography of the study area means that the neighbouring authorities which have the potential to affect flood risk within Charnwood Borough are predominantly Hinckley and Bosworth District, Blaby District, Leicester City, Harborough District and Melton District. Development in Charnwood Borough has the potential to affect flood risk predominantly in Rushcliffe Borough and North West Leicestershire District.

#### **13.6 Status of the SFRA**

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 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 site-specific FRA.

It is recommended that the SFRA is reviewed internally on a quarterly basis, 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 Charnwood Borough Council, Leicestershire County Council, the Highways Authority, Severn Trent Water and the Environment Agency for any new information.

## 14 Recommendations

The following recommendations are made for the Council to consider as part of their planning policy and flood risk management.

### 14.1 Development Sequential and Exception tests

Areas of the borough are at high risk from river and/or surface water flooding. Charnwood Borough Council should use the information in this SFRA when deciding which development sites to take forward in their Local Plan by applying the Sequential Test. Developers should consult Charnwood Borough Council and the Environment Agency (where relevant), at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

#### 14.1.1 Site-specific Flood Risk Assessments

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses 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. Developers should include an assessment of the residual risk where developments are located in areas benefitting from defences. They should consider both the impact of breach, including the effect on safe access and egress, as well as potential for flood risk to increase in the future due to overtopping. Any improvements to defences should ensure they are in keeping with wider catchment policy.

The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk.

### 14.2 Windfall sites

Windfall sites are sites that have not been specifically identified in the Local Plan, that do not have planning permission and have unexpectedly become available. Local authorities are expected to make a realistic allowance for windfall development based on past trends. The acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms. In the event of there being no windfall policy, it may be possible for the local authority to apply the Sequential Test taking into account reasonably available sites, historic windfall rates and their distribution across Charnwood Borough relative to Flood Zones.

### 14.3 Drainage assessments and promotion of SuDS

Planners should refer to the guidance and standards set out on Leicestershire County Council's [website](#) when assessing planning applications. Developers should be able to submit the information outlined in the 'Planning Applications: Lead Local Flood Authority Statutory Consultation Checklist' document to demonstrate how local SuDS standards have been met.

### 14.4 Strategic solutions

Developers should consult with Charnwood Borough Council and Leicestershire County Council at pre-application stage to determine the latest progress with the programme of flood alleviation schemes and opportunities for NFM, culvert day lighting and river restoration on/off site. RMAs should work together through flood risk studies for high priority locations to determine where land should be safe

guarded for future flood alleviation works, such as flood storage, SuDS retrofit or NFM. The Environment Agency should also be consulted at pre-application stage if there are potential opportunities, particularly if there is land required to be safeguarded for potential schemes or where the development may incorporate flood risk measures alleviate flood risk downstream. They encourage discussions in the early stages of development and offer both a preliminary free level response, and more detailed advice under a cost-recovery basis.

## 14.5 Cumulative Impacts

The following Planning Policy recommendations are made in the SWMP for the CDAs and other high-risk areas. These could also be considered for other areas of significant surface water flood risk in Charnwood Borough and where cumulative impact is likely to have the greatest impact on flood risk:

- 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.

The NPPG states that a Flood Risk Assessment is required for all proposed development (regardless of size) in CDAs.

The following general recommendations should be considered for areas sensitive to the cumulative impact of development:

- For rural villages at low risk of flooding, Leicestershire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major developments. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- The LLFA and other RMAs should use the information in this SFRA to inform a long-term pipeline of flood alleviation studies and schemes to help inform where further contributions from developers on/off site would be beneficial.

## **Appendices**

### **A Charnwood Borough Council Level 1 SFRA Geo-PDFs**

### **B SHELAA Site Screening tables**

**JBA**  
consulting

Offices at

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

Registered Office

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

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

Jeremy Benn Associates Limited

Registered in England 3246693

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

