1 Appendix H.2: Mapping Supporting Information

1.1 Introduction

This document provides supporting information to Appendix A: mapping of all sources of flood risk across the SFRA study area. Appendix A is presented as interactive GeoPDFs. The information in this document lists the mapping layers contained in Appendix A and the approaches used to derive the mapping layers.

Important: The 2017 SFRA has been developed using the best available information at the time of preparation, taking into account the latest flood risk data and the current state of national planning policy. This relates both to the current risk of flooding from fluvial, pluvial, groundwater, sewers and reservoirs as well as the potential impacts of future climate change.

1.2 Appendix A mapping layers

1.2.1 Study Boundary

This shows the boundary of the combined study area and covers the seven non-unitary borough and district councils in Leicestershire, Leicestershire County Council and Leicester City Council.

1.2.2 River networks

Main Rivers are based on the Environment Agency's Statutory Main River layer.

Ordinary Watercourses are based on the Lead Local Flood Authority's Detailed River Network (DRN) layer.

1.3 Flood Zones

Flood Zones 2, 3a and 3b shown in Appendix A has been compiled for the study area as part of the 2017 SFRA.

1.3.1 Flood Zone 3b

Flood Zone 3b comprises land where water has to flow or be stored in times of flood (the functional floodplain). The mapping in the SFRA identifies this Flood Zone as land which would flood with a 5% chance in each and every year (a 1 in 20-year annual exceedance probability [AEP]), where modelling exists for both river and sea flooding. Where the 5% AEP model outputs are not available, the 4% AEP (a 1 in 25-year AEP) results were used as an alternative. The presence of defences is considered when mapping Flood Zone 3b.

Appendix H.1 provides a full list of detailed models used in the 2017 SFRA and where the 1 in 20-year or the 1 in 25-year results have been used to prepare Flood Zone 3b.

For areas not covered by detailed models, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a.

1.3.2 Flood Zones 2 and 3a

Flood Zone 2 comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Flood Zone 3a comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year. Developers and the local authorities should seek to reduce the overall level of 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.

1.4 Ordinary watercourses in Leicester City

Leicester City Council provided hydraulic models of eight ordinary watercourses in the city; the models / watercourses are listed by models 21 and 22 in Appendix H.1. The following modelled extents have been used to map the flood risk from these watercourses:

- 1 in 25-year defended outline (comparable to Flood Zone 3b)

- 1 in 100-year undefended outline (comparable to Flood Zone 3a)
- 1 in 1,000-year undefended outline (comparable to Flood Zone 2).

The Leicester City Council ordinary watercourse modelling extents are shown as separate layers in the Appendix A maps, covering Leicester City only.

1.5 Surface Water

Mapping of surface water flood risk has been taken from the Flood Map for Surface Water (RoFfSW) published online by the Environment Agency. The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water. The different levels of flood risk are shown in the below table.

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

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale. Such an assessment will use the RoFfSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

1.6 Climate change

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summer. Increased river levels may also increase flood risk.

Fluvial climate change mapping provides a strategic assessment of climate change risk – developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the guidance set out in the SFRA and Environment Agency guidance.

In the 2017 SFRA, climate change modelling for the watercourses in the combined study area was undertaken using the new climate change guidance. Where appropriate existing Environment Agency hydraulic models were run for the following allowances:

When defining the scope of this commission, the Environment Agency recommended that the above allowances were used in this assessment, to assist with forward planning across the combined study area. The climate change allowances reflect the allowances most commonly used by developers i.e. for residential development, classified as 'More Vulnerable' under Table 2 of the NPPG. The epoch selected i.e. the total potential change anticipated for the '2080s' (2070 to 2115), generally reflects the anticipated lifetime for residential development (i.e. 100 years), as stated in Paragraph 026 of the NPPG. The allowances for the Anglian, Humber and Severn River Basin Districts are provided in

Table 1-1.

Where ordinary watercourse models have been supplied by Leicester City Council, the allowances in Table 1 1 have also been applied. In these instances, the approach to deriving model inflows has been modified to account for the urban nature of the catchments. Model documentation has not been supplied and therefore it has been assumed that inflows were derived from detailed sewer modelling. For the climate change scenarios, without the original sewer models, a linear upscaling of the 100-year flows was applied.

Appendix H.1 provides a full list of detailed hydraulic models used in the 2017 SFRA and which ordinary watercourse model results were used to inform the climate change outlines.

Table 1-1: Peak river flow allowances for the Anglian, Humber and Severn river basin districts for total potential change anticipated for '2080s' (2070 to 2115)

River Basin District	Central	Higher central	Upper end
Anglian	25%	35%	65%
Humber	20%	30%	50%
Severn	25%	35%	70%

1.6.1 Using climate change allowances

To help decide which allowances to use to inform the selection of flood levels for flood risk management measures at 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

The Environment Agency has produced a guidance document called "Flood risk assessment: Climate Change allowances" which details the application of the allowances and local considerations in East Anglia. This document is not published online.

1.7 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater (AStGWf) dataset. The AStGWf dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound. 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.

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1.8 Reservoir flooding

Mapping indicating flooding from reservoir sources has been developed based on Environment Agency supplied National Inundation Reservoir Mapping dataset. Please note that the reservoir inundation outlines shown in the mapping are made up of reservoirs which are located outside the SFRA study area of interest. For further information please see the main SFRA report.