Appendix B - Data sources used in the SFRA

1 Historical Flooding

Leicestershire County Council as Lead Local Flood Authority provided details of historical flooding events and hotspots in the district, as did Leicestershire Fire and Rescue. The Environment Agency's Historic Flood Map is also presented in Appendix A: GeoPDF Mapping. Section 5.1 documents historic flooding records obtained.

2 Fluvial flooding

2.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in Appendix A mapping, show the same extent as the online Environment Agency's Flood Map for Planning (which incorporates latest modelled data), where available, except for the Lubbesthorpe Brook and tributaries where the modelled data was not all fully incorporated into the EA Flood Zones. This has been replaced with the modelled outputs. The approach for the Lubbesthorpe Brook in the SFRA mapping is outlined in Section 4.1.

Over time, the online mapping is likely to be updated more often than the SFRA, so SFRA users should check there are no major changes in their area.

2.2 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b, as shown in Appendix A mapping, has been compiled for the study area as part of this SFRA and is based on the 5% AEP (1 in 20-year chance of flooding in any given year) or 4% AEP (1 in 25-year chance of flooding in any given year) extents produced from Environment Agency detailed hydraulic models, or existing 2D generalised models, where outputs were available (see Figure B-1 for model coverage).

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

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

3 Climate change

Detailed Environment Agency hydraulic models were obtained, and the 100-year flows were upscaled by the Humber basin's 2080s scenarios (+20%, +30% and +50%). Where there were no detailed models available, Flood Zone 2 has been used as an indication of climate change. Figure B-1 shows the existing EA model coverage, where climate change outputs were either already available or was run as part of this SFRA (Lubbesthorpe Brook FAS – see section 4.1). Please refer to Chapter 4 for information on the approach to climate change in this SFRA.

4 Hydraulic Model Coverage

Figure B-1 shows the existing EA model coverage, used to inform FZ3b and climate change extents.

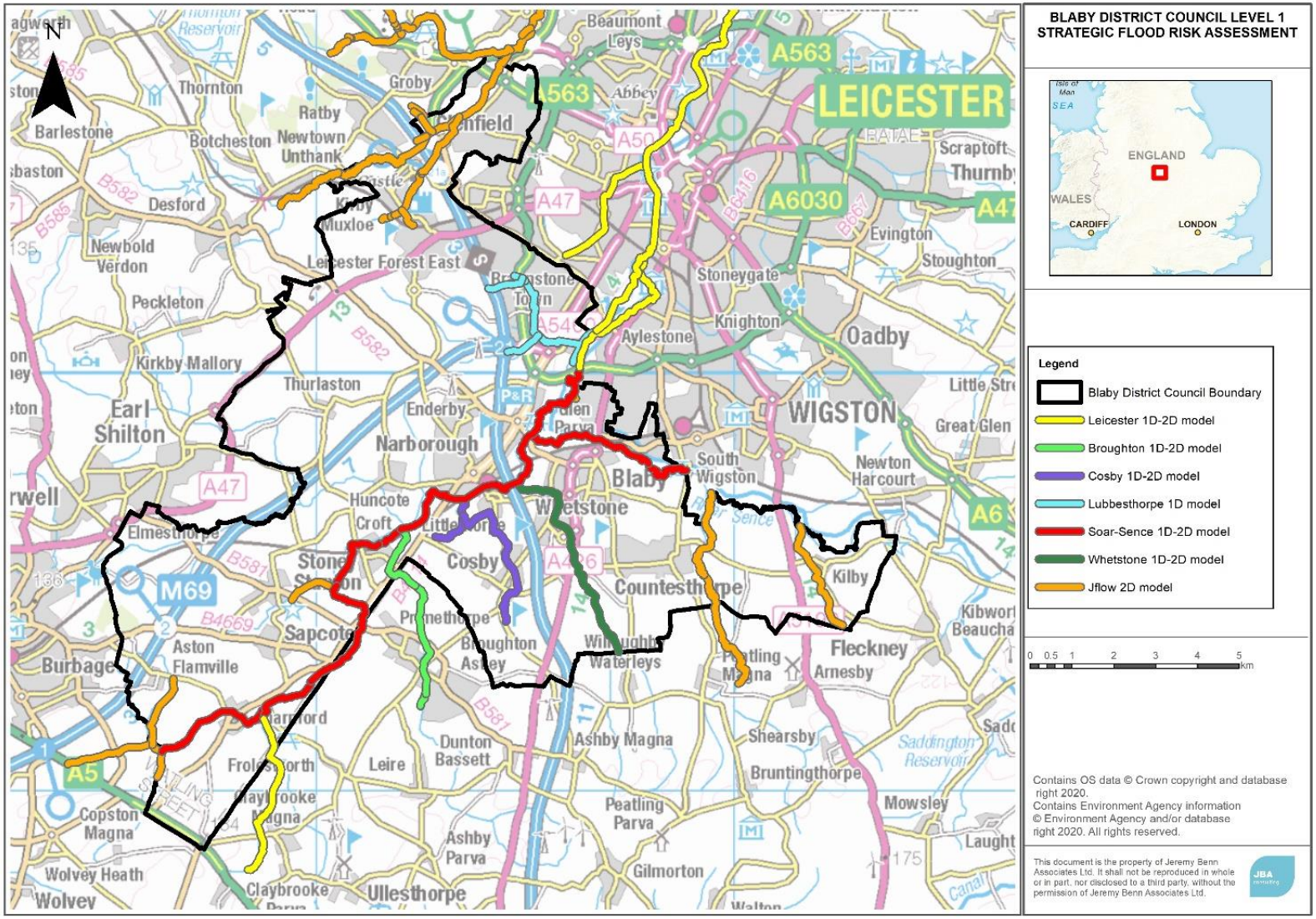

Figure B-1: Existing hydraulic modelling coverage

4.1 Lubbesthorpe Brook Flood Alleviation Scheme (FAS) Model

The Lubbesthorpe Brook FAS 1D HEC-RAS hydraulic model (2011) provided by the EA is a FAS optioneering model. As the FAS has since been constructed, the baseline scenario model which would usually be used to inform mapping was therefore superseded.

The 'Option 5' model scenario represents the FAS in place today, which is a two-stage channel designed to provide a 100-year standard of protection (and therefore contains the 100-year flood extent in the channel). The Brook was moved a few metres in a westerly direction and integrated into the adjacent nature reserve downstream of Watergate Lane. Therefore, this model was run for the climate change allowances in the SFRA, and as no modelled GIS flood extents were provided with the model, the Option 5 20-year, 100-year and 1,000-year model results were also exported and converted into flood extents to represent the Flood Zones.

Prior to running the Option 5 model for climate change in the SFRA, it was noted that there were two versions of this model, representing two different flood alleviation culvert arrangements at the Watergate Lane structure. The report states:

"Improvement works would be required to the Watergate Lane road crossing, in order to prevent high flows from spilling out of bank upstream of the bridge and flowing through properties. The most effective solution would be to install high level bypass culverts adjacent to the existing bridge, which would avoid a rebuild of the existing bridge structure. The optimum culvert arrangement can be further tested when the location of any services has been identified. An arrangement of 3 no. high level 2m x 0.5m bypass culverts has been found to provide an acceptable solution, as has a single 2.1m x 0.8m box culvert laid deeper which is more compatible with services".

The report was not clear as to which arrangement had been chosen as the preferred option and hence a test of the 100-year event with both these Option 5 culvert arrangements was conducted for the SFRA. As there was barely a difference in flood extents from the test, the single culvert arrangement model was used for SFRA mapping as this best represents the current situation, as a bypass culvert has been built in reality.

There are however some discrepancies when comparing the online EA Flood Zones and the equivalent 2011 model outputs: not all of the modelled tributaries were mapped in 2011 because there was not enough LIDAR coverage (ground terrain data), hence the EA Flood Zones in these locations show either older 2D generalised modelling or nothing at all. It is clear though that the reach of the Lubbesthorpe Brook along the FAS has been incorporated into the EA's Flood Zones.

For consistency and clarity in the SFRA, the EA Flood Zones were removed and replaced with the modelled 20-year (FZ3b), 100-year (FZ3a) and 1,000-year (FZ2) extents up to where it enters a culvert at Narborough Road South (just prior to its confluence with the Soar).

It is recommended that developers contact the EA for the final Lubbesthorpe Brook FAS model for site-specific Flood Risk Assessments in this area, given that the FAS has since been designed in detail and implemented; however, for the purpose of the SFRA, the approach above is deemed appropriate to best represent the scheme with the data available.

4.2 River Sence (upstream of Rive Soar and Tributaries model)

The River Sence through Blaby District is represented in the EA's River Soar and Tributaries model, and therefore has been used to inform FZ3b and climate change extents. Upstream of this reach, where the Sence flows along the District's eastern boundary, a 1D hydraulic model was provided. However, very little data was provided to run this model and the model was not geo-referenced, meaning mapping the extents would be very difficult and time-consuming. As this model was very old (2000), the floodplain is wide and rural in this location, and a new EA hydraulic model is currently being built for the Sence at the time of this SFRA, this model was not used. There will be new detailed results available in 2021 for developers to obtain from the EA. Indicative extents were used to represent the Flood Zones and climate change (i.e. FZ3a for FZ3b and FZ2 for climate change) for the purpose of a strategic assessment.

5 Surface water

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

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

Table B-1: RoFfSW risk categories

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

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

6 Groundwater

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

The AStGWF dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and

does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale. Section 5.7 of the Main Report explains groundwater flooding.

7 Sewers

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

Section 5.6 of the Main Report presents this data.

8 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study, and are shown online on the Long-Term Risk of Flooding website at the time of publication. The Environment Agency are currently updating their national reservoir flood maps and SFRA users should check there are no major changes to the reservoir maps before relying on the mapping in the SFRA. Section 5.9 of the Main Report presents the reservoirs affecting Blaby District.

9 Flood Defences

The Environment Agency supplied the location of all flood defences within the district in their AIMS database, including information relating to the type of flood defence and their standard of protection. The Areas Benefitting from Defences shapefile was also considered. Chapter 6 of the Main Report provides information on flood defences and schemes.

10 Overview of supplied data

Overview of supplied data for the Blaby District SFRA from stakeholders is as follows:

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines Hydraulic Modelling Reports	Environment Agency
	Historic Flooding Incidents and Assets Register	Blaby District Council, Leicestershire Fire and Rescue

Source of flood risk	Data used to inform the assessment	Data supplied by
Fluvial (including climate change)	Leicester City (2017) 1D-2D Flood Modeller (ISIS-TUFLOW) Hydraulic Model (HM) River Soar, comprising: -Soar-Sence (2018) 1D-2D Flood Modeller (ISIS-TUFLOW) HM -Broughton (2018) 1D-2D Flood Modeller (ISIS-TUFLOW) HM -Cosby (2018) 1D-2D Flood Modeller (ISIS-TUFLOW) HM -Whetstone (2018) 2D Flood Modeller (ISIS-TUFLOW) HM Lubbesthorpe Brook FAS (2011) 1D Hec-Ras HM Sence 1D (2000) (ISIS) HM Generalised (Jflow) (2017) 2D HM	Environment Agency JBA Consulting (2D generalised)
	Flood Map for Planning Flood Zones	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
Sewers	Hydraulic Flooding Risk Register (HFRR)	Severn Trent Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map)	Environment Agency
Flood Defences	Location and description of flood defences	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	Rugby District Harborough District Council City of Leicester Council Charnwood Borough Council Hinckley and Bosworth Borough Council Oadby and Wigston District Council

Source of flood risk	Data used to inform the assessment	Data supplied by
Other datasets	Partner Data Catalogue: - Source Protection Zones - National Receptor Database - Aquifer Designation Maps - Areas Susceptible to Groundwater Flooding - Detailed River Network - Flood Alert Areas - Flood Warning Areas - Flood Maps for Planning - Groundwater Vulnerability - Historic Flood Map - Risk of Flooding from Rivers and Sea	Environment Agency (via BDC)